THE SOFTWARE DEVELOPERS MAGAZINE

EXE

AUGUST 1997

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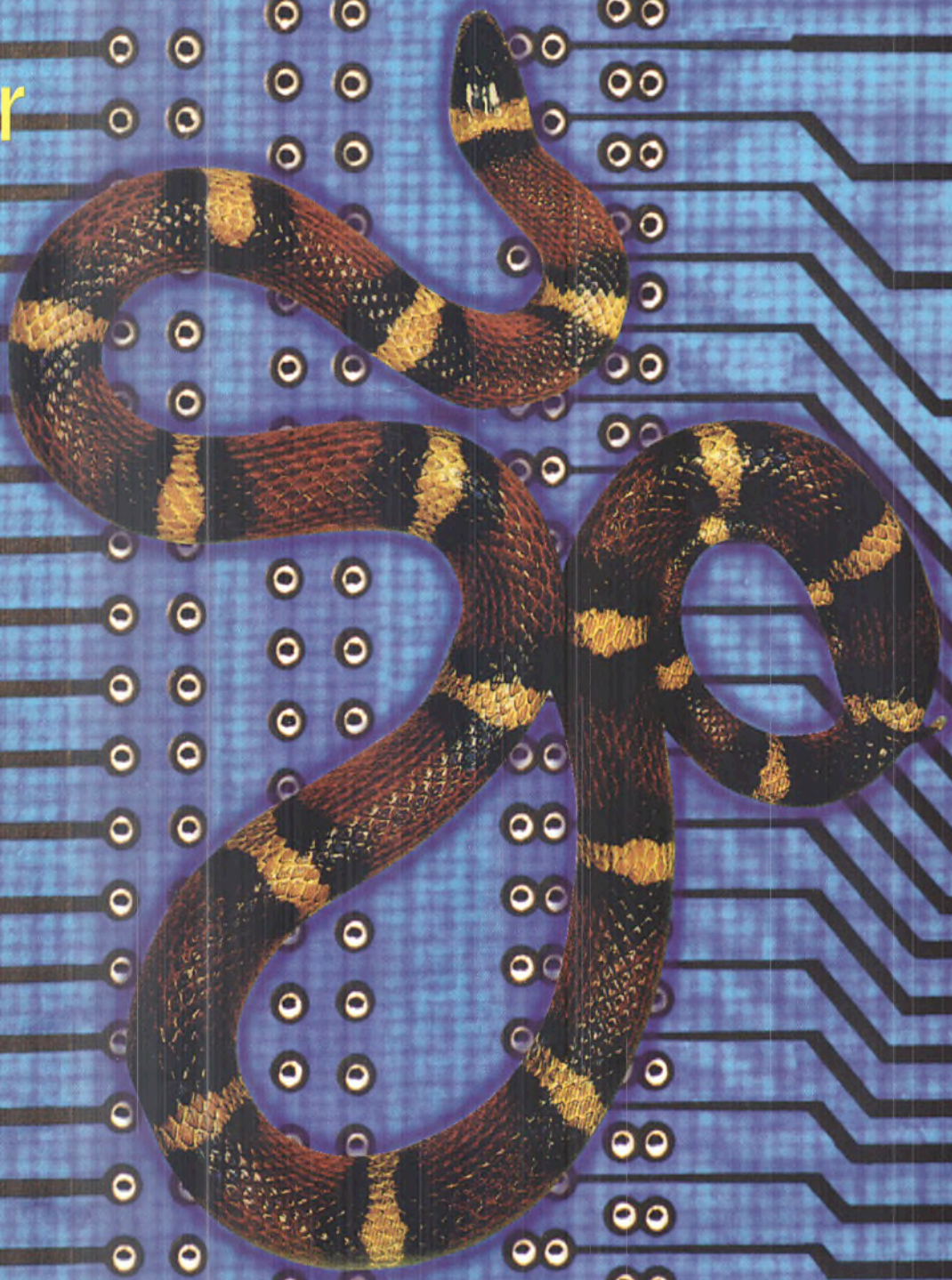

Practical design patterns

What the @*?# is happening?

Assistants for Visual Basic

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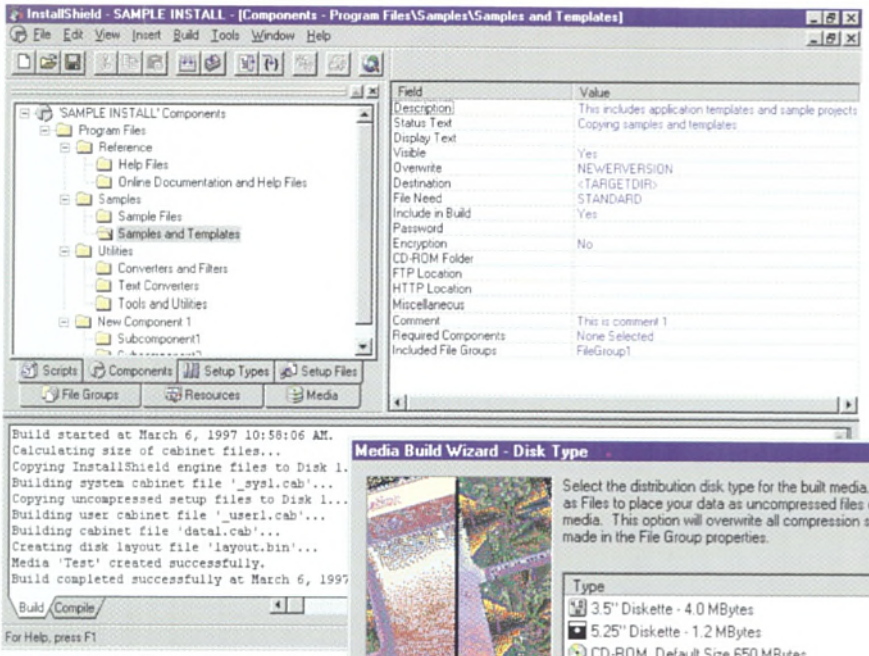
POWER



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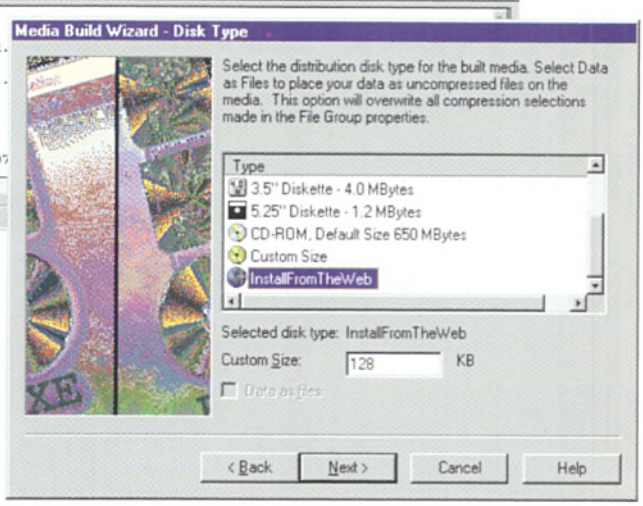

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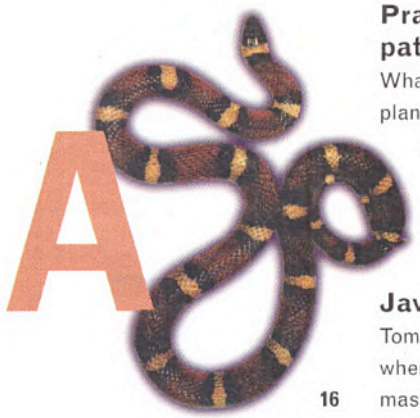
A crew of fifteen 23



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Lost focus

Last month, most of EXE's staff went on its yearly transhumance to Birmingham to attend the Software Development (SD) part of IT Expo and combined with Networks. Last year it was our most succesful show. This year, we had a nice time apart from the fact that we didn't see many visitors. We had fun with our juggling competition (see the News), we learnt a few Origami tricks from another exhibitor and had long chats with companies exhibiting next to us. And it was an occasion to meet colleagues working on other titles (ie the competition). Hey, wait a minute, what's the goal of having a stand, then? Well, in our case to touch base with our readership and introduce potential new readers to the wonders of EXE. On that front, I must admit it was a flop. Other exhibitors in the Software Development section had the same reaction.

What's wrong with this show? For a start it's in Birmingham – or to be more accurate not far from the town. Not only is it a long trip to go to Birmingham but then you've got to take the overcrowded train every evening and morning or wait in the long lines of cars trying to get in or out of the NEC car parks. And the choice of pubs in the town centre is rather limited. Then comes the second issue. Once there, right in front of the entrance are all the Networks halls and then on the side of it, the lonely IT Expo hall. As if that wasn't enough, SD is tucked in a corner. With all the trouble that one has to go through to get to SD, you would expect that they would be highly-motivated visitors. Not so, they looked more like lost wanderers or Networks' exhibitors having a look around during their break.

Another failure was Comdex UK. At least we didn't exhibit there this year. There are just too many shows trying to get bigger and bigger by just amalgamating many different other shows, often unrelated. What is needed is a very small number of shows (and not all of them in the same month) with a tight focus on one aspect of the software industry.

A Java forum for whom?

One of the event at IT Expo was the launch of the Java Forum. The invite sounded impressive: representatives from Sun Microsystems, IBM, Microsoft, Netscape, Corel, Lotus, Borland, Novell, Oracle and Symantec. I hope I haven't forgotten anyone. It was the opportunity to meet at the same time many of the big players in the Java field. Not to be missed.

After an introduction where we learned that 'the Java Forum's purpose is to offer an information channel and support network between the principal Java ISV's and members of the Forum's principally corporate audience of IT Directors and network managers', the long awaited Q&A time came at last. First a general question gave Jeremy Gittins of Microsoft the opportunity to express the strong commitment of Microsoft to everything Java – no mention of J/Direct. Then I tried to start a discussion between Simon Phipps of IBM and Jeremy Gittins. You see, it's not that often that one has the opportunity to have representatives from both IBM and Microsoft at the *same* time to talk about Java. It was the first time for me. I wouldn't have missed such an opportunity. Well, to cut a long story short, the MC told us that this wasn't the point of the announcement. It was eventually revealed, after the event, that participants had been warned not to make any comment on any of the other companies present. Disappointing, isn't it?

It's not often that one has the opportunity to have representatives from both IBM and Microsoft at the *same* time.

Let's try to summarise some of the views on Java (expressed at previous events). Sun Microsystems has started Java or Java started at Sun. Whichever way it doesn't matter much now. Sun is trying to have Java officially recognised as a standard but at the same time doesn't seem willing to relinquish all its control. Microsoft has stated numerous time that it is wholly committed to Java, but seems more committed to its own version of Java. Java is primarily a client language/operating system/environment and Microsoft has the biggest share of the desktop, hence it considers it can control Java on the desktop and introduce 'features' such as J/Direct. Both Sun and IBM promote Java as the way to go as it will give you platform independence. Officially, they do not consider Microsoft as any threat at all. Well, Netscape which embraces the same goals as its partners IBM and Sun, does seem to consider Microsoft as a very real threat which shouldn't be simply ignored. Novell is not as strong but has similar views.

In other words, it's a mess. The different point of views of the Pure Java partners though not exactly the same appear to be compatible. Microsoft has definitely a different approach. Simon Phipps commented rather cynically about the recent announcement of J/Direct: 'Microsoft felt Java had an unfair advantage over ActiveX by being secure so decided to level the playing field by breaking Java rather than by securing ActiveX.' I believe I would have had a better understanding of where Java is heading to if there had been a frank open discussion between all the representatives present.

OK, so it's a forum with one voice where differences between ISVs are muffled. It's probably to hear the voice of the users better. There we face another problem: for the first year, the Forum is financed by these ISVs. The Research Group, the Forum's organiser, is convinced that the simple fact that all these ISVs are putting money in the kettle is enough to guarantee its independence. Ahem, wasn't that a major issue for the United Nations?

David Mery

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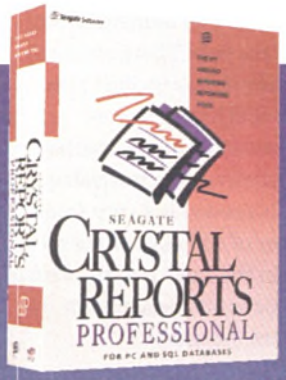

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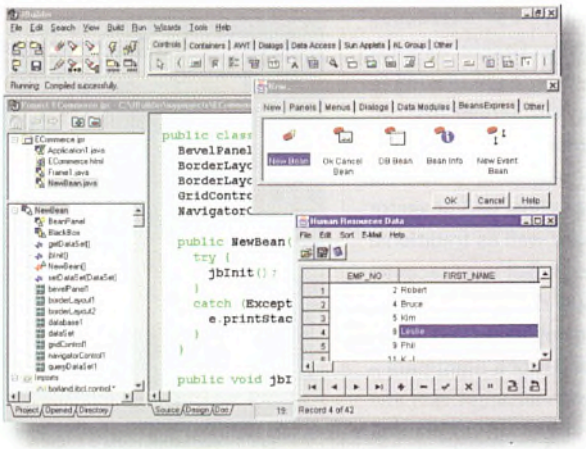
CIRCLE NO. 386

JBuilder set to upset Java applecart

The long-awaited Java development environment from Borland, JBuilder, will be released before the end of the quarter, according to company officials. Beta versions were on display at Borland's annual Conference in Nashville. The product looks set to deliver a knockout blow to existing Java tools as well as prove once and for all the viability of writing large applications in the language. Approximately 70% of the code in JBuilder is written in Java, including the GUI painter, debugger, Application Browser and control palettes. The remainder was written in Delphi. Despite being written in Java, the environment seems very responsive and doesn't suffer from the 'klunkiness' often exhibited by other applications.

New to Borland products is the Application Browser, a single, multi-pane window for viewing source code, debugging information, JavaDoc help information, together with a continuously-updated tree view of project files, objects, methods and variables.



Unlike rival development environments which rely on special comments in source code or object repositories, JBuilder produces and understands pure Java – so any valid Java listing can be immediately added into a JBuilder project.

JBuilder is built around and for use with JavaBeans – all the components on the design palette are Beans, equivalent to the VCLs used in Delphi. ActiveX controls can also be used. Any Bean built with the tool can be re-used in other projects. A new component library – named JCBL – consisting of several hundred Beans including user-interface controls, grids, data controls and more will be supplied with the product. The full source code for most of these Beans will be supplied with JBuilder and will be freely redistributable. JCBL will also be available as a stand-alone library for other development tools.

For more information on JBuilder, visit the Borland Web site.
w www.borland.com

The 'pure' **Borland C++** line will be integrated into the **C++ Builder** line in the next release. It may, or may not, be called Borland **C++ 6.0**. There will be no further separate releases of the product. All those features not currently in C++ Builder will be ported.

There is a possibility that future versions of **Delphi** and **C++ Builder** may compile to Java **bytecode** – Borland would not confirm but Zack Urlocker did say 'it's crossed our mind'.

Borland has a **Java** to **native** Intel code compiler. It was used to write the compiler for JBuilder. It will be integrated into a future release of JBuilder so that it can compile to native code.

IT Expo 97 disappoints

This year's IT Expo, held last month in Birmingham, did not live up to the standard of the previous year's show, according to many of the exhibitors. This may be a result of the growing popularity of the Internet as a way to find product information instead of visiting shows.

The 'great EXE juggling competition' went down well – one competitor managing to juggle five balls successfully, if only for eight secs. Prizes of software, helpfully provided by Microsoft, Borland and NuMega, were given to the winners: Mr J Nutbrown (four balls for 24 secs), Mr G Westlake (four balls for 36 secs), and Mr P Heather (four balls for 28 secs). The winners of the prize draw (for a similar set of software) were Mr A Hawksley, Mr K Royal, and Mr S Kelsey. Congratulations to all of them.

Borland: back for good?

Opening the 8th annual Conference to rapturous applause from an audience of over 2800, the executive team of Borland strode onto the stage at Nashville dressed as characters from Star Wars. A hilarious ten-minute promotional video starring CEO Del Yocam as Obi-Wan Kenobi, Zack Urlocker as Luke Skywalker, and a Bill Gates lookalike as Darth Vader set the audience laughing. The scale of the opening set the tone for the conference which was universally upbeat.

Daily keynote speeches from Novell's CEO Eric Schmidt, IBM's AS/400 supremo Bill Zeitler, and Oracle chairman Larry Ellison followed the announcement of alliances with all three companies to release products including AS/400 versions of Delphi and C++ Builder. Yocam announced that Borland would focus on tools for developing what he called the InfoNet – or e-business in IBM-speak.

The message from all of this is that after a quiet period of restructuring, Borland is back. The imminent launch of JBuilder – which on first impressions seems much the best of the Java development environments thus far and could cause quite a stir – and in the next quarter of a 32-bit version of Visual dBase will be followed up by a range of as-yet-unspecified application management products.

On the evidence of the sheer numbers of developers willing to make the long trek to Nashville to attend the conference, it seems that Borland doomsayers who have been predicting the demise of the company for some months may yet have to eat their words.

Scientific Computer to distribute **SmartSockets** 4.0, Talarian's message-oriented **middleware**. Features include ability to add network protocols, C API and C++ library, GUI for monitoring and debugging **distributed** applications. SmartSockets is **scaleable** and can dynamically reconfigure its routing table. 01293 403636.
www.scl.com, www.talarian.com

The Open University is to offer **M874** – a **course** on software development for networked application using Java. All student interaction for this five-module course will be done via the **Web**. M874 is claimed to be the first masters-level course to use **Java**.
crel-gen@open.ac.uk

Apple reboots. Both CEO Gil **Amelio** and Technical VP Ellen **Hancock resigned**. Apple followers favour a break-up into two companies: AppleSoft and AppleMac. No announcement, yet.

Oracle is shipping **Oracle8** on Windows NT, Solaris, HP-UX, AIX, IBM SP2, Sequent PTX and Digital Alpha AXP. Oracle8 integrates data **partitioning**, Web management, **clustering** capabilities... Prices start at £1150 for 5 concurrent users.
www.oracle.com

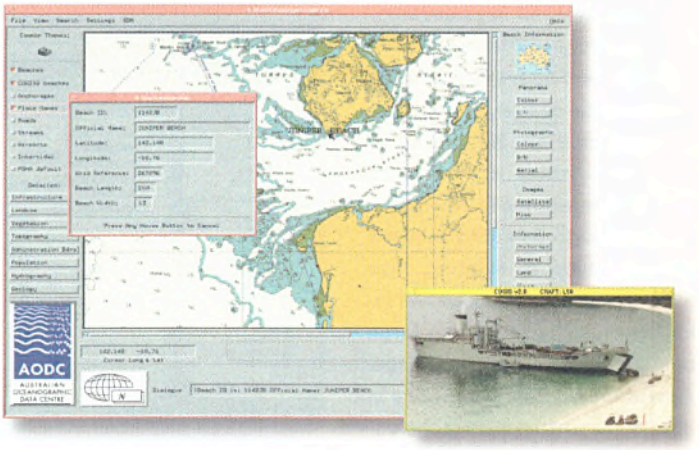
Citrix will release **WinFrame** 1.7, its **thin-client/server** (where execution is 100% server-based) system software, in the third quarter. Two option packs will be added: load balancing and ICA (Independent Computing Architecture) encryption.
www.citrix.com

Microsoft is working on **T-Share**, multi-user support for NT. T-Share is based on Citrix code. At the same time, **Citrix** is working on a competing product codenamed **Picasso**. Major difference is that T-Share will only support Microsoft clients. Don't expect any of these products too soon.
www.microsoft.com

The latest CD from ComponentSource, **CD11**, contains over 1000 products. Fifty additions and 100 new versions. **ComponentSource** claims to be cheaper than its competition. To get a CD register on its Web site.
www.componentsource.com

If you want to add an **annotation** facility to your **Windows** application, check out RasterNote Annotation Toolkit from **Snowbound** Software. With it you can offer highlighting, sticky notes, lines, freehand drawing... The kit costs $995 and comes as a DLL and an ActiveX.
www.snowbnd.com

Taking the middle ground with Formida



So-called 'universal' databases are nothing new. Oracle, Informix and IBM have all been moving in this direction with servers that can handle complex data types – 'spatial' data – including graphical images, video clips, GIS or vector information, as well as traditional alphanumerics. But until recently the task of any developer building the client side of this equation has been little short of a nightmare – struggling with different vast and often incomprehensible APIs for each data type.

Formida Software has come up with what it calls a 'Universal database enabler'; in effect, middleware designed to present a universal API to the client while handling the back-end integration to universal and standard servers from Oracle, Informix and others.

The company is keen to stress that this is not an ultra-thin client solution as favoured by some other vendors – although Formida client applications can be run in a browser through the use of plug-ins, these are hefty enough in size to make casual downloading prohibitive.

The Formida application development environment can work with projects and forms from a variety of other environments, but to build clients keyed to the Formida middleware, developers will have to use the supplied IDE and learn the company's proprietary 4GL. For the prize of single-interface design capabilities and reduced time-to-rollout, this is a price many developers may well be willing to pay.

At the moment, Formida supports Windows 95/NT, NT Alpha, Solaris, AIX, Irix, and HP-UX.
t 01895 434595
w www.formida.com

MKS brings CM to the Web

Most configuration management (CM) tools available today, including MKS' Source Integrity, can be applied, to some extent, to the control of Web sites. However MKS felt that the issues of Web object management (as Web CM has come to be known) were complex enough that a dedicated product was required. Web Integrity is a client/server-based solution with a thin Java client and the majority of the functionality residing in extensions to the Web server.

Web Integrity works similarly to its cousin, with all the checking-in and checking-out options you would expect, as well as hyperlink verification, HTML validation, and spell checking. Information about the Web objects – pages, scripts, images etc – is held in a repository managed by the server extensions.

The server engine is available for most NT and Unix Web servers. Price $15,000 per server.
t 0181 335 5920 w www.mks.com

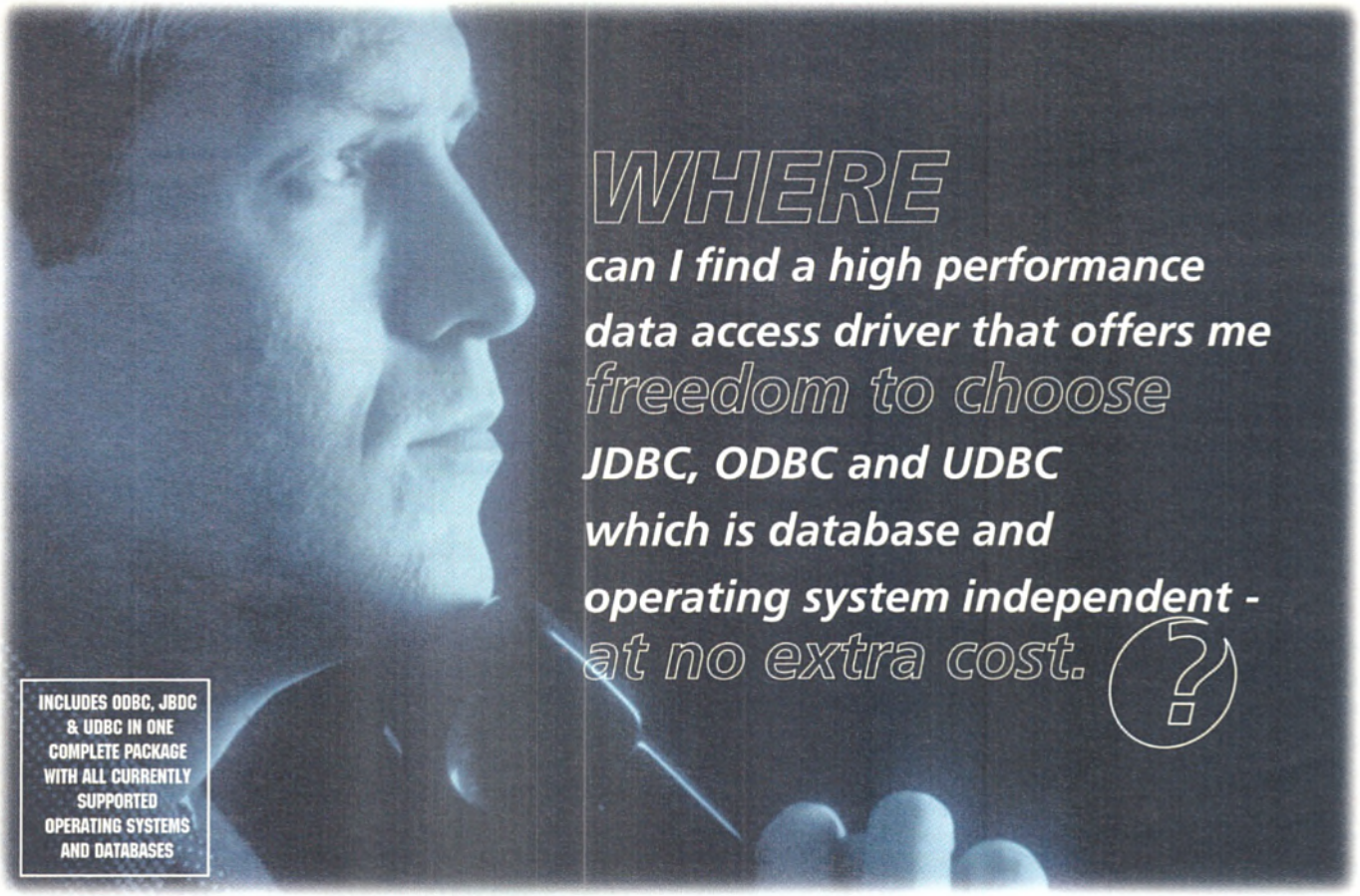
The second revolution

With Java, Ilog is going through what its President Pierre Haren calls the second language revolution. The first one being Lisp. Some twenty years ago Ilog was heavily involved in a French-developed Lisp called Le_Lisp. At that time, (almost) everyone was saying that Lisp would overtake most other languages. Texas Instrument was working on a Lisp processor. Developers were dreaming of a portable Symbolics Lisp machine... If you replace Java by Lisp in the current actuality, you'll have an idea. The players were different but the problems were quite similar. Then came C, and C++ and now Java.

Ilog is now specialising in 'advanced C++ and Java components'. Its first Java product is Ilog Rules which also exists for C++. Two elements might have contributed to the lack of success of Lisp. Firstly, most Lisp systems were interpreted (this is not true anymore) and hence slower. Haren, from his Le_Lisp experience, considers that interpreted languages will always be at least two times slower than compiled ones when deep compilation optimisations are applied. Haren adds that 'Java will penetrate last the high-performance application market'. Secondly, they were many different Lisp implementations some with very fundamental differences (eg dynamic versus lexical scope). Currently there's mostly only one Java language. Haren is of the opinion that this will change in the next two years. It's like a nuclear explosion which depends on velocity (increasing with the Web) and confinement time (about the same).

Haren expects many programmers to move to Java but there will still be a market for components in other languages. Ilog still has a maintenance contract for Le_Lisp for one of its customer which will expire in 2002 and one for Views (C++) which will end in 2010.

t 01344 426666 w www.ilog.com



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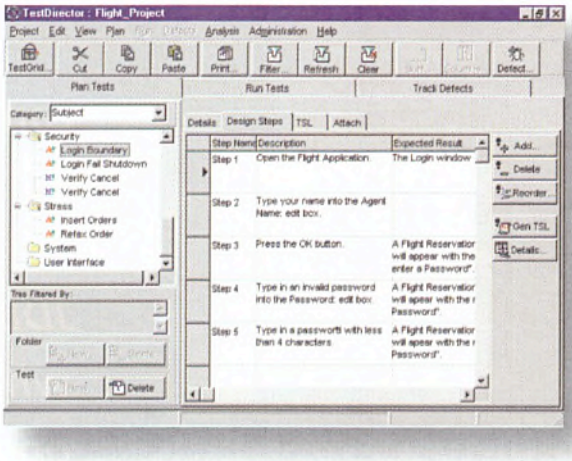
CIRCLE NO. 387

Mercury sets sail for the year 2000

In the wake of figures from various research bodies suggesting that testing may take up to 70% of most companies' Year 2000 conversion efforts, Mercury Interactive has stepped into the breach with revisions to its existing TestSuite range specifically aimed to assist in the process. According to Mercury Interactive CEO Amnon Landan, with only two and half years to go before the immovable deadline, large organisations will simply not be able to complete their year 2000 preparations without automated testing tools.

The aim of TestSuite 2000 is to provide automated support for regression testing and 'script aging'. In practice this means that a set of successfully-executed test scripts built to the pre-existing application are used to test the application after conversion. This provides the essential regression test – proving that nothing which



used to work has been broken by the conversion process. TestSuite then 'ages' the test script to begin exercising the Year 2000 features which have been added. Mercury claims that this process speeds up the testing time substantially.

Although traditionally Mercury's WinRunner and LoadRunner products have been heavily client/server oriented, the 2000 versions of these tools are designed to work with mainframe, AS/400 and Web applications as well.

Alongside WinRunner 2000 and LoadRunner 2000, the new suite features TestDirector – a test co-ordination and management application – and TestBytes, which can be used to auto-generate properly formatted test data.

t 01634 262525 w www.merc-int.com

Java Vision

Client/server tool developer Vision Software, originator of the Vision Builder point-and-click application development environment, has launched a Java version by the name of Jade (Java Application Development Environment). Jade takes the Vision Builder principle a step further by supplying its own GUI painter – Vision Builder uses the Visual Basic forms engine.

Like Vision Builder, applications are developed using a 'declarative' method where business rules are constructed visually. Once the GUI elements are associated to the business rules and the data – from SQL Server or JDBC data sources – the product generates all the Java code automatically. The developer can tweak the code by hand if so desired, of course. The resulting code is then pushed through the Sun Java compiler to produce the finished client software.

Jade is priced from £2250 and is available immediately.

t 01256 812561 w www.vision-soft.com

HTML 4.0 is (almost) go!

The first publicly-available draft specification for HTML 4.0 has been released by the World Wide Web Consortium (W3C). The draft, while certainly embracing the movement towards style sheets and scripting advocated by the two main players, doesn't seem to go far enough in many respects.

Many of the 'improvements' cited by W3C are simply official blessings for tags introduced by Microsoft or Netscape over the last year: the <object> and <script> tags, the <style> and tags, and the <iframe> in-line (aka 'floating') frame tag. Perhaps the area of most significant development is in forms. In HTML 4.0, buttons and other form elements will be able to contain HTML-formatted data rather than plain text.

The philosophical thrust of the draft specification places particular emphasis on using style sheets to achieve browser-independence and for layout control – which most HTML authors currently achieve with complex nested sets of tables. The goal is to make the document content independent from the styles applied. This carries a number of advantages for Web developers – changing the look of a page or pages will simply be a matter of changing the style sheet – and allows pages to degrade gracefully onto browser platforms with lesser capabilities, or even Braille displays and voice synthesisers.

What the specification (so far) fails to include is any support for absolute positioning of HTML elements, or dynamic HTML where page elements can be modified or updated on-the-fly. Both of these are areas where Microsoft and Netscape are at loggerheads, and where the W3C could have a peace-broking role.

w www.w3c.org w www.netscape.com w www.microsoft.com

Be shipped the **Preview Release** of **BeOS** on July 16. The BeOS trial CD is free and will be bundled with some magazines. The Trial Pack costs $10 and the Full Package, $49 (with two free upgrades. Be announced that **binary compatibility** with the Preview Release will be kept in all future upgrades.
www.be.com

Sun Microsystems and **Netscape** announced the developer release of the Java Foundation Classes (**JFC**). They enable applications' look and feel to be switched on the fly to reflect the current GUI. The JFC can be **downloaded** from the Java Developer Connection.
java.sun.com/products/jfc/index.html

RoseGUI is a **RAD** tool for developing versatile and intuitive **GUIs**. Features include: creating interactive scenes, shapes, simulating imaginary or real-life objects, hot maps and toolbars... Available as 16- and 32-bit ActiveX. Price: $299.
http://www.hexatech.com

Antares Alliance Group claims **EdgeworX** (formerly Edge) to be the first **DCOM** and **VBA**-based OO **Web** development and execution framework. Works with any ISAPI, NSAPI or CGI-enabled HTTP server.
www.edgesite.com

Looking to connect an appliance to the **Internet**? Wind River Systems launched an integrated **Embedded** Internet package comprising a Web Server, a browser, **Tornado** for Java (a JVM), and RtX-Windows.
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About *DPR*

DPR, run by Rick Spence, is a training, consulting, and development company with offices in St. Augustine, FL, and Painswick, UK. We specialize in teaching programmers how to develop database applications, and in developing applications for other companies. Our motto is "Programmers Teaching Programmers". We're programmers ourselves, and we only teach programming.

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A toy PC is good for you

All work and no play makes Jules a very dull boy. But can he really justify spending serious cash on yet another PC?

Earning my living (as I do, at least in part) from computers, I find I have lots of bits of machines and a few fully-assembled working PCs strewn across my environment. Those that work do, actually work; over here is a programming box, over there is an oscilloscope, down there is a footrest. What I don't have is a toy PC. Everybody else seems to be buying one, though, so I thought I'd find out what I was missing out on.

I have to admit that a PC doesn't strike me as a very sensible thing to make a toy out of. For one thing, it really needs a table to sit on, and quite a big table at that, what with keyboards, screens, mice, and speakers. Why do I need all that stuff? I've got a perfectly good screen in the corner of my living room, with nothing on it but Hollyoaks and two cheese plants (dead and moribund, and the cheese plants aren't too healthy either), and stuck to the same wall I have a very much better set of speakers than anything a multimedia computer has to offer. Why can't I use those? What's more, as both the manufacturer of my TV and Sega have discovered, I don't want to lean forward to operate these machines; I want to lean back. (Actually, I want to sprawl on the floor, but that's a bit 60s so I don't generally talk about it.) The point is that the keyboard and mouse should be a remote pointing device. I should be able to wave the remote in the general direction of the screen, and the mouse should move appropriately.

But no, a toy PC is just like a business PC except it has attitude (and sound effects). I wasn't going to buy a 300 MHz P6 with multiple local busses just to make a toy out of; this machine was getting a SoundBlaster and a CD drive, and it could consider itself lucky to have that. I discovered that all SoundBlasters seem to have IDE ports, but for the life of me I can't figure out why – you need a separate card in order to control a floppy disk, and there seem to be no IDE CDs which will coexist with any other IDE devices. What you have to have is a treacle-like SCSI controller for the CD drive which rather makes a mockery of 20x speed drives, but suggests that, since you can't just pull animations straight off the CD, a fully MPEGed and 3D accelerated video card might be a sound investment. Err, right.

Now, the interesting thing is software. Running serious machines, I've not really been noticing what's been happening in recreational software. 90% of the 'best' games are no use to me, because I didn't buy the optional TV studio attachment (could it be that fancy animation is all there to disguise the fact that there's sod all gameplay, and that the reviewers haven't noticed?), so what options do I have left?

Games. 1; Endless versions of Doom and Descent, which are quite good, but not so good that I want more than one. 2; Strategy games which look like Kings Quest 1, and either play like it, or are as incomprehensible as 'Railroad Tycoon 27 – the time-travel edition'. What's wrong with SimCity in any case? 3; Adventure games, which I used to enjoy before they became a vehicle for getting you to use premium-rate hintlines when logic doesn't work, and premium-rate tech support when the game engines don't work.

Information. All information CDs are made by three kinds of people; 1. Encyclopaedia companies, who understand books, but don't understand multimedia. Dorling Kindersley makes a very pretty (but otherwise useless) Atlas of the World (I know about that, because I was looking for an atlas. Still looking). Perhaps they should talk to the AA, who have successfully sold the same roadmap about twenty times over. Britannica sells the /text/ to their august book, but without any diagrams – good thinking, chaps! 2. Design companies, with a bee in their bonnet about something. Example; there's a gorgeous CD about martial arts, but when you actually want to know something (like the difference between Japanese and Chinese styles) the stuff just isn't there. Bodyworks is another one; when I wanted to see what the injury was which I sustained last week, it couldn't show me, and I went back to my dog-eared copy of Grays. They all look like oil paintings, and work like indexes. 3. Microsoft. Nuff said.

Cover disks. Cover disks strike me as odd. I remember the days when they had trouble filling a 1.44 MB floppy. 680 MB they've got on a CD now, and it's not enough! At least one magazine gave away two disks last month. The newsagents' shelves are heaving with magazines whose sole function seems to be to provide mechanical support to a library of CDs – why bother with the paper? I've noticed a number of patterns with cover disks. 1. All the cover disks carry the same software every month. 2. The software is in the process of being launched, or being killed. 3. The software is either non- or part-working demos (forget it, chaps, I won't install software that doesn't work, no matter how good I can imagine it to be), slideshow (ditto, with knobs on), fully-working, but time-bombed programs (sod that!) or extensions to paid-for software (which I probably don't have). In short, from a library of over 300 disks, I got not one useful product. (Gentlemen; if you want to give me a free gift to show me how clever you are, make it a gift, and make it free. I'll always pay for a needed addition to software which I use regularly.)

The first time I saw a box of 10 100 KB floppies, I thought 'My God, there isn't that much data in the whole world!' (Back then, there probably wasn't.) When I saw the first 1GB hard drive which would fit up your nose, I thought something very similar. The trouble with CDs is that they are so easy to mass-produce that there just isn't enough data in the world to fill them – that's why they're stacked with animation and sound. Unfortunately, it doesn't give the expensive toy PCs anything useful to do. I wonder if anyone will notice.

Jules is developing a small business recycling unwanted CDs (turning them into flowerpots, clocks, shaving mirrors, kiwi fruit corers, and microwave oven massagers). If you have any unwanted CDs, contact him on 01707 662689, or on cix as jules@cix.co.uk.

BeOS isn't perfect

We welcome short letters on any subject relevant to software development. Please write to: The Editor, *EXE Magazine*, St. Giles House, 50 Poland Street, London W1V 4AX, or email editorial@dotexe.demon.co.uk

Dear Sir,
Following your article on BeOS (EXE, July '97) pointing out some of the good things about BeOS, I thought it would be sensible for me to point out the main bad thing about it.

The main problem with BeOS, is that (at least when I last looked at it) it uses a very weak object model. In an OO OS the object model is one of the most important elements so this is very significant.

In BeOS, inheritance is usually single and code is statically compiled (as opposed to the Java JIT compiler). This leads to chaos when classes are updated to have more features. Convention is to place them in the base class, but this means that all code which uses the object needs to be recompiled to adapt to new `vtable` entries. Be has tried to reduce this a little by leaving empty slots in BeOS' `vtables` for when further members will be added, but these slots will still get filled up and so it is little more than a hack. Code will still need to be frequently recompiled and we will have the kind of problems we have over different builds of C++ static libraries.

If one compares this with the more advanced object models of Corba, Java and COM, BeOS comes out looking very bad indeed.

The multithreading is good. The efficiency is good. But Be has got to do something about its object model.

Robert Ennals
ennals@aol.com

Like any other C++ class hierarchy, BeOS' kits suffer from the Fragile Base Class (FBC) problem. In short, the offset of data and `vtable` for a class instance depends on its ancestor's data and `vtable` size, so adding data or virtual member functions to a base class results in a different object layout and hence incompatibility. Non-virtual member functions can be added with no trouble.

I should have mentioned this in the Article, even though Be was very aware of the problem and was working on a solution – also critical for binary compatibility, which has never been retained across developer releases. As I write the Preview Release is shipping, and since it's supposed to be binary compatible with future BeOS versions the 'solution' is cast in stone.

But first, you mention Corba, Java and COM.

COM doesn't require you to recompile sources against updated object interfaces since... you actually can't change interfaces! With COM you have to create a new interface and explicitly call the old interface for unchanged methods, thereby obtaining an increase in method invocation time as the hierarchy grows. With enough hacking you might obtain a predictable invocation time, but hardly constant, not to speak of low.

Real object models, and let me also mention SOM, would indeed solve the FBC problem, but the expressiveness of C++ would be limited and performance would degrade (witness Apple's OpenDoc C++-based implementations compared to later SOM-based ones). The reason is that Corba, SOM and similar object models also attempt to solve language independence and object interface repository issues.

To use Java's object model you have to use Java. Although Java is supported, BeOS isn't a Java OS. The same can be said about Smalltalk and Objective-C, for that matter.

Browsing through technical articles in Be's newsletters gives you an idea of what speed freaks these guys are. They would hardly have given up an instruction or two per virtual method invocation if they had any other way of doing it, as Be's engineers have informally said more than once in the developer mailing list.

The ideal solution here would have been a lightweight architecture allowing for dynamic object data and `vtable` sizing targeted straight at the FBC problem. Maybe some compiler magic combined with weak linking, late binding and OS loader support to wrap it up. This might actually show up in later versions of the BeOS, but Be currently doesn't appear to want to go the Taligent or Spring way and, as I stated in the article, has 'taken a realistic, proven-technology approach'.

What's left is Be's 'solution' that is, as you mention, padding data and `vtable` with extra space for future use. They also added an ioctl-like `Perform` method called 'The Ugly Safety Net', and spare data is always large enough to hold a pointer.

For the official word refer to issue 79 of Be's newsletter at *http://www.be.com/aboutbe/benewsletter/*.

Is this solution elegant? No, but it works while retaining efficiency. Nobody knows how soon Be will fill the space it has reserved. When this happens, Be will freeze the kits and start a fresh new class hierarchy, with old code bound to the old shared library and new code bound to the new one – BeOS functionality is mainly in the system servers after all.

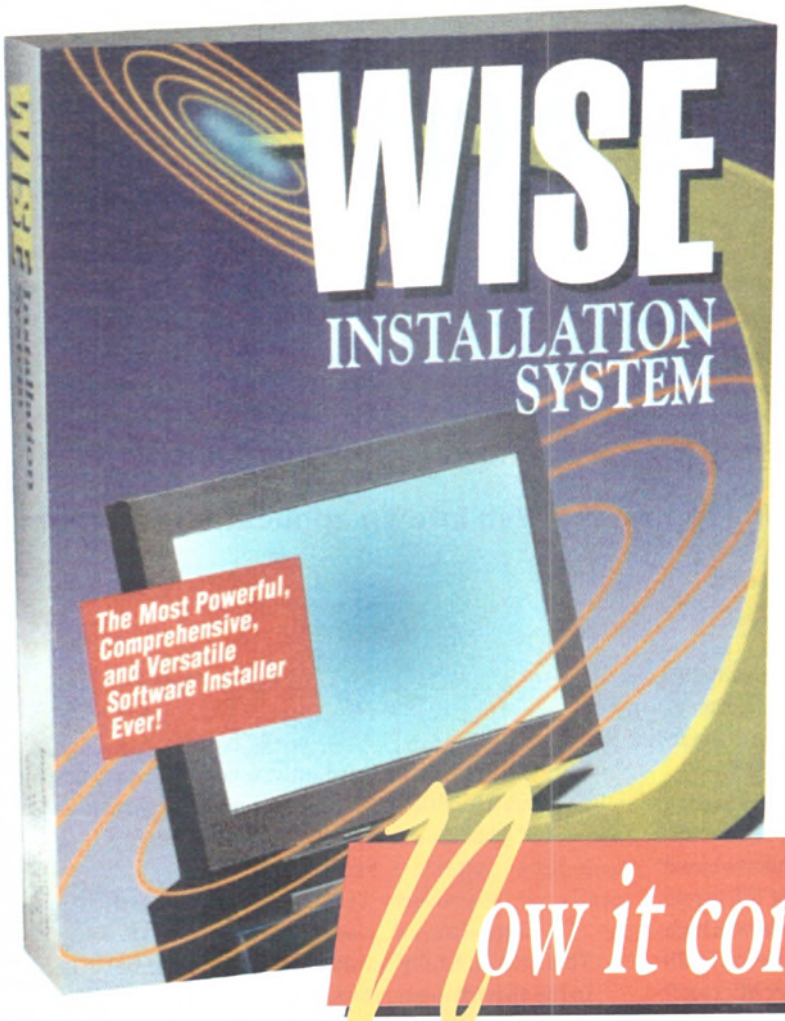
BeOS has another hurdle: moving away from PEF to a more open executable format. Hopefully Be will combine that step (that breaks binary compatibility) with an elegant and efficient FBC solution.

Duncan Wilcox
duncan@mclink.it

EXE getting the bends

Dear Sir,
Many thanks to Jules for his EXE article on parametric curves – that was the most effective explanation I've seen.

Chris John Jordan
chrisjj@cix.compulink.co.uk



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Scripting the Server with Active Server Pages

Hot on the heels of client scripting comes NT server-side scripting, bringing together HTML, ActiveX and ODBC, threatening to turn the Web into an application environment. Roy Tynan shows us how to make it work.

Since the introduction of Windows NT 4.0, Microsoft has signalled its intention to try to dominate the Internet web server market as well as the client desktop market. NT 4.0 has made inroads into a market dominated by Unix and is set to continue its meteoric rise.

Shipping with NT 4.0 Server is Microsoft's Internet Information Server (IIS), currently at version 3.0. This package is arguably the easiest to configure and maintain compared to most other Windows-based web servers available. IIS is rooted in the security system of NT, is reliable, and is able to handle fairly heavy loads assuming you have a high spec machine. Service Pack 2 for NT 4.0 introduced an extension to IIS called Active Service Pages (ASP). ASP is reliant on another Microsoft technology, the Internet Server Application Programming Interface (ISAPI). ISAPI applications are developed in C++ and come in two flavours, Extensions and Filters. An ISAPI filter is responsible for interpreting and compiling ASP code into HTML content.

All together now

With ASP Microsoft has integrated ActiveX, COM and DCOM, ODBC, OLE DB and IIS. This enables the Web developer to build sophisticated applications without having to face the steep learning curve involved in implementing an equivalent system on Unix. Indeed, a competent VB 4 programmer will encounter few headaches in developing complex ASP.

Components are the single most important feature of ASP. They are at the core of all new Microsoft products. Components – or controls – are supposed to give programmers easier maintenance and promote code reuse. Active Server Components expose operating system services to ASP. The ActiveX Scripting Engine is responsible for processing the ASP script code: this engine is essentially an OLE automation wrapper for the ActiveX Scripting languages. Figure 1 shows the ASP object model.

The greatest strength of ASP is its ability to implement dynamic web database applications using ActiveX Data Objects (ADO), the ActiveX version of the database object DAO. ASP without ADO is no more than HTML with a bit of dynamic scripting thrown in for good measure.

ADO enables a client application to access and manipulate data in a database. ADO's primary benefits are ease of use, high speed, low memory overhead, and a small disk footprint. In ADO, the `RecordSet` object is the main interface to data. This is an example of script using the ADO object.

```
set conn = CreateObject("ADODB.RecordSet")
conn.Open "SELECT * FROM
customer","DATABASE=client;UID=sa;PWD=;DSN=ClientsUK"
```

This generates a forward-only, read-only `RecordSet` object. A slightly more functional `RecordSet` can be generated as follows:

```
set conn = CreateObject("ADODB.RecordSet")
conn.Open "SELECT * FROM
customer","DATABASE=client;UID=sa;PWD=;DSN=ClientsUK",_
        adOpenKeyset, adLockBatchOptimistic
```

This creates a fully scrollable and batch-updatable `RecordSet`.

In the above two examples we are using a Data Source Name (DSN) on the server called *ClientsUK*. This DSN points at the *client* database and then we select all records from the *customer* table. Note also that we are connecting as the System Administrator, *sa* with no password. In ADO, the object hierarchy is *de-emphasised*. Unlike DAO or RDO, you no longer have to navigate through a hierarchy to create objects because most ADO objects can be independently instantiated. Use of ADO in ASP is discussed in more detail later.

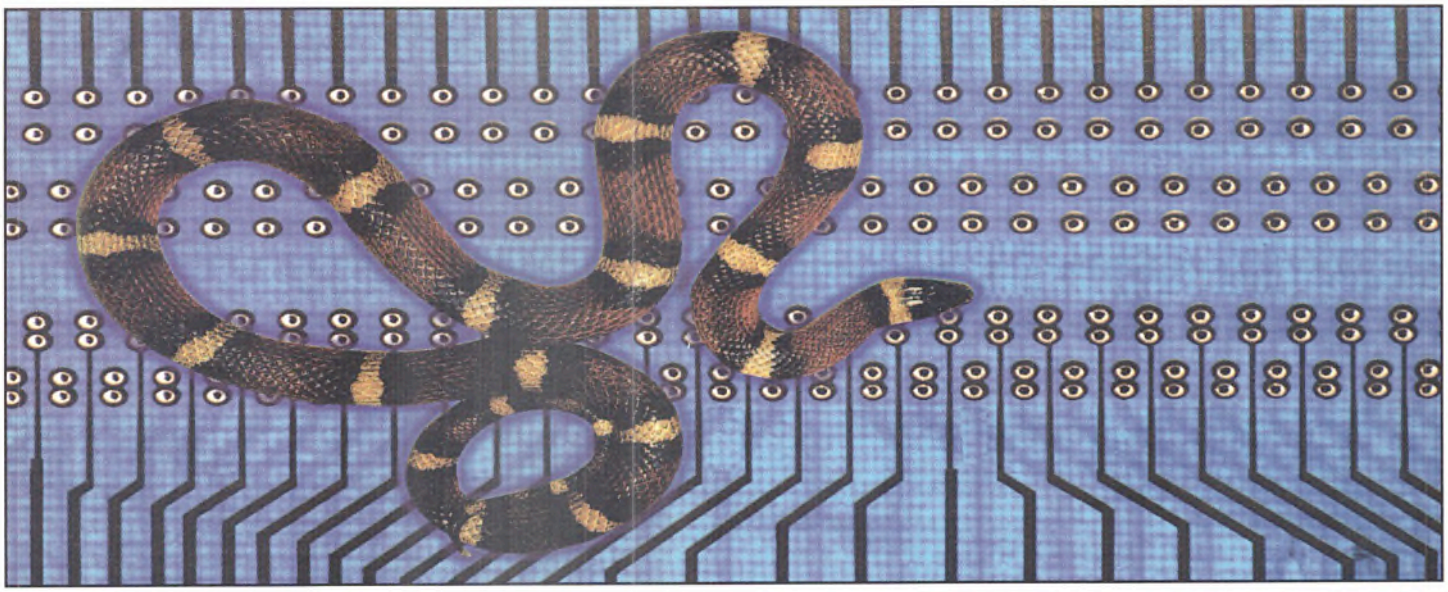
ADO methods

- `CreateObject` – enables the instantiation of the ADO objects eg `Connection` and `RecordSet`.
- `Open` – creates a channel of communication with the server.
- `Requery` – applied to the `RecordSet` object created with the `Open` method, invokes the query that populated the recordset.
- `Update` – used with the `RecordSet` Object, moves data from the data cache to the `RecordSet`.

ADO properties

- `ActiveConnection` – informs ADO where the data is and how to access it.
- `CursorType` – determines how the data provider engine supplies data to the `RecordSet` object.
- `LockType` – resolves concurrency issues with the Open method of a `RecordSet` object.
- `Name` – the actual name of a `Field` object or `RecordSet` object.
- `Source` – a SQL text command to fetch data from the data provider.

Table 1 – ADO methods and properties.



Intrinsic Objects in ASP

Active Server Pages includes a number of built-in server and application objects. These objects free developers from the burden of writing code to access details about incoming requests from clients, manage the application state, handle cookies, and assemble the response. These *intrinsic objects* include:

Request and Response – the `request` object provides access to any information passed into the script with the HTTP request. This includes information from cookies, forms, URL queries, and HTTP headers. The `response` object is used to build the response, including setting cookies, page expiration, and full control of the HTTP output stream.

Session and Application – these objects are designed to make state management easier. Managing state across a number of users and applications has typically been difficult. The `session` object stores information needed for a particular user session. Variables stored in the `session` object are not discarded when the user jumps between pages in the application; instead, these variables persist across the entire site. The server destroys the object when the session expires or is abandoned. The `application` object allows properties to be set that share information among all users of a given application. `Lock` and `Unlock` methods ensure that multiple users do not alter a property simultaneously.

Server – the `server` object allows scripts to create instances of ActiveX components, and thus extend the Active Server Page environment with new capabilities. The `server` object provides access to methods and properties on the server. Most of these serve as utility functions. Without the `server` object, it would not be possible to access components from a Web application.

To help you create web applications, Internet Information Server 3.0 also provides several base components:

ActiveX Data Objects – as discussed above.

Content linking component – you can use the Content Linking component to automatically generate and update tables of contents and navigational links to previous and following Web pages.

File system component – this component provides access to the server file system.

Browser capabilities component – using this component, ASP files can determine the capabilities of a requesting browser and dynamically optimise the layout and content. This ensures that the developer does not have to create a series of duplicate pages for each browser. For example, a site has one view for ActiveX enabled browsers, a second for frame-enabled browsers and a third for browsers that don't support frames.

Content rotator – the Content Rotator component allows a list of different HTML elements (for example GIFs or JPGs) to be assigned relative display-priority percentages. Each time the page is requested, the component will display content based on the preset criteria.

Application Structure

An ASP application is defined within the IIS directory structure. Each Web contained within IIS is assigned a *virtual root*, while the top-level

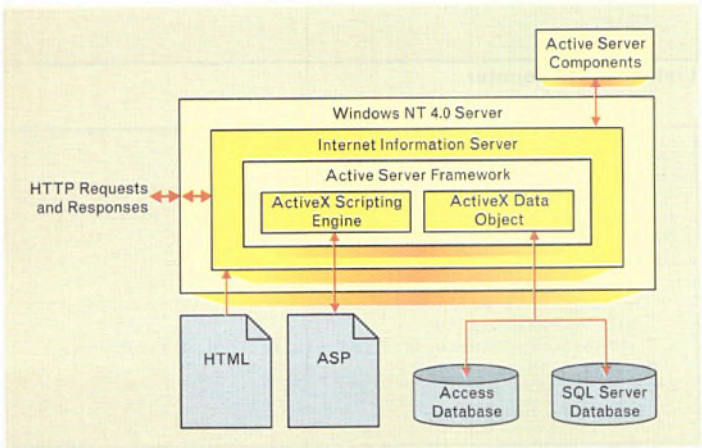


Figure 1 – Active Server programming model.

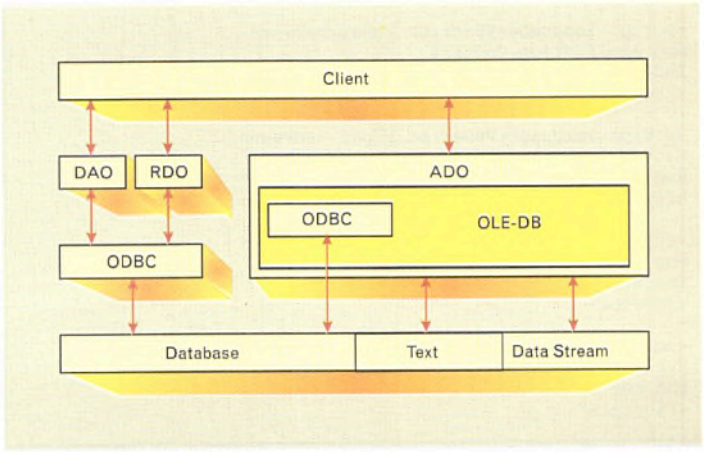


Figure 2 – ADO/DAO/RDO model.

directory is the *root web*. These directories are configured with their own IP address and for security reasons are usually given aliases. Within each site a separate directory structure exists for ASP applications consisting of the ASP content files and an optional *global.asa*. This file configures the `application` and `session` objects via their `OnStart` and `OnEnd` events.

The `application` object comes into scope when a user requests a page from the application directory for the first time, at which point the `Application_OnStart` event is fired. The `application` object remains in scope until all sessions have terminated or IIS is restarted. As it passes out of scope it fires the `Application_OnEnd` event. A `session` object is invoked each time a user's browser requests an ASP page from the application directory.

The session time-out value is set in minutes and defaults to 20. This is the minimum value at which it can be set. The `Session.Abandon` method can be used within ASP to terminate a session directly if required.

Listing 1 shows the skeleton of a *global.asa* file. Note the use of the scripting tag `<script language=VBScript runat=server>`. This informs the server that the script language is VBScript. The `runat` attribute specifies that the script will execute on the server and not the client. In ASP this is the default but if a page has scripting code which *should* be run on the client, you must include this attribute.

Listing 2 shows a more practical implementation of a *global.asa* file. The code in this example implements a hit counter. Note that there is no embedded HTML code because this script executes only on the server. Listing 3 shows the ASP code which you would use to access the hit counter and send the results back to the client browser. When a client's browser requests this ASP page the *global.asa* file is accessed and the hit counter is incremented.

Listing 3 also demonstrates how server-side scripting code must be embedded into ASP. The `<%` and `%>` denote the start and end of the ASP code. To form an expression, enclose a valid VBScript or JScript expression like this: `<%= FormatNumber(Session("VisitorID"),0)%>`. Note the slightly altered opening tag – this indicates the code is an expression, and the return value is embedded into the HTML output.

ADO and ASP

Assuming you're a database programmer wanting to Web-enable a database then ADO is the component for you. ADO is built around OLE DB which is essentially an object oriented C++ API wrapped around ODBC.

```
<script language=VBScript runat=server>
Sub Application_OnStart
End Sub
</script>

<script language=VBScript runat =server>
Sub Application_OnEnd
End Sub
</script>

<script language=VBScript runat =server>
Sub Session_OnStart
End Sub
</script>

<script language=VBScript runat =server>
Sub Session_OnEnd
End Sub
</script>
```

Listing 1 – Basic global.asa

```
<SCRIPT LANGUAGE=VBScript RUNAT=Server>
SUB Application_OnStart
   ' This script executes when the first user
   ' comes to the site.
   ' Open file and read the number of visitors so far
   ' the directory "/vasp" is an alias for the
   ' directory "c:\inetpub\wwwroot\asp"
   ' we also create a standard text file "hit.txt"
   ' which is used to keep a count of visitors

VisitorCountFilename = Server.MapPath ("/vasp") + "\hit.txt"

Set FileObject = Server.CreateObject( _
                 "Scripting.FileSystemObject")
Set Out= FileObject.OpenTextFile( _
                 VisitorCountFilename, 1, FALSE, FALSE)
   ' Initialize soft visitor counter here
Application("visitors") = Out.ReadLine
   ' Store physical file name of file containing
   ' the visitor count
Application("VisitorCountFilename") = VisitorCountFilename
END SUB
</SCRIPT>

<SCRIPT LANGUAGE=VBScript RUNAT=Server>
SUB Application_OnEnd
   ' This script executes when the server shuts down or
   ' when global.asa changes.
   ' Overwrites the existing visitors.txt file
Set FileObject = Server.CreateObject( _
                 "Scripting.FileSystemObject")
Set Out= FileObject.CreateTextFile ( _
                 Application("VisitorCountFilename"), _
                 TRUE, FALSE)
Out.WriteLine(application("visitors"))
END SUB
</SCRIPT>

<SCRIPT LANGUAGE=VBScript RUNAT=Server>
SUB Session_OnStart
   ' Increment the visitor counter
   ' the Application Lock stops other users from executing
   ' the "locked" code until the present user has exited
   ' this section of code
Application.lock
Application("visitors")= application("visitors") + 1
t_visitors = application("visitors")
Application.unlock
Session("VisitorID") = t_visitors

SET FileObject = Server.CreateObject( _
                 "Scripting.FileSystemObject")
Set Out= FileObject.CreateTextFile (Application( _
                 "VisitorCountFilename"), TRUE, FALSE)
Application.lock
Out.WriteLine(t_visitors)
Application.unlock

END SUB
</SCRIPT>

<SCRIPT LANGUAGE=VBScript RUNAT=Server>
SUB Session_OnEnd
END SUB
</SCRIPT>
```

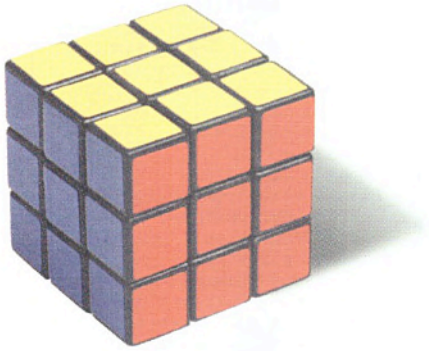
Listing 2 – Hit counter

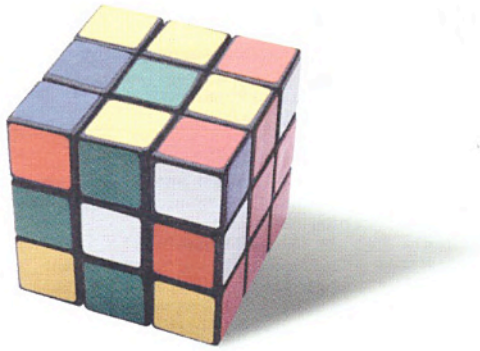
```
<html>
<head>
<title>ASP Test Page</title>
</head>
<body bgcolor="ffffffff">
<center>
    <h1>Welcome< h1>

    Hi, you are visitor
    <b><%=FormatNumber(Session("VisitorID"),0)%></b> <br>
</center>
</body>
</html>
```

Listing 3 – default.asp

Hitachi WebReuser





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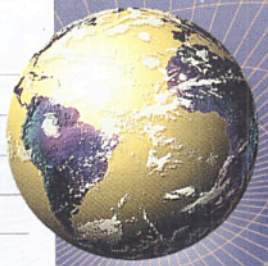

```
<%

'~~~~ open the database connection
set conn = Server.CreateObject("ADODB.Connection")

'~~~~ create a RecordSet
set rs = Server.CreateObject("ADODB.RecordSet")

conn.open("DRIVER={SQL Server};SERVER=MAIN;
          UID=sa;PWD=;DATABASE=person"),

'create the SQL string
sqlStr = "insert into pdetails (fname,sname,address1,
                address2,town_city,county,postcode,tel) "
  sqlStr = sqlStr & "values ('"
  sqlStr = sqlStr & Request.Form("fname") &"',"
  sqlStr = sqlStr & " '"& Request.Form("sname") &"',"
  sqlStr = sqlStr & " '"& Request.Form("addr1") &"', "
  sqlStr = sqlStr & " '"& Request.Form("addr2") &"', "
  sqlStr = sqlStr & " '"& Request.Form("town_city") &"', "
  sqlStr = sqlStr & " '"& Request.Form("county") &"', "
  sqlStr = sqlStr & " '"& Request.Form("postcode") &"', "
  sqlStr = sqlStr & " '"& Request.Form("tel") &"')"

  set rs = conn.execute(sqlStr)
  conn.close

%>
<html>

<head>
<title> Reply Page</title>
</head>

<body bgcolor="ffffffff">

<center>
     Thank you <b><%=Request.Form("fname")%>
     <%=Request.Form("sname")%> </b>for your details.<br>
</center>

</body>
</html>
```

Listing 4 – A simple ASP database application, detail.asp

```
<html>
<head>
<title>Details </title>
</head>
<body bgcolor="ffffffff">
<center>
    <h1>Personal Details</h1>
</center>
<center>
<hr width="60%">
<table width="60%">
    <td>
  <font size="+1">
  Please enter your details below.<br><br>
    <form METHOD="post"
      ACTION="http://your_server.co.uk/vasp/details.asp">
    <font size="+0">
<strong>Your Forename<br></strong>
    <input type="text" name="fname" size=30><br>
<strong>Your Surname<br></strong>
    <input type="text" name="sname" size=30><br>
      <br><hr width="50%"><br>
<strong>Address 1<br></strong>
    <input type="text" name="addr1" size=50><br>
<strong>Address 2<br></strong>
    <input type="text" name="addr2" size=50><br>
<strong>Town/City<br></strong>
    <input type="text" name="town_city" size=30><br>
<strong>County<br></strong>
    <input type="text" name="county" size=30><br>
<strong>Postcode<br></strong>
    <input type="text" name="postcode" size=8><br>
<strong>Daytime Telephone Number<br></strong>
    <input type="text" name="tel" size=15><br>
      <br><hr width="50%"><br>
      <p>
      <input type="submit" value="Send Details Now">
      <input type="reset" value="Clear">
    </form>
  </table>
</center>
<br>
</body>
</html>
```

Listing 5 – details.html

Figure 2 shows this model along with simplified DAO and RDO models. You don't have to worry about C++ and the more complex issues of OO programming to use ADO. In fact ADO is easier to use than DAO and RDO if you're a Visual Basic programmer.

There are three main objects within ADO: the `connection` object, the `command` object and the `RecordSet` object. The `connection` object is responsible for maintaining information about the data provider from which the `RecordSet` object will be created. It works in conjunction with a DSN on the NT server.

The `command` object is used to create a minimal cursor-driven `RecordSet` but is designed to take advantage of advanced features such as passing parameters inside a query or even invoking stored procedures. The code example below outlines a call to a stored procedure within a database pointed to by DSN `myConn`. The stored procedure is named `myQuery`. Note that `objCmd.Execute` would actually create the `RecordSet`.

```
Set objCmd = Server.CreateObject(ADODB.Command)
objCmd.ActiveConnection = "myConn"
objCmd.CommandText = "myQuery"
Set objResult = objCmd.Execute
```

When you use the `RecordSet` object to create a recordset, you are using the `CreateObject` method of the `server` object. You must specify all the properties of the recordset. However you can create a recordset implicitly by using `connection` or `command`. See Table 1 for a description of ADO methods and properties.

Listing 4 shows a complete code example for an ASP application that creates a `RecordSet` object. This listing enters user details into a database then thanks them for their entry. It uses a DSN named `person`, which is defined as an ODBC source connection to SQL Server. I've left out the details of how the database actually holds the data eg *varchars, integers*.

One other point to note is that the data sent to the user comes from HTML form based elements – text fields – and are posted by the submit button, hence the `Request.Form` method. This can be seen in Listing 5.

ASP and ye shall receive

ASP is a simple solution to a complex problem – that of deploying large-scale applications over the Web to clients which might be running on any of a variety of platforms or operating systems. Because all the code and logic runs on the Web server or other NT machines on the server side, it's a great way to exploit the power of existing applications and ActiveX controls without the overhead of installing great volumes of software to all the clients.

With new ASP-enabled tools coming from Microsoft and other companies in the near future, it would pay any Web developer building sites on NT to have a look at this technology. Start scripting today! ■

Roy Tynan is the technical director of Manchester-based hardware and software design company, The Pixel Factory, whose software expertise covers real time embedded micros, Windows software design and Interactive Internet/Intranet solutions. Roy can be contacted at roy@pixel-factory.com.

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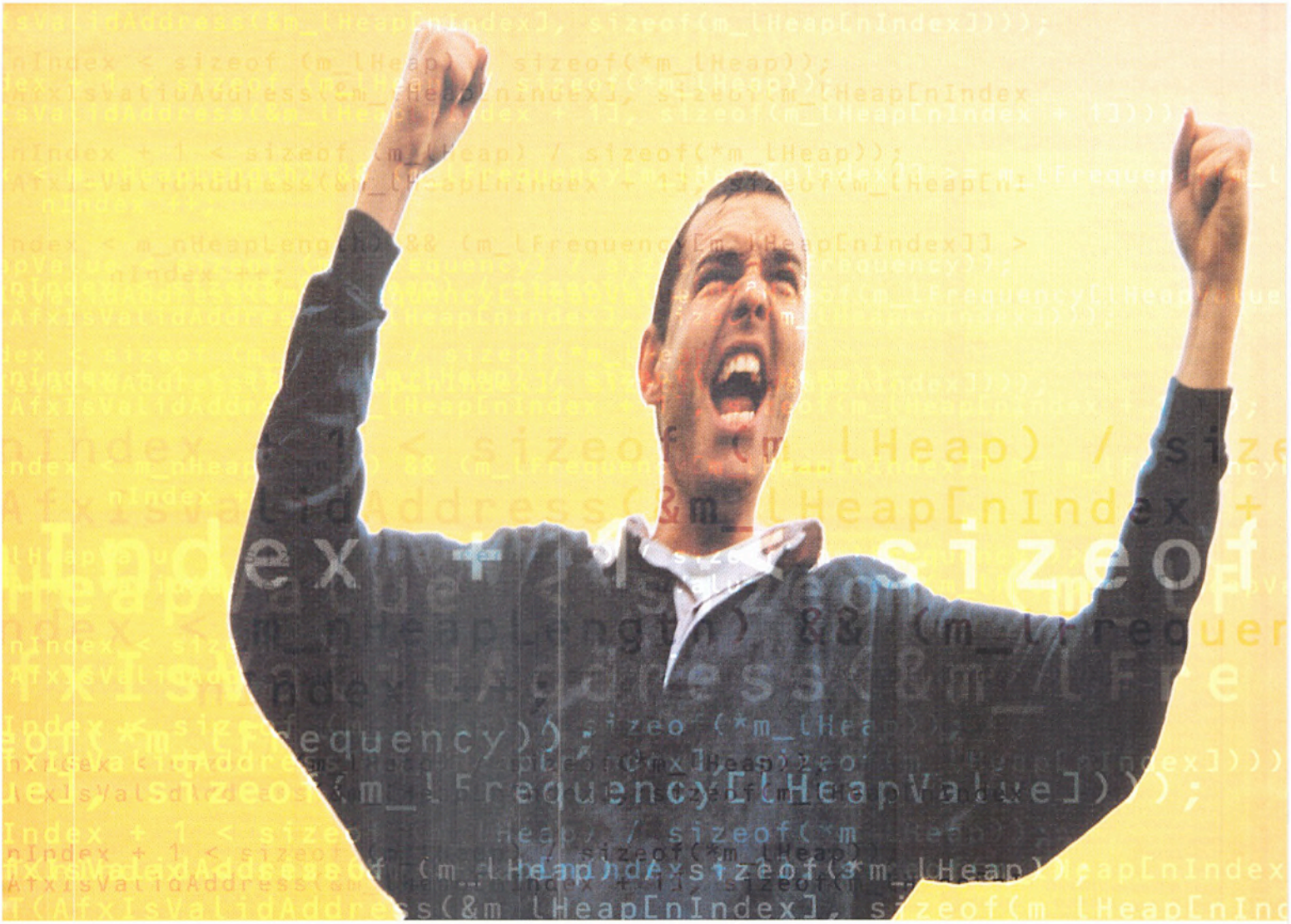

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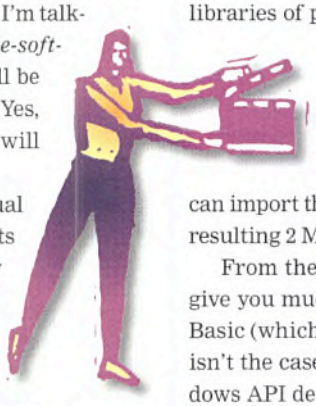
A cast of thousands

You are a busy Visual Basic 5.0 developer and you could do with some assistants. Dave Jewell found a horde of them in Sheridan's VBAssist 5.0.

Most modern development systems are far more customisable than was the case a few years ago. The Borland C++ 5.x IDE, for example, contains a sophisticated scripting language, cScript, which pretty well qualifies as a programming language in its own right. Delphi 3.0 doesn't advertise the fact that it's customisable, but provided you know which strings to pull, you can do some remarkable things with the new package support. Hint: if you don't know what I'm talking about, point your browser at *http://www.eagle-software.com/*, download the latest Raptor beta, and you'll be amazed at just how much string-pulling can be done! Yes, it is possible to do this sort of thing for yourself, and it will almost certainly form the subject of a future article...



In a similar vein, you can build add-ins in the Visual Basic 5.0 IDE which look and feel just like existing parts of the development environment (even like the new Office-97 style toolbars). VBAssist 5.0 from Sheridan is a set of fifteen productivity-based add-ins specifically designed to work with Visual Basic 5.0. The complete set requires around 10 MB of disk space, including the online help. The online documentation is excellent (see Figure 1), and it needs to be, because Sheridan does not apparently supply a printed manual with this product. Installation is painless, and once done, you can immediately fire up Visual Basic, and you'll find all fifteen add-ins neatly packaged inside a new toolbar. VBAssist 5.0 is an update of a previous product for earlier versions of Visual Basic, but this review assumes that – like me – you haven't encountered it before.

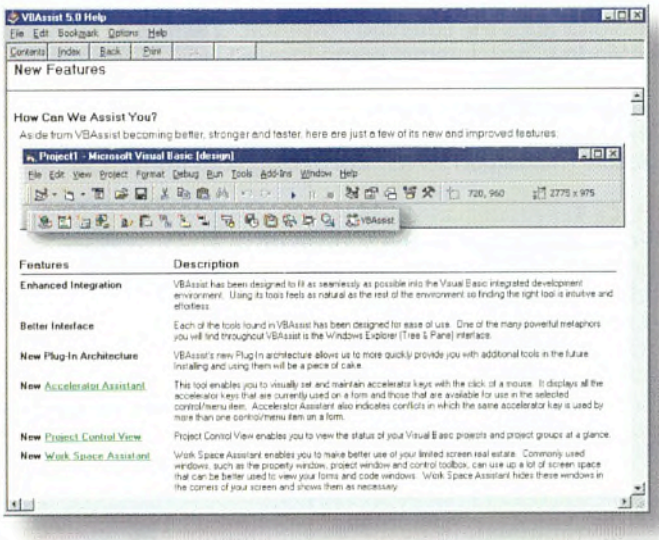


Figure 1 – Although VBAssist doesn't include a manual, the online documentation is first-rate, and context sensitive help is available whenever the different elements of VBAssist are active.

The first item on the VBAssist toolbar is Code Assistant. This small utility allows you to maintain what Sheridan refers to as 'Code Libraries' (filename .COD). If you come from a more traditional programming language, this is something of a misnomer, because we're not talking about libraries of pre-compiled code. Rather, Code Assistant enables you to logically organise constants, types (as in Figure 2), declarations or the entire body of a routine into a single, hierarchically organised, network-shareable database, from where you can easily copy/paste them into an active Visual Basic project. As a bonus, Code Assistant can import the WIN32API.TXT declarations file into a code library, the resulting 2 MB .COD file being a standard Jet database.

From the above, you might suppose that Code Assistant doesn't give you much over and above the API Viewer supplied with Visual Basic (which can also convert the API declarations to a Jet file). This isn't the case: Code Assistant isn't specific to working with the Windows API declarations, has a much nicer user interface and you can edit database entries in place, meaning that other developers on the network immediately get access to any changes you've made. You can associate up to four keywords with each library entry and you can search for entries using these keywords. Finally, Code Assistant lets you add new group names to your library and move entries between groups. Thus, you might create a new 'Compression' group, and move all your compression-related routines into this group.

No VBAssist, no comment...

The next VBAssist goodie is the Comment Assistant. Click this item, and another toolbar appears, with seven different component-related options. As the name suggests, Comment Assistant is all about the comments you include in your Visual Basic code. Some of the Comment Assistant options are a bit trivial, while others are genuinely useful and save a lot of typing time. For example, you can select a block of code and comment out the entire block in a single operation, while another toolbar option reverses the process. You can add a standard comment header to the beginning of every procedure or function body, and there are simpler options for adding a comment to the top or to the right of the currently selected program text. The Comment Assistant isn't likely to set the world on fire, but it is template-based, meaning that when you, say, add a procedure-style comment header, the format of the comment text is taken from a standard template. You can customise these templates to your heart's content, and each template can include one of several macros, so that, for example, $P expands out to the name of the project, $I expands out to the name of the developer, and so on. You can even use the $R macro to interactively ask the programmer for a block of text from within a comment template.

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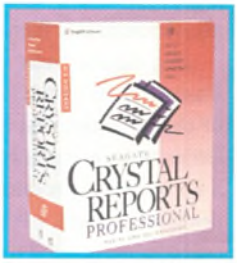

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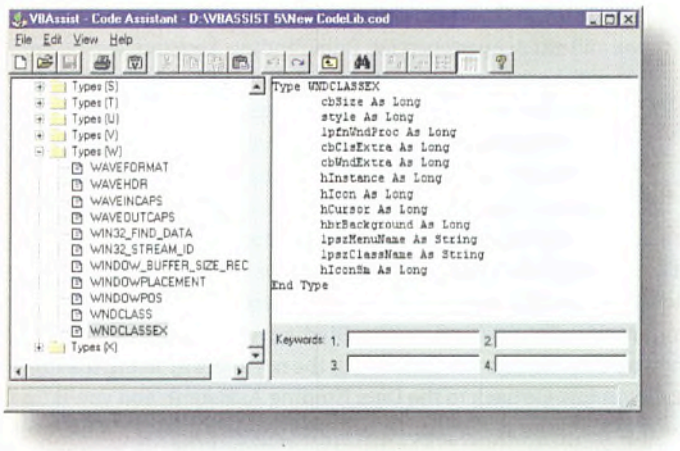


Figure 2 – Code Assistant organises your program code into network-shareable database libraries. You can attach up to four keywords to each library entry and search on keyword, name or text.

Next in line is the Common Dialog Wizard. This walks you through the steps needed to add a common dialog to your Visual Basic application. It handles Open, Save, Printer, Color, Font dialogs and (somewhat oddly) can also be used to invoke the Windows help engine which certainly isn't a common dialog! However, it does make sense to include this functionality in with the Common Dialog Wizard. For each possible type of dialog, you get asked a series of questions about the dialog configuration you want (eg can the user specify a default colour, should there be a Help button and so forth). Once you've answered all the questions, the necessary VB code can be either copied to the Windows clipboard or else pasted into the currently open code window. It's a shame the Common Dialog Wizard doesn't automatically add the necessary `CommonDialog` control to the form window – you have to do this manually. Not being an authority on Visual Basic add-ins, there may well be some dark and mysterious reason why this can't be done. As a convenience, once you've created a dialog using Common Dialog Wizard, you can save it as a named configuration, meaning that at some future time you can add an identical dialog to another form or project without answering all the questions again.

Resource Assistant is all about managing resources (.RES files). You can use it to create and edit bitmap (as in Figure 3), cursor, icon and string resource types, import resources from external files and export resources to individual .BMP, .ICO and .CUR files. You can also generate resource script files for use with an external resource compiler. Resource Assistant can automatically generate .BAS modules which contain symbolic constant declarations for the resources contained within a .RES file. Dialog boxes and menus aren't supported by Resource Assistant because these resource types aren't normally used within the context of Visual Basic programming, but the resource editing facilities it *does* contain are excellent. The editor has a Developer Studio-style feel to it, and there's a nice screen capture utility built-in for capturing screen images into a bitmap image.

Of particular interest is the ability to work with a designated form in the current project, as well as .RES files. If you open a form from within Resource Assistant, you can directly edit the `Picture`, `Icon`, `MouseIcon` and `Palette` properties of the form. Better yet, in the same way you can edit the graphical properties of any controls which happen to be on the form. This pretty well eliminates the need to leave the IDE when performing resource editing. I do have a couple of minor criticisms though; it would be great if you could import resources from .DLL and .EXE files as well as from resource files. Secondly, it's a shame that when you double-click the ellipsis (...) on a relevant property in the Properties window, it doesn't automatically fire up Resource Assistant with the relevant graphic ready for editing. Again, this may be a restriction on what can and can't be done through VB's add-in interface.

Clicking the Accelerator Assistant brings up a cute little window from where you can instantly assign an accelerator to whatever control is selected on the form. As you move the mouse along a horizontal character set, you can instantly see which accelerator shortcuts have been allocated, and which ones are still available. Selecting a particular shortcut immediately changes the caption of the control, adding the requisite ampersand character needed to enable the shortcut. If you want more control, you can expand the Accelerator Assistant window. This shows you a tabbed dialog where you can see the accelerator key associated with each control, determine which controls haven't currently been assigned an accelerator, and check for possible conflicts between different controls.

Mother of all alignment dialogs

Control Alignment Assistant is a sort of 'mother of all alignment/positioning dialogs'. I've extensively used the control alignment facilities in Delphi, Developer Studio, and other IDEs, and this one must surely be the most ...umm... comprehensive. One feature which I've not seen elsewhere is the ability to swap the position of two different controls. On the positioning side, you can do all the usual stuff like align left, right, top and bottom. You can centre controls horizontally and vertically with respect to their centres, and with respect to the parent window. Under the sizing tab, unusual features include the ability to resize with respect to the client area of the parent. You can use a couple of small edit boxes to specify horizontal and vertical margins between the control(s) and the boundary of the parent client area. There's an option to resize the parent window so

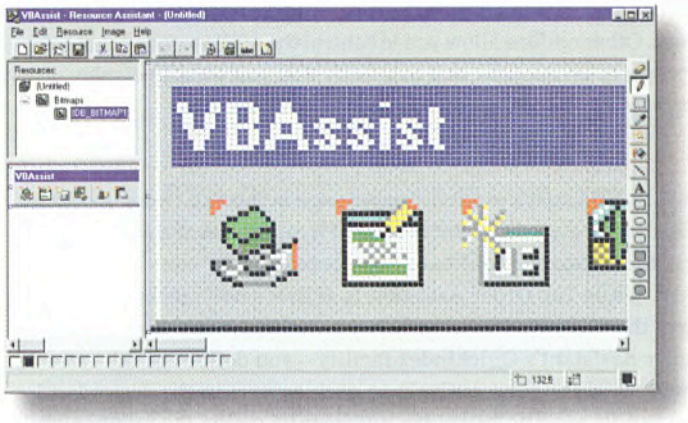
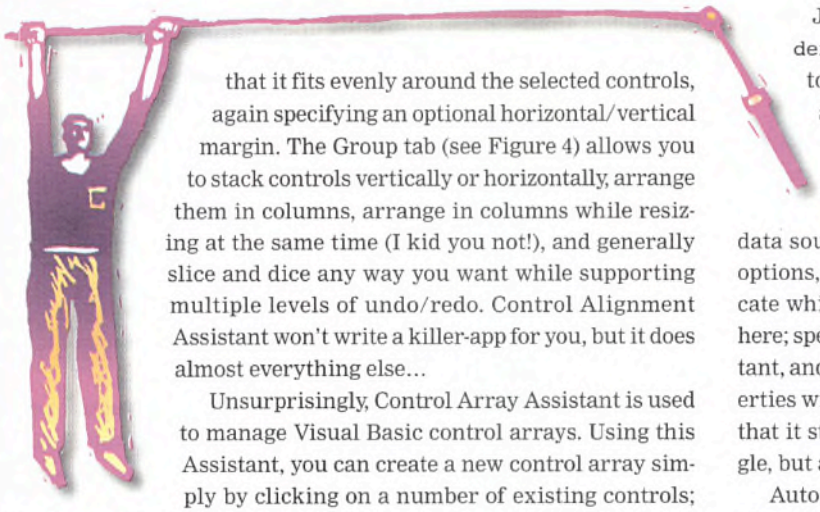


Figure 3 – The Resource Assistant supports bitmaps, cursors, icons and string resources. It includes a very acceptable bitmap editing facility, and can be used to perform screen capture.



that it fits evenly around the selected controls, again specifying an optional horizontal/vertical margin. The Group tab (see Figure 4) allows you to stack controls vertically or horizontally, arrange them in columns, arrange in columns while resizing at the same time (I kid you not!), and generally slice and dice any way you want while supporting multiple levels of undo/redo. Control Alignment Assistant won't write a killer-app for you, but it does almost everything else...

Unsurprisingly, Control Array Assistant is used to manage Visual Basic control arrays. Using this Assistant, you can create a new control array simply by clicking on a number of existing controls; they automatically become part of the control array. You can also use the Assistant to remove one or more controls from an existing array, and to rename an array. This last option causes all the individual controls of the array to be renamed at the same time. If you delete various parts of a control array, you'll end up with array members which are numbered non-contiguously. By using the Compress Array feature as shown in Figure 5, you can compress a sparse control array, removing any gaps in the index values and causing the affected members of the array to be automatically renamed. A clever QuickIndex feature can be used to reorder the individual members of an array by just consecutively clicking on them.

One problem with the Visual Basic IDE is the plethora of windows you've got to handle; Code window, Form window, Project window, Properties window, Component palette and so forth. In general, it's a pain to select a control and then have to hunt around for the Properties window in order to determine how a particular property is set. Even when you've found the Properties window, you have to scroll around to find the property you're interested in. Is there a better way? Well, you could always right-click the control and then select Properties from the popup menu, but where's the fun in that?

VBAssist's Property Tips option provides a more exciting solution. Using property tips, you can move the mouse over a particular control (the control doesn't have to be selected, and you don't need to click the mouse) and a popup tip-window will appear, showing you a subset of properties for the control. Using the property tips configuration dialog, you can control which properties are displayed in the tip window, and which aren't. Having built a set of displayable properties, you can save this as a 'property tip set' and then save it to disk for later reuse. Other options allow you to control the milliseconds delay before a property tip appears, and to specify that you want to display property tips for the form, as well as for its child controls.

Keeping tabs on things...

Next in VBAssist's extensive repertoire is the Tab Order Assistant. No prize for guessing what this does! It automates the process of setting the `TabOrder` and `TabStop` properties for each control on a form. While Tab Order Assistant is active, small markers appear to show the current order of tabs. It uses a similar approach to Control Array Assistant's QuickIndex facility – you define the tab order by simply clicking consecutively on each control in the desired order. You can set specific `TabOrder` numbers by typing the number while the mouse is over a control. A small popup window (like a tip window) appears, but containing an edit box in which the new tab number may be entered.

Just as Tab Order Assistant automates the setting of `TabOrder` and `TabStop` properties, Data Binding Assistant can be used to set the `DataSource` and `DataField` properties for data-aware controls, set data access options, and so forth. With Data Binding Assistant active, clicking on a simple control such as a label will pop up a dialog from where you can change the data source and selected field. Clicking on a data source control brings up a more complex dialog to set access options, specify the type of database you're working with and indicate which specific database file is being used. I found a minor bug here; specify a database using Data Binding Assistant, close the Assistant, and then change the database in the normal way using the Properties window. Go back to the Data Binding Assistant, and you'll find that it still thinks it's using the original database. Only a small niggle, but a little irritating...

Auto Project Save is one of the simplest tools in VBAssist. It simply auto-saves a project at specified time intervals, with or without confirmation. 'Nuff said! Clipboard History Assistant is a cute little utility which enables you to set up a clipboard history database, recording all the items that have been pasted onto the clipboard (see

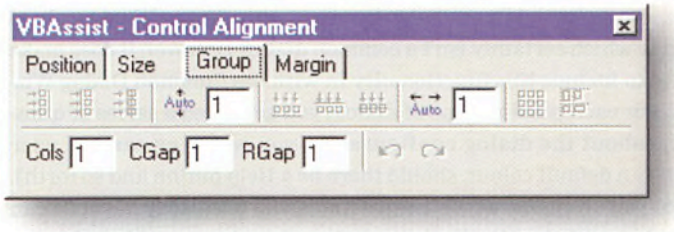
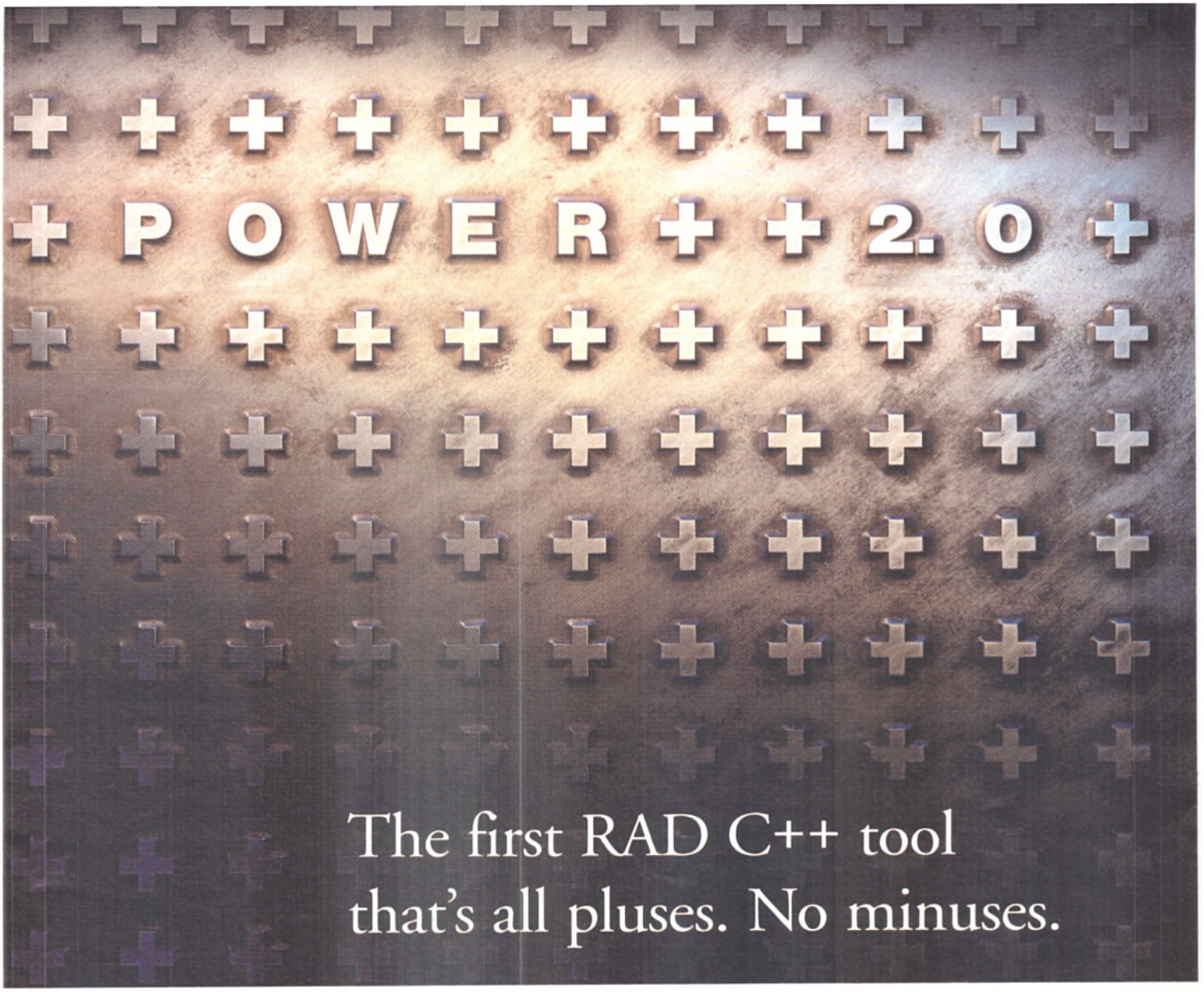


Figure 4 – Mother of all alignment/sizing dialogs. It doesn't look much here, but there's a great deal of functionality lurking beneath that mild-mannered exterior. Some might say, a little too much...

Figure 5 – The Control Array Assistant is great for managing control arrays, removing unused array entries and so forth. Fundamentally, it won't do anything for you that can't be done with the Properties window, but it's a lot quicker to use.



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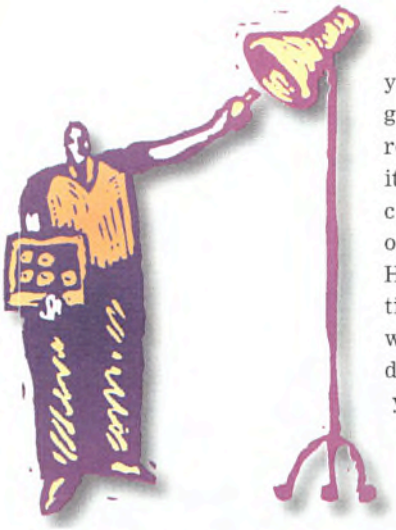

Figure 6). You can split the clipboard history up into your own, user-defined categories and you can easily retrieve a clipboard history item that would (in the normal course of events) have been overwritten. With Clipboard History Assistant active, cutting or copying an item from within the IDE, causes a small dialog to popup up from where you can assign a name to the item – it then appears with this name in the Clipboard History window. An especially nice feature of Clipboard History Assistant is its ability to save a control, complete with its various event handlers, as a single entity. This is very convenient and means that you can effectively treat the Clipboard History Assistant as a scratchpad where controls, bitmaps, and so on can be stored for easy copying between different project and forms, or in those cases where you want to temporarily remove a control from a form for some reason.

VBAssist's new Project Control View window works rather like a souped-up version of the IDE's built-in Project window. As with the Project window, it shows a hierarchical view of your project (or projects, if you've got a project group open) and allows you to view the different forms and class modules making up the project. Unlike the existing Project window, you can view the individual controls on a form, see a list of event handlers for the selected control and instantly fire up a Code window by double-clicking a specific handler. As well as getting a project-oriented view on life, you can select another tab on the Project Control View window and see a control-oriented view of your project. The root of the displayed hierarchy then becomes the individual controls, and for each control, you can see which projects and forms use it and – as before – jump straight to an assigned event handler. You can view object attributes and code in the right-hand pane of the window, and double-click there to go to the appropriate form or code editor. It sounds complicated to explain, but it's dead easy to use, and represents a simple way of navigating around inside a complex project hierarchy.

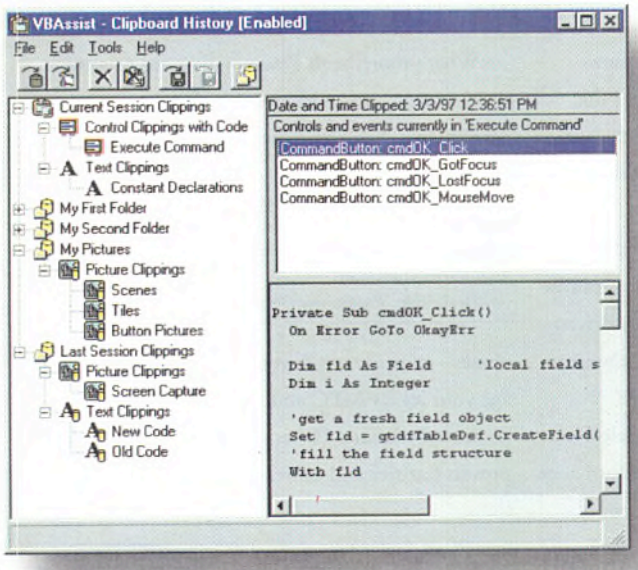

Figure 6 – The Clipboard History Assistant keeps track of everything that's cut/copied onto the Windows clipboard from within the Visual Basic IDE. It works like a sophisticated scratchpad, storing the event handlers associated with each control.

Confetti and chewing gum removal assistant

I've already referred to the excessive number of windows which you have to grapple with in the Visual Basic IDE. Either you make 'em undockable and end up with them floating around all over the place like high-tech confetti, or else you make 'em dockable at which time the damn things develop a mind of their own and – like chewing gum – stick everywhere except where you want them to be. Sounds familiar? If so, you'll *love* Work Space Assistant.

With Work Space Assistant, you designate four windows as mapping to the four corners of your computer screen. For example, I map the Project window to the top-right corner of my screen, the Properties window to the bottom-right, and the component Toolbox to the bottom-left. When I move the mouse to the bottom-right corner of the screen, the Properties window slides into view ready for instant action, but when the mouse leaves the Properties window, it slithers back whence it came. With the Work Space Assistant setup dialog, you can configure the hide and show delays for when the individual windows appear and disappear. In addition to working with built-in windows, this feature works with VBAssist's own windows so that, for example, you might want to put the Resource Assistant in the top-left hand corner. I work at a screen resolution of 1024 * 768 and find Work Space Assistant very useful for reducing screen clutter.

Finally, VBAssist is rounded out by the inclusion of Zoom Assistant which captures and magnifies selected parts of the screen. Zoom Assistant owes much to the Microsoft's old SDK sample program, ZoomIn, and includes an auto-refresh feature, allowing it to keep updating according to the state of the currently selected screen area.

Fleshed out

VBAssist is a useful package of productivity add-ins for Visual Basic 5.0 which significantly improve the user interface of the bare-bones IDE. I reckon it's worth it for the Work Space Assistant alone, but you'll find the Clipboard History Assistant equally indispensable, and with the somewhat over-done Control Alignment Assistant, you've got absolutely no excuse for not aligning all your form controls with pixel precision! ■

Dave Jewell is a freelance consultant, programmer and technical author specialising in low-level systems programming, development systems and compiler design. He is the author of 'Instant Delphi' published by Wrox Press. You can contact Dave as djewell@cix.co.uk.
VBAssist 5.0 costs £130 + VAT and can be obtained from Contemporary Software on (01344) 873434. Alternatively, you can email them at: sales@contemporary.co.uk. If you want to 'try before you buy', download the trial versions of VBAssist 5.0 from Sheridan's Web site at http://www.shersoft.com.

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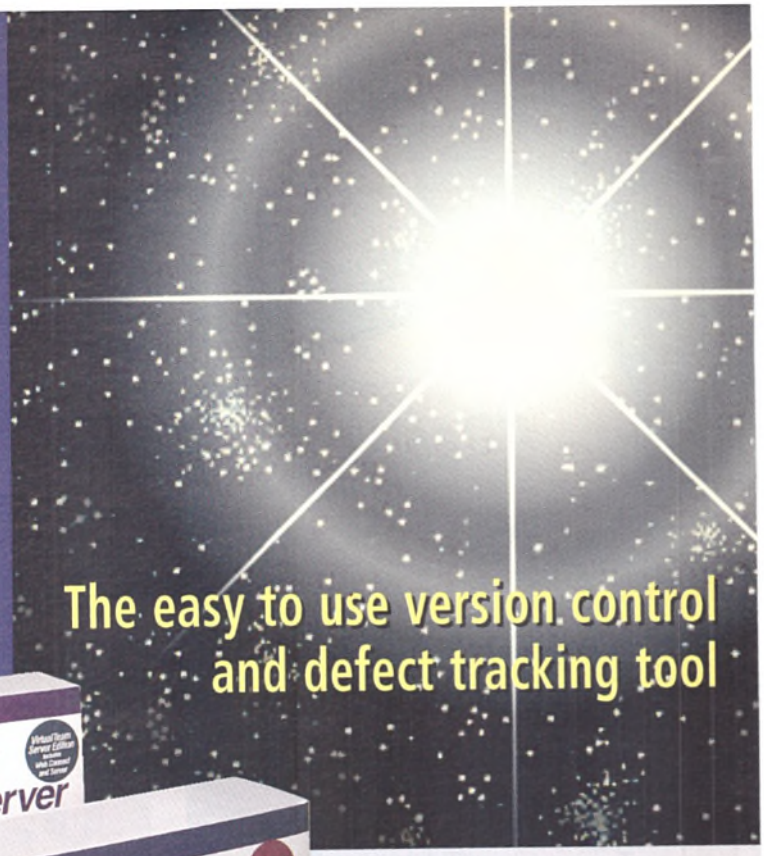

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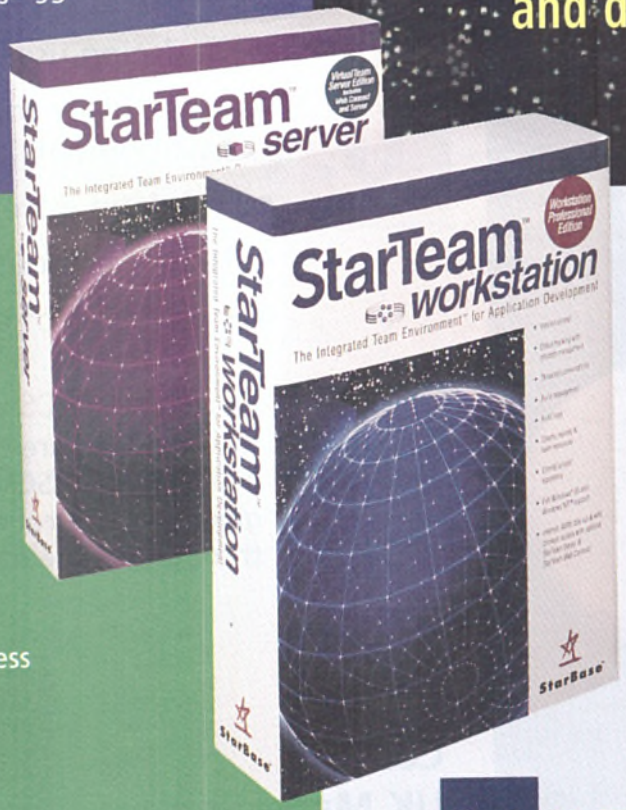

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StarBase

What the @*?# is happening?

When a process or a program starts to go wrong, anything could have happened anywhere. Don't panic! Peter Collinson is used to dealing with such situations and he explains how.

I've been writing some Perl programs for handling CGI scripts recently. I confess that I have been avoiding Perl, but not for any particularly good reason. I suppose that I have not found anything where I felt I needed to use it. I'd hacked someone else's Perl code for my visitors book on the net, so I'd done some Perl programming but didn't (and still don't) consider myself a Perl programmer. I'm learning.

I suspect that delaying looking seriously at Perl until Perl 5 was well developed was actually a good move. Perl 5 is a reasonable language, in which it seems possible to avoid much of the nasty side effects that characterised the older syntax. There were altogether too many bits of quiet magic in Perl, so you could never be quite sure what was going on. Some of the magic persists, for example, I'm still not too happy about the syntax used to pass parameters into functions and procedures, but I'm learning to live with it.

However, when you're writing something in a scripting language with a considerable number of high-level features, then there will come a point where you wonder what is happening. Is the script not functioning because you are experiencing a problem with your understanding of what you have said in the language or is there something else that is fundamentally wrong? You are dealing with a layer of interpreter code that is somewhat of a black box, and perhaps it's broken as well.

David Humphries @ Monster

We seemed to have moved to a point where many systems are actually black boxes, where what you need to know as a developer is limited by (hopefully) clean interfaces to the underlying goo. Systems present a model of how things work, and that model can often be some way remote from the reality of the implementation which exists under the hood. Actually, we are all paying for this. I had not appreciated the processing speed that's available on my laptop until I replaced Windows 95 temporarily by BSD/OS and discovered a lively machine that zipped through the work. There must be layers and layers and layers of system code in Windows 95 that knocks the stuffing out of the processor.

I guess I have been spoilt by growing up with a Unix system which came fully supplied with source. Most of my working life, I've been able to look at the source code to find out what some program did or didn't do; and I still search through the source when dealing with my BSD/OS system. Of course, the C source is very WYSWYG programming, the code is not much more than high-level assembler and the programs provide a very thin layer that sits between the user and the machine.

As time has inexorably advanced, we've found ways to make that thin layer into a thick one, for example, using C++ or interpreted languages. There have usually been good reasons for this change, and a feeling that there are processor cycles to burn hasn't held anyone back. Also, the ability of developers and users to inspect the underlying code has largely disappeared. Most Unix systems are shipped as binary entities where you have to guess what some program is doing based on enlightened deduction or seat-of-pants guesswork.

Who said that...

One of the problems that I frequently seem to encounter is encapsulated by the question 'who said that?' At some point during program development or just getting on with life, my system presents me with a message that didn't come from anything that I had written, but perhaps emanated from the kernel or some other process to which my program was talking. Of course, I am now largely unaware of what servers my program is discussing the work with. Calls to ancillary servers can be embedded in libraries and I have no clue about what libraries my program is linking to unless I take steps to find out.

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In these cases, I resort to an old BSD program that is still kicking around on Unix systems, largely because it became sanctified by Posix: the `strings` program. The job of `strings` is simple. It is given one or more files and searches though them looking for sequences of bytes that look like C strings. There's usually a default minimum size (Posix says four characters) but the program will print any sequence of bytes that are longer than the minimum size and are terminated by a newline or a null character.

Actually, this minimum size means that large portions of the machine code on Intel machines will print out as legal strings. You'll see stuff like:

```
HJ;E
8WVS
-%SW
BA@9
 A@9
y(;}
OH;O
```

To find the strings you are looking for, the use of `grep` is mandatory.

Using the `strings` program to scan binary object files and libraries should tell you the exact file from which that mysterious message emanated. I used the `strings` program to scan my systems when I was writing the article that was printed in EXE in May. I wanted to see how many programs on my Sun were likely to be possible problems when the calendar clicks over from 1999 to 2000. How many programs use code like:

```
printf("19%2d\n", year);
```

rather than:

```
printf("%4d\n", year+1900);
```

I fed all the binaries into `strings`, and piped the output of the program into `grep` to identify the strings I was looking for, the script was something like:

```
for name in /bin/*
do
    strings $name | grep '19%' && echo $name
done
```

The script passes each file into the `strings` command, and then passes the decoded output into `grep`. If the `grep` succeeds, then the `echo` command is executed, printing the file name. If you run this on a Solaris 2.5 system, you should find that `atq` will need replacement before 1999 finishes.

and what is it doing...

If you've found some server running on your machine that is the likely culprit for that random message, then the next question is 'what is it doing?' Actually, I often seem to be asking this question about processes that are running on the machine. Sometimes processes are running away, perhaps getting bigger and bigger, perhaps emitting messages, perhaps not. The solution may be to reboot the machine and hopefully all will be well. However, if you do reboot the machine, then you've lost the evidence of what is happening, and do not really know what went wrong.

Ideally, you need some way of deducing what a process is doing. I tend to use one of the tools provided by my Unix systems which dump a trace of the system calls that a process is executing. On Solaris, this program is called `truss`, on SunOS `trace`, on systems derived from 4.4BSD (like BSD/OS or FreeBSD) it's called `ktrace`. The Sun based programs send text data to their standard output, although some options can be used to write the output to a file. The `ktrace` program creates a file in the current directory called `ktrace.out`, and the contents of this file can be printed with `kdump`.

On a Solaris system, you can run a command and see what it does by writing something like:

```
$ truss /bin/ls
```

The output will start like:

```
execve("/bin/ls", 0xEFFFF2C0, 0xEFFFF2C8) argc = 1
open("/dev/zero", O_RDONLY) = 3
mmap(0x00000000, 4096, PROT_READ|PROT_WRITE|PROT_EXEC,
open("/usr/lib/libw.so.1", O_RDONLY) = 6
fstat(6, 0xEFFFEF74) = 0
```

The output is truncated here to fit the printed column. You can see the program starting, and then connecting all the dynamically linked libraries that it needs. The program uses the `mmap` system call to load the library binaries that it needs into its address space. Somewhat later on, you can see the program opening the current directory and reading its contents data:

```
open(".", O_RDONLY|O_NDELAY)    = 3
fcntl(3, F_SETFD, 0x00000001)   = 0
fstat(3, 0xEFFFF0B8)            = 0
getdents(3, 0x0002D118, 1048)   = 1040
getdents(3, 0x0002D118, 1048)   = 732
brk(0x0002E4F0)                 = 0
```

The number at the end of the line is the returned value from the system call, `getdents` is the actual system call used to read directory entries. The code is calling `malloc` to get memory to store the information that it is finding and `malloc` is calling the `brk` system call to get more space to work in. Having done that, it will print the result:

```
acctcom     fc              montbl          sort
write(1, " a c c t c o m    "..., 59)       = 59
adb         fdetach         more            sortbib
write(1, " a d b              "..., 62)     = 62
```

The output is printed before the system call that created it. Finally, the program will call `_exit(0)` to signal success.

What's useful in the output from `truss`? Well, obviously, the sequence of operations can give you enormous amounts of information about exactly what the program is doing. If you do have the source of the program, then following the system calls along with the code can tell you what tests in the program were true and which were false. It allows you to deduce the path through the code.

You can get similar output by connecting the `truss` program to a running process using the `-p` parameter:

```
$ truss -p 145
```

where the `145` is a process id. You have to own the process or be superuser, otherwise `truss` would circumvent system security, and this would not be a good thing. When you connect to a background process using this flag, you can detach again using Control-C, leaving the traced process running.

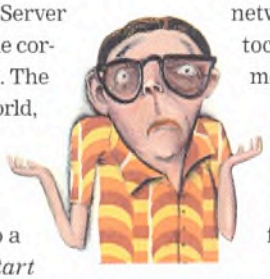
If you are looking at a program that is stuck in the background, then you can usually see the loop that it is continually executing. Maybe the program is trying to open a file and failing, and knowing the full pathname of that file can give you clues about what is or is not happening. So the values associated with the system call arguments and their return values can help you to deduce and rectify problems.

If the process being traced forks to create a new process, then what you would like to do varies. Sometimes you would like to only log system calls from the current process; in other situations, you are interested in what a child does, so you would like to trace the calls in the child. The `truss` command provides a flag that permits you to follow any child forked by the original process.

The ability to trace children is very useful if you are trying to debug a program started from the network, perhaps from `inetd`. I've had sit-

uations where programs appear to be okay when started in debug mode but fail when started from `inetd`, and `truss` has been very useful in sorting out why things were not working as expected. To be sure, you do need to use a lightly loaded machine for this exercise so that you are not deluged with output from unrelated operational processes.

My Web server lives on a BSD/OS machine and I made use of `ktrace` when I was debugging CGI scripts that I had written in Perl. Like `truss`, `ktrace` can be attached to a running process and instructed to follow the output from the children that a process forks. At the time, I was uncertain of the exact environment provided by my Web Server for the script. I was reluctant to believe that I was using the correct incantations in the script to make it do what I wanted. The script was using many system calls to access the outside world, and by guesswork I could relate the system calls back to statements in the language.



Incidentally, you'll find that Windows NT provides a way of attaching the debugger supplied by Visual C++ to a running process. I have found that selecting the *Start Debug/Attach to Process* option in Developer Studio 5.0 results in the death of the Studio, optionally putting you in the interestingly recursive situation where the Studio is debugging the Studio. However, you can attach a process to the Studio. The trick is to start the NT Task Manager and select the *Debug* option summoned by using a right button click on a process name. Processes will die when you stop debugging, so you need to be circumspect when looking at system processes.

Getting a quick snapshot of what a running process is doing is actually not too easy on NT, but I did use this technique recently when my NT system became seriously unstable. The `explorer.exe` process (the Win32 shell) was continually running and growing in size until the system died. In extremis, I used the debugger to find that the process was in a tight loop trying and failing to open a file that was locked in some mysterious way. Rebooting the machine made no difference, surely a lock should go when the system dies? Maybe I am naive. Anyway, the system would not delete the file, but Windows NT 3.51 would, and normal service was resumed.

and what is it saying...

If you cannot see the system calls that a process is executing, then maybe you can see what it is saying to the outside world. This is easy if it's writing or reading from a file, but less so if the process is chatting away on your LAN. Well, all the systems that I use possess some form of network sniffer than can be used to look at the packets flying by on the Ethernet. On Solaris, the program is called `snoop`. On systems that take their networking from 4.4BSD like BSD/OS, it's called `tcpdump`.

Windows NT also has a network monitoring program that's theoretically part of the NT Workstation release, but I found a copy on the fiendishly expensive Microsoft Developer's Network where some folks in Holland send me loads and loads of CDs containing stuff, some of which is useful. Much of it seems less helpful to me, I don't have much use for the Outer Mongolian release of Windows 95.

The NT program works by capturing the packets into a temporary file and then allowing you to analyse them. While it's capturing, it displays statistics about how busy your network is and the types of packet that are flying along the wire. The NT program doesn't know much about IP. It is intended to operate at a lower level in the protocol stack. It displays the hardware addresses of the machines that are communicating and its filters are intended to separate different low-level packet types from the network.

All these programs will put your network interface into promiscuous mode, where the hardware picks up all the packets that pass by. The programs then capture the packets and display them. The Unix programs need super-user capability and the NT program is restricted for use by Administrators. The need for privilege is an attempt to provide some semblence of security on your network. At least, these defences will stop mortals from idly capturing packets if they are using a Unix or NT machine. However, you only need DOS and a sniffer program to be present on the same Ethernet segment to defeat these tiny defences.

It's interesting to get a vague feeling for the type of traffic that your network is carrying in normal use. I run the Network Time Protocol to synchronise my machines and you can see the daemons firing up every so often checking that the time is okay. NT seems very chatty on the network. My NT machine seems paranoid about the network printer, it frequently sends messages to the printer, presumably checking that it's on or off or perhaps wondering whether the printer is feeling mellow today.

All the network-monitoring programs permit you to be selective about the packets that are displayed. You can give them some expression that is applied to each packet to determine whether you want to see it. On even a lightly loaded network, this is a must if you are looking for some event or messages from a particular service on a machine. The expression that you give can be used to test various aspects of the communication, a host name, a port number, specific IP addresses *etc.*

Both the Unix programs dump just the packet headers by default, so you can see the type of transaction that is going on, the port numbers in use and the size of the message. The programs understand IP and TCP and will print the packet type and the TCP sequence number. The programs will also give you the machine names that the packet is travelling between. Actually, this gives rise to a little Heisenberg effect. When I run `snoop` on my Sun, I see a huge amount of traffic that is DNS lookups, and is actually the `snoop` program translating IP addresses to visible names for my benefit.

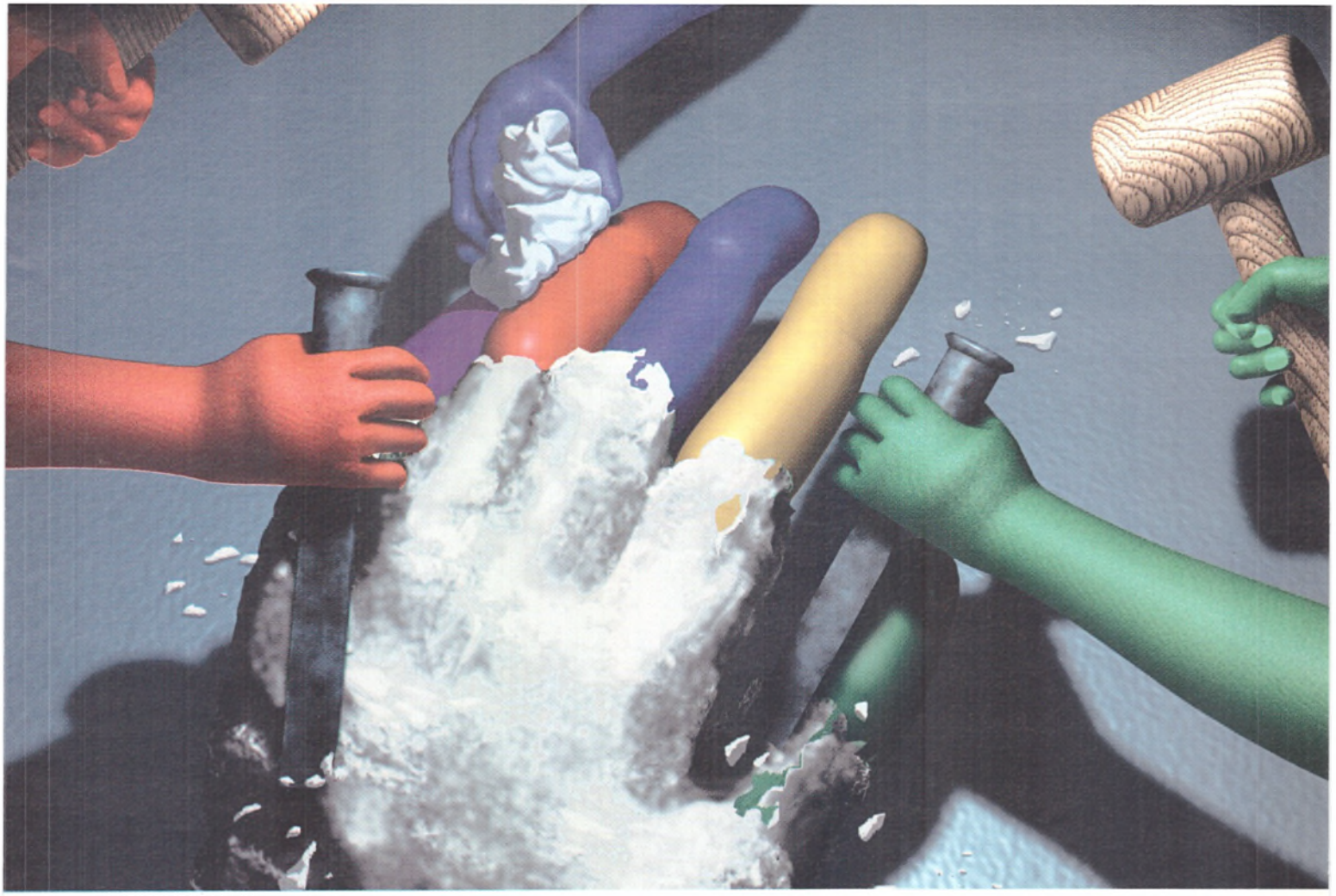
You have to take special action by supplying program options to display more of the packets if you want to look at the data that the packets contain. If you are looking for an exchange of messages inside the IP or TCP packet, you can find it quite easily. I actually used this today on a client site to investigate a daemon being used for Web Server authentication and to prove that the exchange of messages were correct.

So, by using a packet sniffer, you can find out exactly what a particular process is saying on the network, and check the responses. This is another reason for devising protocols that are human readable and not solely binary information.

and then..

I find myself fairly frequently poking at programs on machines using the tools I've described. I not only use them for debugging my programs but also for trying to work out what is happening on my systems when things have gone wrong. It may work to reboot a system and hope a problem will go away, but then the problem will undoubtedly reappear when you least need it. Trying to diagnose the problems that you've inherited from your system supplier is a good thing. It should help your vendor if you plan to use this information to complain. If complaining seems a waste of energy, then you've done your bit. Better, you are now in full possession of the facts and can hopefully generate a work-around. ■

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



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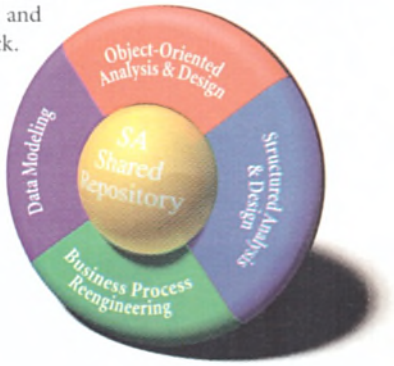

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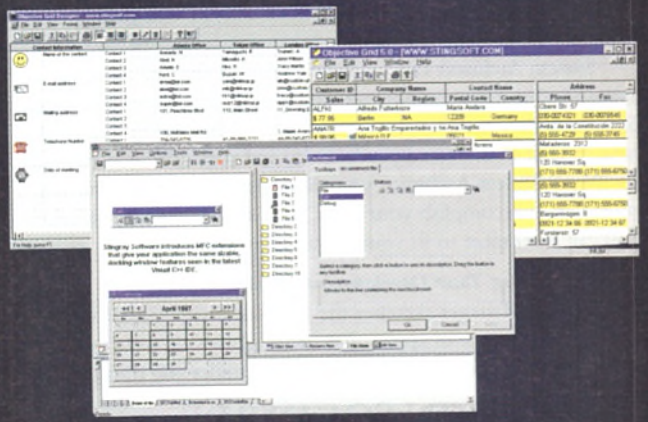

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Practical design patterns

What's the link between town planning and writing a drawing tool? Find out by following Edward Kenworthy's software patterns.

First of all what exactly *is* a design pattern? Trying to tie that down at an abstract level is quite difficult and the best I can do is quote Christopher Alexander:

'Each pattern describes a problem which occurs over and over again in our environment, and then describes the core of the solution to that problem, in such a way that you can use this solution a million times over, without ever doing it the same way twice'.

Christopher Alexander is an architect and what he was talking about were patterns in designing buildings and towns. But what he says also applies to software design in general and object-oriented software design in particular. It's about as precise as you can get in tying down what a design pattern is without giving some examples, and even then that will only give you an idea rather than an exhaustive definition. For a start, though, see the box 'What's it all about?'

Ok, so now you know what a Design Pattern is – what's the point? There are two answers: one is long and convoluted, and complete, and the other is short. For the former read *Design Patterns* (see Bibliography on page 45). For the short version read on.

There are several good reasons for using design patterns. Firstly, once you are familiar with the patterns you can describe many types of design problems and their possible solutions in a more concise way. Rather than having to say 'I need to be able to change the type of object that's created at run time, and I'm going to do that by having a method that holds an object that returns copies of that object...' (and so on... you get the message) you can instead say 'I'm using a factory method which uses a prototypical object to create instances'.

Secondly, if you have a catalogue of standard solutions to known problems which are applied consistently when the problem is encountered, then your code will be much more understandable than if you were to create a unique solution to each variant of the same or similar problems. Finally, you don't have to start from scratch every time you encounter a problem: instead you start from the 'standard' solution, the design pattern, and adapt it as necessary.

In order to illustrate how design patterns can be used, we'll look at the development of a drawing tool, concentrating on some of its key requirements, and how these can be met by applying the appropriate patterns. However because of the space limitations inherent in a magazine article, and for the sake of clarity (the subject of this article is the application of design patterns, not the development of a drawing tool), I shall not be presenting a complete application. I've even gone as far as removing some of the boiler plate code that Microsoft's J++ generates in order to reduce clutter. For the rest of the code go to EXEOnline.

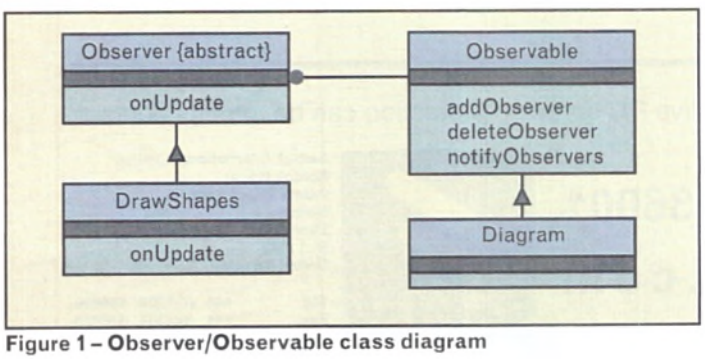

Figure 1 – Observer/Observable class diagram

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The key features the tool should have are as follows:

- Support for multiple views of the same diagram.
- Delete, undelete and redo commands.
- User definable complex compound shapes (ie dynamic definition of new classes).
- Flexible shape selection.
- 'Extensibility' (would sir care to be more specific?).

Multiple views

An essential feature is to support multiple concurrent views of the same model, with each view updated automatically when the underlying model changes. For example, you could have both a bar chart and tabular view of some data in a spreadsheet. Similarly in our drawing tool, we would like to be able to show different views of a drawing

```
// DrawShapes.java: Applet

import java.applet.*;
import java.awt.*;
import java.util.Observer;
import java.util.Observable;
import DrawShapesFrame;
import MainMenu;
import ShapeFactory;
import Diagram;

// Main Class for applet DrawShapes
public class DrawShapes extends Applet
                        implements Observer {
   // The diagram contains all the shapes in diagram...
   static Diagram m_Diagram = new Diagram();

   public static void main(String args[])       {
      ShapeFactory.Initialise(); // Init the ShapeFactory

      // Create Toplevel Window to contain
      // applet DrawShapes
      DrawShapesFrame frame =
                  new DrawShapesFrame("DrawShapes");
      frame.show();
      frame.hide()
      frame.resize(frame.insets().left
                  + frame.insets().right + 320,
                  frame.insets().top
                  + frame.insets().bottom + 240);
      DrawShapes applet_DrawShapes = new DrawShapes();
      frame.add("Center", applet_DrawShapes);
      applet_DrawShapes.m_fStandAlone = true;
      applet_DrawShapes.init();
      applet_DrawShapes.start();

      // Setup the main menu bar
      MainMenu menu = new MainMenu(frame);
      menu.CreateMenu();
      // Initialse the shape menu with all factory's shapes
      int i = 0;
      while(ShapeFactory.NumberOfAvailableShapes() > i) {
         menu.AddShapeToInsertMenu
                        (ShapeFactory.GetShapeAt(i));
         i++;
      }
      frame.show();
   }

   public void init() {
      resize(320, 240);
      // Register as an observer with the Diagram
      m_Diagram.addObserver(this);
   }

   // DrawShapes Paint Handler
   public void paint(Graphics g) {
      int i = 0;
      while (m_Diagram.NumberOfShapes() > i) {
         ((Shape)m_Diagram.GetShapeAt(i)).Draw(g);
         i++;
      }
   }

   // The mouseDown() method is called if the mouse
   // button is pressed while the mouse cursor is over
   // the applet's portion of the screen.
   public boolean mouseDown(Event evt, int x, int y) {
      if (evt.clickCount > 1
         && ShapeFactory.NumberOfAvailableShapes() > 0) {
      // Double click
         try {
            Shape newShape = ShapeFactory.BuildShape
             (new Dimension(x,y), new Dimension(100,100));
            m_Diagram.AddShape(newShape);
            // MS's observer/observable require this
            update(m_Diagram, newShape);
         }
         catch (Exception e) { // Throw exception away }
      }
      return true;
   }

   // Handles updates from the Diagram
   public void update(Observable o, Object a) {
      // force whole screen to be redrawn in response
      // to the diagram changing. Easy but inefficient.
      repaint();
   }
}
```

Listing 1 – The main DrawShapes Java applet

– perhaps one showing the whole drawing while another displays only the circles. If a change is made to the model through any one view, then we would like all of the other views to be updated automatically. (This lays the foundation for multi-user support but that's another article.) However, so that we can add new views later without having to modify the `Diagram` class that holds the drawing, we need to detach the view from the model (ie from `Diagram`). Conversely, though, the `Diagram` class must know about these views so that it can tell them when the drawing has changed and they need to update themselves! Sounds like a tall order – the `Diagram` has to both know and not know about the views upon it!

The pattern that offers a solution to this problem is probably one of the oldest. Smalltalk calls it the *Model/View/Controller*, in Microsoft's Foundation Classes (MFC) it's the *Document/View* and in Java it's the *Observer/Observable* interface/class pair. Gamma *et al* call it the Observer pattern. As I am using Java to illustrate this article I shall adopt the term Observer/Observable.

In the Observer/Observable pattern, classes derived from `Observer` (which are responsible for rendering the model) register their interest in the model with the `addObserver()` operation of an `Observable` class. This adds them to the list of `Observers` maintained internally by the `Observable`.

When the model held in the `Observable` object changes it iterates its way through this list and invokes each `Observer`'s (overriden) `onUpdate()` operation. The `Observer`-derived class then interrogates the `Observable`-derived model and updates its display accordingly. As you can see in Figure 1, the observer class needs to know about the actual model derived from `Observable`, but the model only needs to know that its list of observers are of type `Observer` and have the `onUpdate()` operation defined. Perfect. In our case, `Diagram` is our `Observable` class, and `DrawShapes` our only `Observer` (see Listings 1 and 2).

Delete, undelete and redo

One of the features, or rather family features, that are these days required of any sort of editor is delete, undo and redo. There are a number of ways we could support this, but why go to the effort of 'inventing' and then evaluating them? There's an existing design pattern which covers this; `Command`, shown in Figure 2. In actual fact, the `Command` pattern covers considerably more functionality than we need. `Commands` can be used to manage and log transactions, for example.

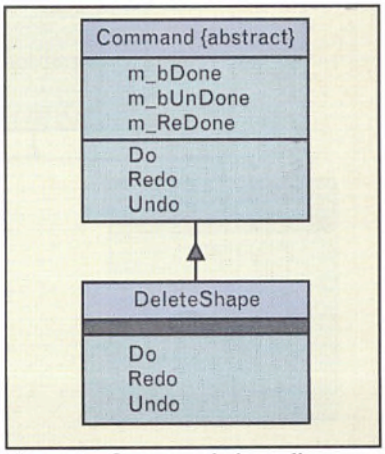

Figure 2 – Command class diagram.

To delete a shape, we first create a `DeleteShape` command, telling it which `Shape` to delete from which `Diagram`, and then invoke its

What's it all about?

Johnson, Helm, Gamma and Vlissides (in the design patterns bible, *Design Patterns*) group design patterns into three categories: behavioural, structural and creational, and we'll see examples from each of them.

Behavioural patterns describe techniques for modelling the behaviour of objects or groups of objects. For example, they describe how to model an object's state and changes in its behaviour based on it's state; or how to model behaviour that isn't associated with one particular object but with a group of objects.

Structural patterns describe how to model solutions that deal with how networks or groups of objects are related to each other. For example, modelling a situation where a single part may be a composite of other parts, or where an object can only exist as part of a greater whole, but where it should not have to know precisely what that greater whole is.

Creational patterns deal with how objects are created, how to apply rules to their creation, and the creation of networks of objects. One of the classic problems with an OOPL like C++ is that when you instantiate an instance of a class you have to hard code the name of the class, as in `Customer * c = new Customer;` What happens if you change your mind about which class you want to use, and decide to instantiate `NewCustomer` instead? You have to go through every occurrence of where you hard-coded an instantiation of Customer and change it to `NewCustomer` (even if `NewCustomer` is a subclass of `Customer`), and then recompile, relink and retest everything. So much for OO encapsulating change! And what if you need to dynamically generate new classes at run-time? Again, because inheritance is static you can't do that. Creational patterns offer standard solutions to this type of problem (and others).

`Do()` method to delete the shape. The command holds enough internal state and information such that it can undo and redo the deletion if the `Undo()` and `Redo()` methods are invoked (making sure not to undo an operation that hasn't been done, and so forth).

Our `DeleteShape` command is a relatively unsophisticated beast – we only support one level of undo, and it has simplistic way of undoing deletions. We could maintain a deletion history by placing each `DeleteShape` object in a LIFO list as its `Do()` method is invoked, thereby providing an n-level undo capability. Alternatively, we could make the `Undo()` method itself more sophisticated.

In more complex models issues such as those involving hysterisis – where repeated deletions and undeletions introduce an increasing degree of error – and those cases where undeletion is not a simple matter of re-inserting the deleted item, our simple approach wouldn't work too well. In this case the `Command` object needs to remember enough about the internal state of the model, to be able to completely restore it. The problem is of course that this idea breaks every rule of encapsulation – suddenly our `Command` object needs to know about the internal implementation of the model! Fortunately there's a design pattern for that too. A `Memento` is a black box that is only accessible by the object that created it (in C++ terms it has only `private` members, and specifies its creator as a `friend` class), and encapsulates enough of its creator's internal state to allow its creator to restore itself to the state it was in when it created the `Memento`.

If we were to modify our editor so that it used `Mementos` for undeletion (rather than simply remembering which `Shape` was deleted from which `Diagram`) then `DeleteShape`'s `Do()` operation would obtain and store a `Memento` from the `Diagram` before removing the appropriate `Shape`. To reverse a deletion, the `Undo()` operation passes the stored `Memento` back to the `Diagram`, which restores itself to its original state. Of course, this would require extra functionality to be added to the `Diagram` class.

User definable complex compound shapes

Within our tool we have specified that we want to be able to group shapes together into compound shapes that we can resize and move as atomic units in the same way as normal shapes. It should even be possible to build a compound shape out of other compound shapes. The design pattern that supports this is the `Composite` pattern, shown in Figure 3.

The Composite patterns define a way in which we can treat both individual parts and aggregates of parts as being the same. The `Shape` abstract class defines the interface for both kinds of atomic shapes, and leaves the responsibility of implementing the `Draw()` and `Clone()` methods to its subclasses.

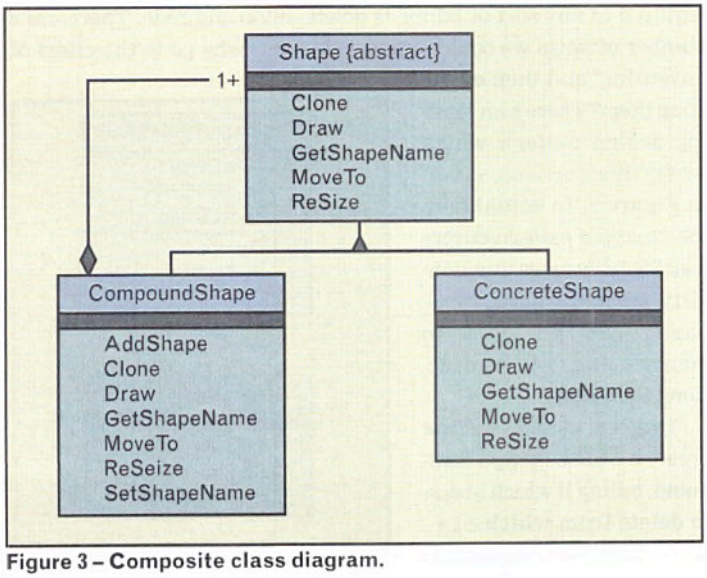

Figure 3 – Composite class diagram.

```
import java.util.Observable;
import java.util.Vector;

// Diagram - contains all the shapes in current diagram.
class Diagram extends Observable {
   public int NumberOfShapes()
      { return m_AllShapes.size(); }
   public Shape GetShapeAt(int i)
      { return (Shape)m_AllShapes.elementAt(i); }
   public void AddShape(Shape newShape) {
      m_AllShapes.addElement(newShape);
      notifyObservers(newShape);
   }
   public Shape RemoveShapeAt(int i) {
      Shape s = (Shape)m_AllShapes.elementAt(i);
      m_AllShapes.removeElementAt(i);
      return s;
   }
   // The list of all shapes in the diagram
   Vector m_AllShapes = new Vector();
}
```

Listing 2 – The implementation of the Diagram class.

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```
import java.util.Vector;
import java.lang.Exception;
import java.awt.Dimension;
import AbstractFactory;

/*
 * ShapeFactory - This factory holds all the available ConcreteShapes
 * that can be drawn and the "currently selected" or "enabled" shape ie
 * the one that is built if the factory is asked to build a shape.
*/
class ShapeFactory extends AbstractFactory {
   static Vector m_AllAvailableShapes = new Vector();
   static int m_iCurrentShapeIndex = 0;

   private ShapeFactory() {} // disable the default ctor

   static public void Initialise() {
      // setup the list of basic shapes
      AddShape(new Circle()); AddShape(new Square()); AddShape(new Star());
   }
   static private void AddShape(Shape NewShape)
      { m_AllAvailableShapes.addElement(NewShape); }
   static public Shape BuildShape(Dimension TopLeft, Dimension Size)
      throws Exception {
      if (m_AllAvailableShapes.size() != 0) {
         // uses the prototype to create the shape
         return (((Shape)m_AllAvailableShapes.elementAt
                              (m_iCurrentShapeIndex)).clone());
      } else {
         throw new Exception("ShapeFactory::BuildShape()
                              No shapes available or selected.");
      }
   }
   static public void SetCurrentShape(String ShapeName) throws Exception {
      int i = 0;
      while (m_AllAvailableShapes.size() > i) {
         if (((Shape)(m_AllAvailableShapes.elementAt(i))).GetShapeName()
                  == ShapeName) {
            // Shape found so make it the current one
            m_iCurrentShapeIndex = i;
            return;
         }
         i++;
      }
      throw new Exception("ShapeFactory::Shape '" + ShapeName
                              + "' Not in catalogue.");
   }
   static public int NumberOfAvailableShapes() {
      int iNumberOfShapes = m_AllAvailableShapes.size();
      return iNumberOfShapes;
   }
   static public Shape GetShapeAt(int i)
      { return (Shape)m_AllAvailableShapes.elementAt(i); }
```

Listing 3 – The shape factory.

In the case of the subclasses of `ConcreteShape` this is directly implemented by the class. In the case of the `CompoundShape` class these methods are implemented by iterating over the member shapes, invoking their `Draw()` or `Clone()` methods as appropriate. If one of these component shapes is itself a `CompoundShape` then it invokes the `Draw` (or `clone`) method of its component parts, and so on.

Shape selection

The `Shape` class is also an example of the prototype pattern, as evidenced by it's `clone()` method. (The lower-case notation goes against our convention, but that is how Java's standard clone method is declared in the `Cloneable` interface).

One benefit of this approach is that we can set up our `ShapeFactory` class (see Listing 3) in such a way as to limit its knowledge

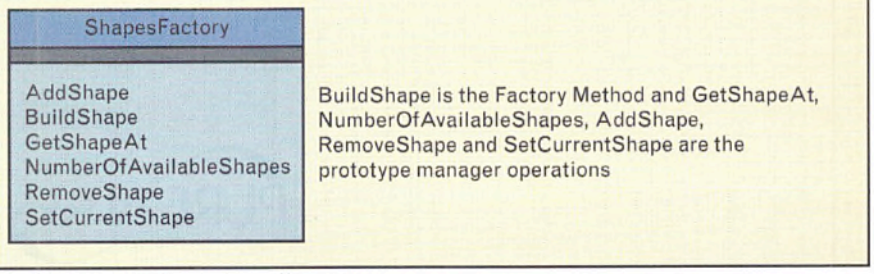

Figure 4 – Factory method class diagram.

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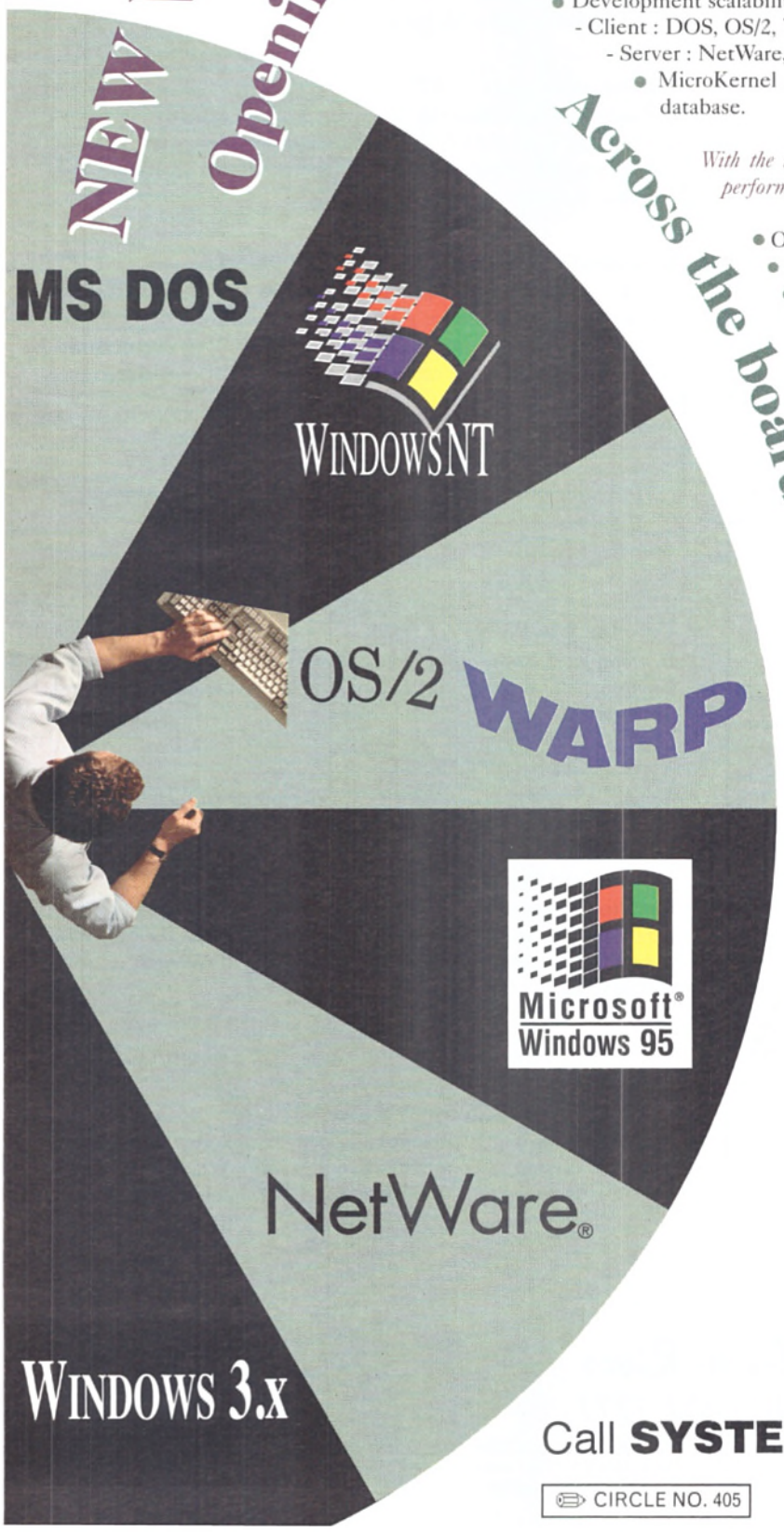

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Bibliography

The bible of design patterns is *Design patterns* by Erich Gamma, John Vlissides, Richard Helm and Ralph Johnson, published by Addison-Wesley (ISBN 0-201-63361-2). Unfortunately, it lacks any useful practical examples – but then you don't need those now you have this article! Another book worth a look is *Pattern languages of program design*, edited by Coplien and Smith, and published by Addison Wesley (ISBN 0-201-60734-4). This is a collection of articles about the broader application of patterns to all stages of the development process. They are generally quite worthless simply because the ideas expressed have not been very well developed. In some cases it seems someone had a good idea but couldn't be bothered to make the effort to develop it and thought 'I know I'll publish this and claim the credit when someone else develops it'. There are occasional gems that are worth rooting out, but even they very much leave the reader to figure out the detail.

Patterns are gaining a more general acceptance and Ivar Jacobsen has begun some work to identify patterns in use cases and a recent book, *Analysis Patterns*. extends the same ideas into the area of analysis.

of the `ConcreteShapes` it can create. Even the `FactoryMethod` (see Figure 4) doesn't actually know which type of `Shape` is being instantiated – it simply asks a given prototypical instance to make a copy of itself, and returns the copy. Secondly, we can handle new shapes defined by the user based on those available `ConcreteShapes` and any pre-defined custom shapes. The user creates a `CompoundShape` object and then registers it with the `ShapeFactory`. The new `CompoundShape` is then automatically available for selection as the 'current' shape. The `ShapeFactory` acts as a prototype manager, in that it holds a list of all available shapes, including those user-defined `CompositeShape` shapes registered by the user.

This is an example of being able to create new types through composition (or aggregation) rather than through inheritance, dynamically rather than statically.

It seems reasonably obvious that there should really be only one `ShapeFactory`, so how do we model that? The answer is using the pattern called a `Singleton`. In Java (and C++) this is implemented through class members – ie static methods and attributes. The `ShapeFactory` has only static members and therefore there is automatically a class instance of the `ShapeFactory` – without having to instantiate it. Indeed, it is impossible to explicitly instantiate a class instance and there can be only one. Problem solved. (You'll notice that I've deliberately ensured that it is impossible to instantiate objects of this class by making `ShapeFactory`'s default constructor `private`).

Making the editor extensible

One of the OO promises is 'good' maintainability, and one of the most important aspects of this is being able to extend an application with the minimum effort and risk of introducing new bugs. We'll see one way that we can design our tool so that we can extend it with support for additional shapes, with the minimum impact on the rest of the system.

This is achieved principally through extensions to the `ShapeFactory` class, so that in addition to providing the mechanism for creating new `Shapes`, it holds the list of all available `Shapes` referenced dynamically by name. `MainMenu` (in Listing 1) uses this list to dynamically build an Insert-Shape menu. Indeed, as far as our drawing tool is concerned the only class that knows (and has hard coded) the available sub-classes of `Shape` is the `ShapeFactory` `Singleton`. So any change to the available `Shape` only affects one operation on one class.

We've covered the practical application of several design patterns (`Factory Method`, `Prototype`, `Command`, `Memento`, `Singleton`, `Composite` and `Observer`), as well as a number of auxiliary techniques (for example the prototype manager). I have concentrated very much on the practical application of patterns, and as a result other important patterns like `State`, `Iterator` and `Strategy` have fallen by the wayside. As they say in all the best textbooks – determining the practical application of those patterns is left as an exercise for the reader. And, of course, if you are now capable of doing that then this article has been successful. ■

Edward Kenworthy is a senior consultant with Select Software Tools. His mission there is to teach the unwashed masses the joys of OO, n-tier client/server and an iterative and incremental lifecycle in the warm and comfortable bosom of Select's OO CASE tool: Enterprise.

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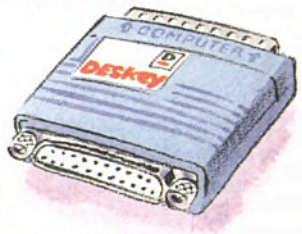

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The Zen of JavaBeans

Tom Guinther longs for the days when one didn't need to be a Zen master to understand the fundamental purpose of an API. After looking at Reflection, this month he talks about Introspection.

Oddly enough, I find it difficult to admit to curious co-workers that the subjects of my musings are 'Reflection' and 'Introspection'. My answer always draws a blank stare, a smirk, or some wisecrack about 'getting in touch with myself'. No one ever said software engineering was going to be easy, I just wish I wasn't being set up so ruthlessly by those oh-so-clever engineers at JavaSoft.

Introspection

As we saw last month, one aspect of Reflection is the mechanism for extracting information about Java classes, particularly the fields and methods of a class. Introspection is similar, but rather than a process of extraction, it is more like extrusion because we are interested in drawing out class properties and functionality by searching for well-known semantic content. If that description is too vague, think in terms of semantic patterns, and very specifically design patterns. Take the following class as a very simplistic example.

```
class Foo {
        public String foo = "" ;
        public String getFoo ( void ) { return foo ; }
        public void setFoo ( String otherFoo )
                { foo = otherFoo ; }
}
```

Here we have `class Foo` which has a member, `foo`, which is of type `String`. There are two methods `getFoo` and `setFoo` which deal with objects of type `String`, and not coincidentally, the member variable `foo`. Another way to describe the same thing is to say that `class Foo` provides a read/write property, `foo`, that is of type `String`. Although both descriptions are correct, the first one seems to be more exact in that it is simply dealing with factual information about the class, while the second description is making an assumption about the close-knit relationship (the semantic) of the various class members. In this second description, we are applying a simple 'property' design pattern which we will discuss further.

JavaBeans – a software component model

The JavaBeans API is designed to define a Java software component model where 'beans' (as they are affectionately called) are 'light-weight', reusable components used to build a larger, more sophisticated, composite application. If you're familiar with OLE or OpenDoc then you can correlate a bean to an OLE Control or an OpenDoc Part.

One of the major difficulties of creating the JavaBeans architecture and related APIs is the need to create plug-and-play component interfaces, and to achieve seamless bean/application interoperability without creating pre-existing limitations. One of the overriding constraints is that beans should, in general, be lightweight so they cannot carry around a lot of unnecessary baggage. A second consideration is that the bean should amiably interact with any design time 'builder tools' which might be used to create the composite application. As part of its job, the builder tool must expose the properties and methods of the bean to the programmer so that the beans initial program state can be specified. This implies that the builder tool has a way to determine the properties and other characteristics of any arbitrary bean.

Hopefully it is clear from the considerations stated above that to define an effective component model it is necessary for both the application and builder tool to have a way to *dynamically* determine which aspects of the JavaBeans API the bean directly supports. Non-essential or undesirable aspects of the object model can be left unimplemented or delegated to a default handler provided by the java.beans package. Also, new interfaces can be easily defined without compromising or breaking existing beans.

In order to determine the various capabilities of a bean at design time or run-time, the JavaBeans API suggests that developers use specific design patterns. These predefined design patterns can be applied to a large variety of bean interface functionality, and can be recognized by the previously described technique of Introspection.

About JavaBeans

The three most important aspects of a bean are the properties, methods and events that the bean exposes to the outside world. Properties are typically named attributes that can be read and/or written at design or run-time. A common example is the 'caption' attribute of a GUI button bean. This attribute would reflect the user-visible caption of the button, which might have a default value of 'Ok'. At design time and/or run-time the caption property can be programmatically read using, `String getCaption(void)`, and written using `void setCaption(String caption)`.

Beans are integrally tied to sending (source) and receiving (listener) events, a simple communication mechanism typically used to deliver notifications. These event notifications represent state changes that a bean may generate, or be interested in listening for.

Not to be forgotten or underestimated, a bean can expose a subset of its public methods for use by a scripting language or similar environment. This functionality makes it relatively simple to throw a bean onto an HTML page and drive it from a scripting language, such as VB Script or JavaScript.

Now that we know about bean properties, methods and events, we need to define the mechanisms to describe them. The JavaBeans designers chose two primary mechanisms, design patterns (Introspection) and, optionally, a developer provided BeanInfo class that augments the default Introspection capability provided by java.beans.

In this area the JavaBeans API has two goals in mind. Make it easy to write simple bean components, which means that the burden of Introspection needs to be on the system (java.beans.Introspector), not the bean

developer. The second goal is to allow the developer to explicitly specify those properties, events and methods that are exposed by the bean. This requires that the developer implement the BeanInfo interface in a class that has the same name as the bean class but with a suffix of 'BeanInfo'.

Having come around full circle we can compose an excellent definition of Introspection in more familiar terms: Introspection uses the Core Reflection API to query the methods of a target bean/component. Using the class method descriptors, it compares the method signatures against simple design patterns to deduce from the methods those properties, events and methods the bean/component exposes. The BeanInfo interface provides the same basic results as Introspection, the primary difference being that the bean developer predetermines those results.

Bean design patterns

To paraphrase the JavaBeans specification, in this context, the term design patterns is intended to imply conventional names and type signatures for sets of methods and interfaces used for standard purposes. JavaBeans use a small number of design patterns to describe properties and events. The design pattern for methods is very simple: all public methods should be exposed.

For simple properties (see the example for `class Foo`):

```
public <PropertyType> get<PropertyName>() ;
public void set<PropertyName>(<PropertyType> t);
For boolean properties:
public boolean is<PropertyName>();
```

For indexed (array/container) properties (`<PropertyElement[]>`):

```
public <PropertyElement> get<PropertyName>(int n) ;
public void set<PropertyName>
              (int n,<PropertyElement> t);
```

The indexed properties pattern is only applied if an array property is found, `FooType[] getFoo()` or `void setFoo(FooType[])`. In that case, if either of the index design patterns is found, then it is assumed that the property can be used to read and/or write an indexed value.

The patterns for events, while still simple to describe, is more difficult to implement. The primary reason for this is that in order to match the design pattern it is necessary to find two symmetrical methods.

For multicast event sources (supports multiple simultaneous listeners):

```
public void add<EventListenerType>
              (<EventListenerType evt);
public void remove<EventListenerType>
              (<EventListenerType evt);
```

For unicast event sources (only supports one listener):

```
public void add<EventListenerType>
              (<EventListenerType evt) throws
              java.util.TooManyListenersException;
public void remove<EventListenerType>
              (<EventListenerType evt);
```

The only difference between multicast and unicast events is that a unicast event throws the `java.util.TooManyListenersException`.

For each event supported, the following needs to be true in order for the pattern to be recognized. 1) Both the `add` and `remove` methods must exist. 2) The type of the `<EventListenerType>` argument must be the same for both methods. 3) The `<EventListenerType>` must extend the `java.util.EventListener` interface, and 4) the name of `<EventListenerType>` must end with 'Listener'.

Although the JavaBean design patterns are good examples of what can be done with Introspection, you shouldn't feel limited to this subset for your own custom or non-bean components. Like `java.beans.Introspector`, you simply need to provide the Introspection code to analyze class methods and recognize your custom design patterns.

The Introspector

In order to make writing lightweight bean components as simple as possible the java.beans package must provide a default Introspection class. This allows developers to concentrate on the functionality of the bean, rather than wasting time on describing that functionality. Somewhat contrary to this is the developer who wishes to explicitly specify the functionality of a bean by implementing the BeanInfo interface. Regardless of which approach is taken for a particular bean we have a potential problem in that an arbitrary client (such as a builder tool) would like to avoid writing two different sets of algorithms to handle each case. What is needed is a uniform mechanism that allows the client or composite application to obtain all the relevant information about a bean without caring where or how the information was derived. This is where the Introspector comes into play.

A uniform implementation is critical so that all clients and beans see each other exactly the same way. While this may initially seem like a simple task (the design patterns are simple enough), I haven't discussed any of the gory design and implementation details that must be handled to resolve pattern ambiguities. There are also potentially complex issues with inheritance, overriding, and hiding of superclass bean properties, events, and methods. Add to this list the need to seamlessly find and integrate BeanInfo classes as well as the need to minimize a myriad of potential performance problems and you can see why providing the JavaBeans Introspector is a necessity for both beans and their clients.

Introspect sample application

I have written a very simple example of using the Introspector to enumerate the properties of a Java Bean. The application is called Introspect and it can be run from a stand-alone interpreter environment such as Microsoft JView. The only argument is the name of the bean class. The Introspect source code includes an extended version of `class Foo` that should make it easy for you to review how the basics of Introspection work. Just use the following command line: jview Introspect Foo. You can retrieve the source and binary .class files from EXE OnLine (*ftp://ftp.exe.co.uk/pub/exestuff/9708_Java*).

Although the functionality of this initial version of Introspect leaves a lot to be desired, it is a good starting point for an exhaustive BeanInfo analyzer. I am looking forward to providing a more complete implementation for next month.

Just Say No

You can obtain the latest JavaBeans SDK, the JavaBeans Specification, and a variety of work in-progress at the JavaSoft Web site: *http://www.JavaSoft.com*. At the time of this writing, the newest JavaBeans related specification, 'Glasgow' (bean containers), is avidly being discussed.

Introspection is an interesting approach to providing a simple way of dynamically interfacing to another component. Yet, there is a variety of ambiguities in how introspection is defined and implemented, not to mention that it is a non-extensible interface. Because in the long run you get what you pay for, I can only recommend that you 'Just Say No' to (Java) Introspection and provide an explicit BeanInfo class for your Java components. Next month we will talk more about how to do that, and look at other aspects of the JavaBeans API. ■

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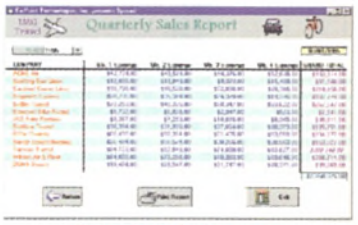

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C9x – Some changes to C

Trying to follow the standardisation efforts around C, C++ and Java easily fills one's diary. Francis Glassborow writes this column on his way to yet another meeting.

During the last week of June, BSI and Plum Hall Europe hosted the joint meeting of WG14 and X3J11 – the committees working on C9X (the next version of ISO C). Unfortunately, from my perspective, that meeting coincided with a UK based symposium on dialects of C for parallel programming. My diary is currently crowded with events relevant to my areas of expertise and interest. As I have yet to acquire the ability to distribute my presence over multiple sites I had to give priority to my long-term commitment to the C Standard. A pity that the symposium had not been arranged either directly before or after the WG14/X3J11 meeting as I think that parallel C should be the next major development.

Last week saw the London meeting of ISO's Java Study Group. This was scheduled as a two-day meeting but in the event we finished in a day. This is largely because we can do very little until Sun Microsystems and ISO have resolved various administrative issues. The JSG meeting was followed by three days of Object Expo Europe which includes Java Expo Europe. I have attended this event for almost as long as it has existed but I find myself questioning the latest format. Two of the three main days now only have two two-hour conference sessions with the rest made up of public (ie free) keynotes and vendor presentations. Couple this with late changes of speakers for at least two of the C++ items and you finish with something of questionable value to the conference delegate. Of course the value to the exhibition visitor is much better.

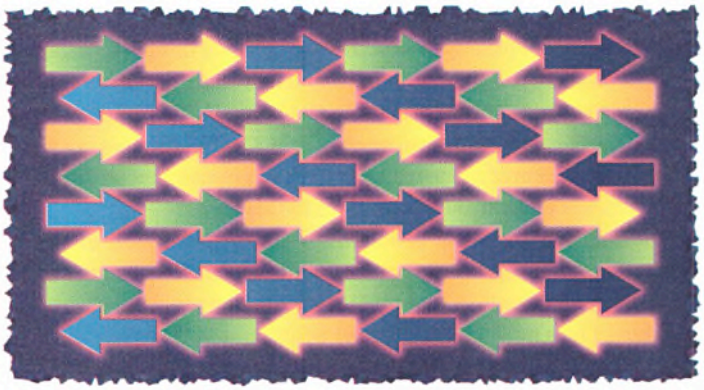
Today I have a BSI C++ Panel meeting and next week there is the London meeting of WG21/X3J16 (the committees responsible for standardising C++) but more of that next time. For now, let me focus on C as we are preparing to put the working paper out as a Committee Draft. If all goes well, it may be C9X which shows what can be achieved by being tightly disciplined and focused on a limited target. There are a number of surprises for those who have been unaware of what was going on. Some are good some are more questionable.

First, the new standard is going to be almost twice the size of the current one, mainly because the ongoing work on extended numerical support is being incorporated into C. This includes such things as variable length arrays and very advanced support for complex numbers (much more than that provided by the C++ Standard Library). The driving force behind this work has been to provide numerical methods specialists with support in C so that they no longer need to use Fortran. This material will have little if any impact on the vast majority of C programmers. However it is clearly in the spirit of C and is the result of almost ten years work by the Numerical C Extensions Group.

Unfortunately, the current proposals for variable length arrays make retention of the old K&R style function definitions more attractive to some. Consider:

```
void example(int varray[size], size_t size){ ... }
```

The problem is that the first use of `size` occurs before the name has been declared (by the second 'use' which is currently the declaration of `size`). The result is that either `size` has already been



declared as a global variable which will not be hidden until the compiler sees the second parameter (too late), or there is an error. Note that C9X has grasped the nettle and removed implicit `int` so that there is no implicit declaration of `size` as an `int` even if that is the type you wanted. Writing:

```
void example(size_t size, int varray[size]){ ... }
```

would work fine but the numerical experts do not like it because it is not the way they think and more importantly it is not the way Fortran would specify such a function/procedure. The latter is important because we would certainly want to reuse the specialised Fortran numerical libraries. That leaves us with a choice between encouraging people to use a deprecated feature by writing:

```
void example(varray, size) int varray[size],
        size { ... }
```

and reworking the rules for prototypes and definitions. The former is easy for those writing the standard. However, I think that the latter is the only long-term solution. I hope that there will be enough International demand for this to be fixed. I would welcome hearing from readers who have strong opinions on this subject.

Another feature is the introduction of a kind of implicit overloading for maths functions. By this I mean that when you use such functions as `sin`, `cos`, `log` etc. the exact version you get (`float`, `double` or `long double`) will depend on the type of the argument with which the function is called. I remain unconvinced that this is a desirable extension as I can provide the bulk of it without this specific extension (by using forwarding functions and the proposed `inline` extension for C).

While I remember you should note that implicit function declarations went along with implicit `int` so the following bugged code should get a diagnostic in future:

```
#include <stdio.h>
int main() {
        double x=1.0;
        printf("%f", sin(x));
        return 0;
}
```

It is surprising how often essential header files get missed because the compiler just deduces a wrong definition for a function.

The bad news is that it will be a long time before compiler vendors ship their products with detection of attempts to use implicit `int` and implicit function definitions switched on by default.

I will return to the subject of `inline` when the committees have finally settled on the wording, and the constraints and semantics that they will require for this feature. You might be surprised at just how hotly this topic is being debated. Perhaps you think C should just import the C++ version. This is unacceptable because C++ solves the problem by allowing apparent multiple definitions of externally linked `inline` functions. C wishes to tie this down more exactly so that there is always a unique translation unit that provides the one true definition. Then there is an issue of local `static` variables in `inline` functions. C++ can solve this easily with its name-mangling (or alternative) mechanisms, C explicitly does not want to require any form of name-mangling. While I remain unconvinced by the arguments there are strong feelings in this area.

Another area causing problems is the introduction of `bool`. (Almost) everyone agrees that at the very least we should standardise the spelling for a boolean type and its values. The problem is whether this should be a minimalist `typedef` solution or a true type version. The key issue is whether you can have boolean bit-fields coupled to supporting the expected behaviour for arithmetic conversions. Consider:

```
bool b = 0.5;
```

What should be stored in `b`? Unless `bool` is a built-in type the answer is almost certainly going to be false (0). Does this matter? Well do you expect `if(b)` and `if(0.5)` to behave identically? The only way that we can ensure that `bool` behaves consistently with the logic of C is if `bool` is a built-in type with defined standard conversions. The trouble is that nobody is sure how big an impact such a change might have on existing code. Most of us think it would be very small, but try convincing a doubting Thomas.

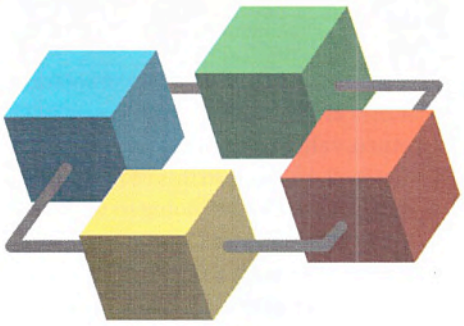
By the way, `bool` (and `true` and `false`) will be conditional keywords. They will only be keywords if specific header files are included. I think this is a silly way of sitting on the fence over the issue of new keywords.

Last month's problem

What is wrong with this C code? How can C++ mitigate the problem?

```
#include <stdio.h>
int main() {
        char * strict = "OK? ";
        char strange = 'ABC';
        int member = 0;
        for (member=0; strict[member]; member++){
                if (strict[member]== strange)
                        strict[member]= 'Y';
                else strict[member] = 'n';
        }
        puts(strict);
}
```

I wonder if you noticed the identifiers (`strict`, `strange` and `member`) in the above code. Did you know they were acceptable because they were local variables, or did you not notice that they were all in the reserved namespace for future library functions? If you are intending to write portable C you certainly have to avoid using such names at file scope for functions and I think it would be good practice to avoid them for all other uses at file scope.



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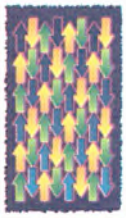

Now, to a couple of more specific problems. Look at the initialisation of `strange`. What sort of thing is `'ABC'`? It is correctly described as an integer character constant and has type `int`. Its value (as it consists of more than one character) is implementation defined. A question that has been raised recently is 'Can implementations define implementation–defined behaviour as undefined?' This important question, to the best of my knowledge, has never been resolved. The only constraint that I am aware of is that the implementer must document what behaviour shall occur. Anyway it is probably unwise to write code like the above and you certainly have no right to expect the compiler to issue a diagnostic.

There are still two problems left. `strict` is a pointer to a string literal. While it is perfectly okay to index it for the purpose of reading individual characters, any attempt to write to a string literal results in undefined behaviour. Many older systems let you get away with it but many, particularly more recent ones, do not. The kindest result is simply that your program aborts with a segment violation error but much more vicious behaviour is allowed. To appreciate just how bad undefined behaviour can be consider the possible consequences of writing off the end of an array. If it is a local array it might cause change to the function return address. With bad luck this can be pretty bad news. I once reprogrammed a graphics board that way and a friend of mine managed to corrupt the root directory of his hard drive.

The final error is that there is no return statement. As return from `main()` results in a call of `exit()` to clean up, you have undefined behaviour if `exit()` makes any use of its parameter.

C++ solves these last two problems. A program that falls out of `main()` is deemed by C++ to `return 0`. This is the only function whose return value is fixed up for you. I look forward to the day when Microsoft wakes up to this requirement. Not only is `void main()` not supported by C++ but doing so would buy nothing.

C++ now specifies that the type of a string literal is array of `const char` so a C++ compiler should issue a diagnostic for the declaration of `strict`. Once you fix that, you'll then get diagnostics for the attempts to write to the string. Some programmers do not like this because it appears that their working code now breaks. I prefer my development tools to find bugs and defects in my code even if I have to spend time fixing them.

This month's problem

Consider this code fragment:

```
. . .
int * a = (int *) malloc (sizeof(int));
puts("How many entries in the array? ");
scanf("%i", a);
a = (int *)realloc(a, (a[0]+1)* sizeof(int));
. . .
```

I hope that the programmer's intent is clear, but what must she do to ensure that there is no undefined behaviour? ■

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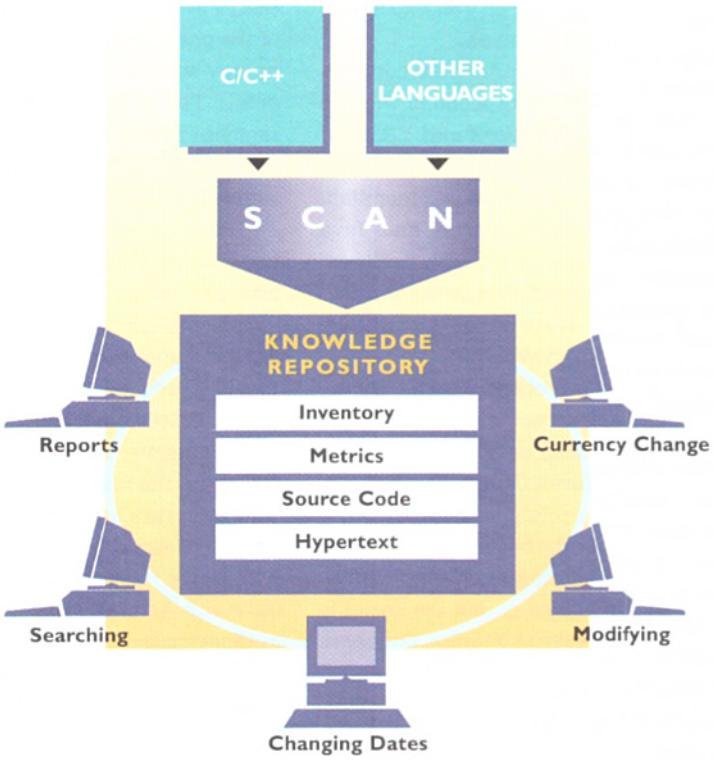

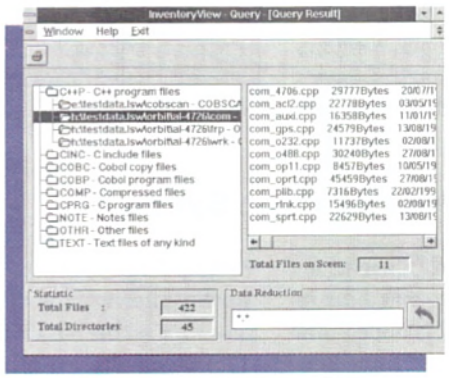

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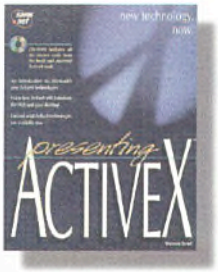
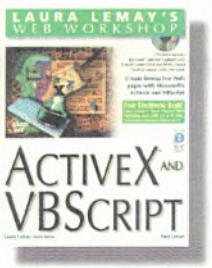
ActiveX and VBScript, and Presenting ActiveX reviewed by John Cant





If there's a pot of gold at the end of the rainbow of Internet hype, it will probably turn out to be an ActiveX control. Certainly publishers think so, punting an ever-expanding spectrum of books on ActiveX.

The development of ActiveX controls themselves is beyond the scope of the two books under review. *ActiveX and VBScript (AXVBS)* is primarily concerned with the VBScript language that glues together standard HTML, ActiveX controls and Java Applets to create Web sites with flash and real computing power. *Presenting ActiveX (PAX)* is more an overview of the strategy and technology of ActiveX.

AXVBS is a comprehensive guide for the serious Web designer covering all aspects of VBScript and related development tools – principally the ActiveX Control Pad. The seasoned programmer might balk at the dedication of a quarter of the book to the rehearsal of general programming techniques such as the evisceration of strings, but the layout is well designed for easy skimming, and there is plenty of substance and examples.

The book also covers the use of the HTML Layout Control to create accurately positioned components, the integration of Java applets with VBScript, the conversion of existing VB applications for use on the Web, and a host of useful tricks such as taking control of the Browser, baking Cookies and client-side processing of image maps and forms. Appendices summarise the VBScript language and functions, HTML, and the properties of popular ActiveX controls.

The CD gathers together an impressive package of public domain software, supplying all you need to get down to work.

While *AXVBS* follows a standard recipe-book format, *PAX* is more a collection of essays by different authors that give a taste of the possibilities offered by ActiveX technology without getting bogged down in detail. The material covered by *AXVBS* is sketched in broad strokes culminating in an example of building a Web site around the Active Movie Control.

PAX then moves into realms not mentioned by *AXVBS*. A section on ActiveX Documents – in-place activation of hyperlinked documents – shows how to modify the classic 'scribble' application to run inside Word and inside Internet Explorer. Two chapters discuss ISAPI filtering, Microsoft's replacement for the server-side CGI, with examples including the mapping of one server directory structure onto another on the fly, and building a server directory browser.

Finally, the competing technologies of Java and ActiveX are compared, with the authors struggling to find an adequate rationale for Java other than its elegance as a language; they clearly feel that once Windows truly rules the waves, the allure of Java's promise of platform independence will pale in comparison with the spectrum of functionality promised by ActiveX. Neither book discusses with any seriousness the thorny question of security.

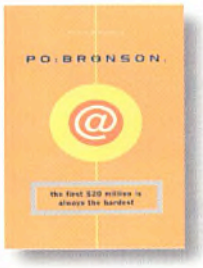
PAX suffers a little from uneven coverage – a chapter on the development of ActiveX controls themselves would have counterbalanced the detailed discussion of the esoterics of ISAPI Extensions. The attached CD is less interesting than that of *AXVBS*, although it holds an electronic copy of another Sams publication, *Presenting Java*.

Both books are unashamedly focused on Microsoft products and Internet Explorer, which at the time of writing is the only browser to support directly the technology. They are unusually well written, and should you be lacking a pot of gold, the combination of the two together would be a good buy... at half the price.

✓ ***Verdict:*** *both well written*

Title:	*ActiveX and VBScript*
Author:	*Paul Lomax et al.*
Publisher:	*Sams.Net*
ISBN:	*1-57521-207-2*
Price:	*£37.50*
Pages:	*516, CD-ROM*
Title:	*Presenting ActiveX*
Author:	*Warren Ernst et al.*
Publisher:	*Sams.Net*
ISBN:	*1-57521-156-4*
Price:	*£27.95*
Pages:	*318, CD-ROM*

The First $20 Million Is Always The Hardest reviewed by Kristin Syltevik



Are you sad enough to read a tale about the life and times of some Silicon Valley geeks? I am obviously, because a nice Sunday evening earlier this Summer I picked up Po Bronson's *The First $20 Million Is Always The Hardest*. It's a long time since I enjoyed a fictional account about the tech industry. The last time was probably Steven Levy's *Hackers*.

The First $20 Million Is Always The Hardest is fun and (based on some real life people and situations) quite educational. Bronson's book is centred around Andy Caspar, an ignored but brilliant (must be something in Valley water) engineer. Andy is duped into working on a computer that should sell for just $300. While opting for the project out of pure naiveté, Andy discovers that the project is feasible and sets up on his own. The story takes a number of twists and turns, but as this is good old American fiction, the little guy (Andy) wins over some large and horrible corporations. By the way, doesn't this remind you of something?

The early pioneering spirit of The Valley, and the business acumen and drive that dominate the community today, is described in a fun, fast phased and entertaining manner. Pick up Bronson's book and have a better Sunday afternoon on the couch or liven up your time on the bus on the way to work.

✓ ***Verdict:*** *Fun, entertaining and recommended*

Title:	*The First $20 Million Is Always The Hardest*
Author:	*Po Bronson*
Publisher:	*Secker & Warburg*
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Pages:	*295*

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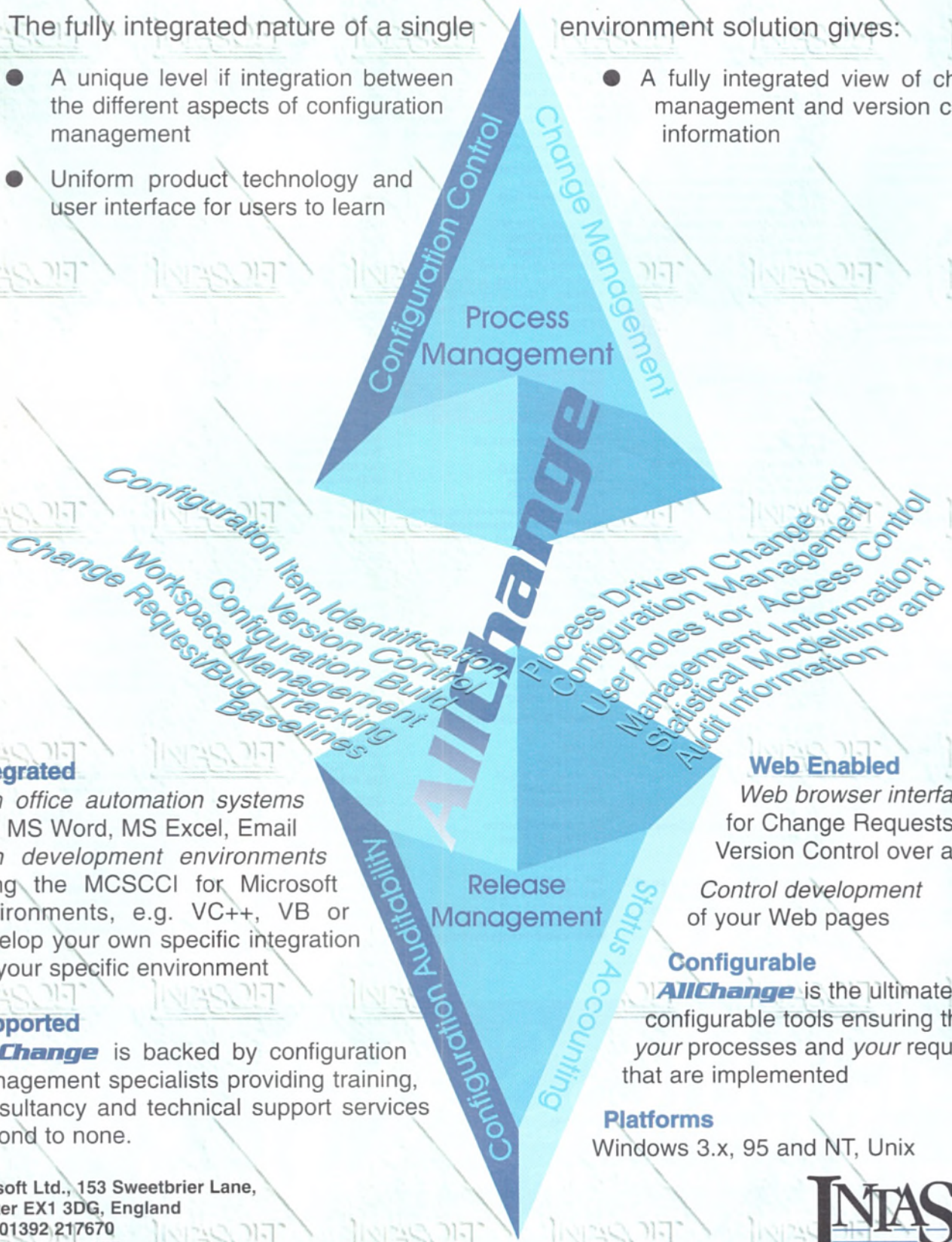

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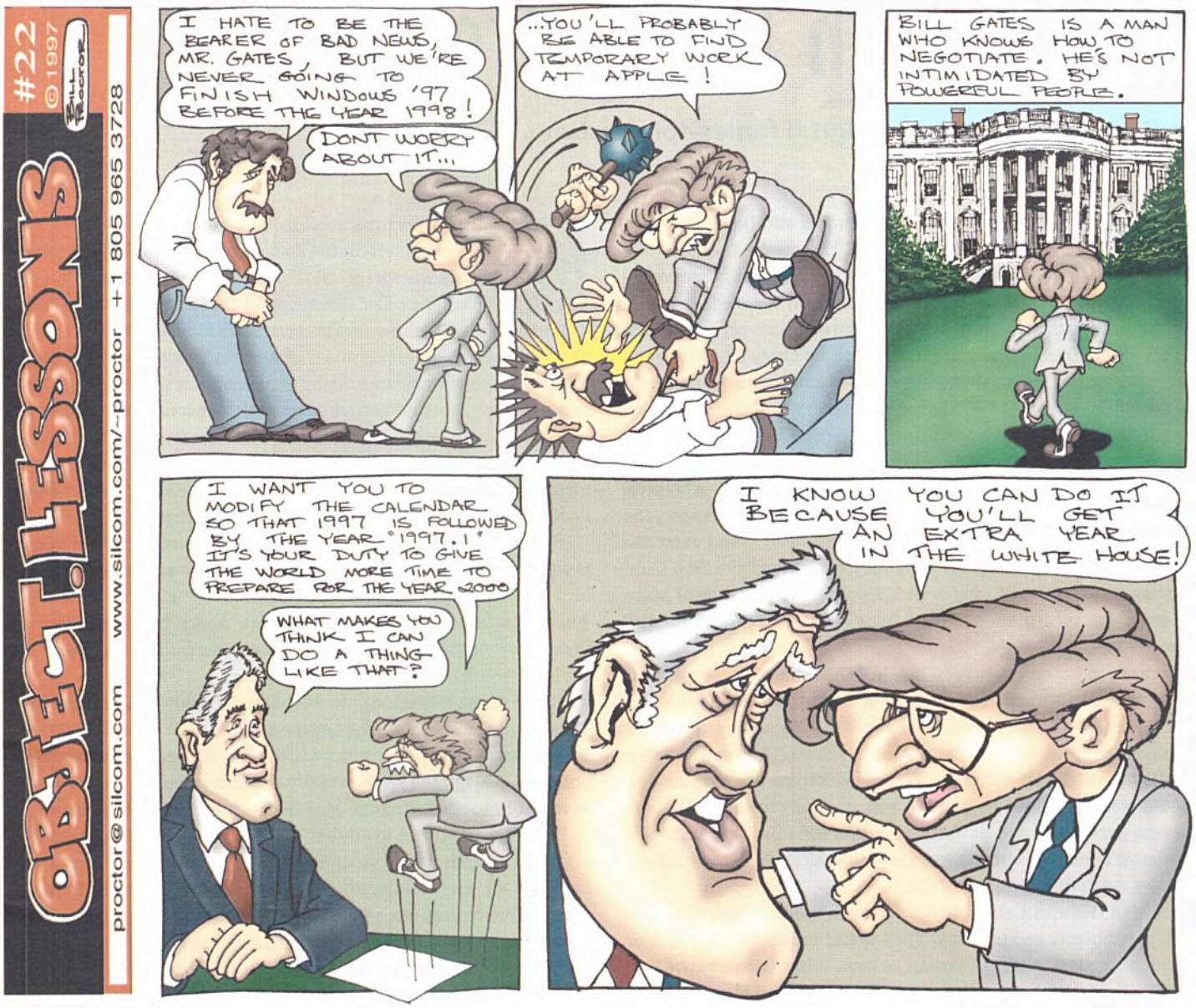

Internet meme

The Ctrl-Brk team listened very carefully – too many times said their colleagues in utmost despair – to the following song in order to give you an accurate transcript. If you trawl carefully the Web you might find it. The words were written by Richard M Stallman and the melody is supposed to be a Bulgarian dance tune, but we think it sounds more like a dirge. Check it out.

Join us now and share the software, you'll be free.
Hackers you'll be free.
Join us now and share the software, you'll be free.
Hackers you'll be free.

Porters can get piles of money that is true.
Hackers that is true.
But they cannot help their neighbours that's not good.
Hackers that's not good.

When we have enough free software at our call.
Hacker's at our call.
We'll kick out those dirty licences ever more.
Hackers ever more.

Join us now and share the software, you'll be free.
Hackers you'll be free.
Join us now and share the software, you'll be free.
Hackers you'll be free.
((applauds))

Mild Green Fairy Stories

Ms Stob offers two more digital fables-for-our-time.

Ray, Des and Death

Some folks might have said that Ray and Des spent more time than they should in IRC chatrooms. You see they were lucky enough to be employed by one of those corporates – and some still exist, oh best beloved, notwithstanding downsizing – where with a little care one can get a job where all that is required is that you should pitch up every day with your newspaper and not get in anybody's way. Des and Ray had landed two of these plum roles, and they shared a pleasant windowed office, two down from the stationery room.

And since they had got a direct Internet connection with no firewall restrictions worth speaking of (I know this is hard to believe. But it was so – they could probably direct-dial 0898 numbers too, the company was that slack), Ray and Des had been saved even the expense of a newspaper. Some days they would surf the Web looking at episode guides of long-dead TV series and pictures of Mars and so on, but mostly they liked to hang out in IRC chatrooms and make trouble.

In case you haven't ever been in one, I should explain how an IRC chatroom works. First you choose a room from a wide range of topics catering for all possible tastes – from the Win 95 Registry to cybersex to lesbians to Jesus to Swedish lesbians to Amiga. Then you choose a 'handle' by which you want to be known, which can be anything provided it is not your real name. Now you are ready to enter the room and take part in the real-time online conversation, which at its best can almost match the wit and sparkle of the worst Usenet newsgroup you have ever put into your kill file.

Ray and Des spent all their time in such rooms, winding up the other participants and giggling. They would pretend to be a girl, or Australian, or Marxist, or Christian, or even Young Conservative, and carry on 'in character' until the moderator expelled them from the room with rage. Then they would print out the highlights of their affray, emphasising their favourite put-downs with a green highlighter pen, and pin them to the wall.

One day, when Des was away on a training course, Ray went into #ScrewMeNow pretending to be a boy scout. A new character, who Ray hadn't encountered before, appeared: *Death*. Ray hailed him the traditional chatroom greeting of the 'FK U'. Here is the rest of the conversation, which Des later printed out from the log.

DEATH: I AM DEATH.

BADEN-POUT: DO U WANT ME BABY YUM

DEATH: NO. I AM DEATH

BADEN-POUT: I AM BADEN-POUT, THE SEX MAD BOY SCOUT

DEATH: NO. U R RAY. I AM DEATH

BADEN-POUT: HOW U NO ME?

DEATH: I AM DEATH & U R 57005 HEX

Ray must have entered a '3' instead of a '5' into his programmers' calculator, because when Des picked it up from under Ray's body it read 'DEAB'.

And now Des has the whole office to himself.

Moral: Whatever your business, you'll find the Internet opens up new opportunities for you. Clip the coupon for a thirty-day free trial.

Goldie Locks and the three programmers

Once upon a time, a few months back, there cohabited three programmers in the same rented house in Chelmsford. There was a K&R style C programmer called Reg, a C++ programmer called Charlie, and a Java programmer (yes, there genuinely are two or three Java programmers in real life) called Jeremy. They lived together happily and shared many things, such as the playing of network-aware games on the house network (in defiance of their tenancy agreement they had wired up an Ethernet network through the skirting board between their bedrooms – just like the one *you* would like to put in, oh best beloved), the going down to the pub together every other night, and the communal watching of *Shooting Stars*, with many happy, lustful cries of Ulrika-ka-ka. Such is the modern monastic life.

Goldie 'Locks' Udell was the owner of the house. They say Goldie is a great bloke to have as a friend, but only a so-so person as a landlord – he has an unfortunate reputation for changing the locks while you are out at work just because of a few weeks' back-rent. Perhaps that is how he got his nickname. I know it certainly wasn't down to his hair, which is brown and mostly absent.

One evening, while the guys were out at the pub, Goldie turned up. There being no answer to the bell, he decided to let himself in. I think he planned to leave a note pinned to the breadboard with a meatknife or some such, but the kitchen really was in a state, and Goldie was so appalled by the festering remains that he was obliged to sit down.

The only furniture available in the kitchen was Reg-the-C-Programmer's three legged stool. So what? It had started life as a *four* legged stool, and Goldie, unaware that successful use of the stool required one to keep one's weight on the north-east corner, was precipitated to the floor, banging his arm on the washing machine as he fell.

Goldie picked himself up and went through to the telly room and sat down in C++ Charlie's Relaxo-Lax Parker-Bowle sofa-ette, a monstrosity rather like the one Jimmy Saville used to sit in to fix things, intending to compose a stern note on the treatment of furniture in rented accommodation. But when he leaned back, the back went down, a footrest came up and a musical fridge embedded in the arm began to play a selection of the Spice Girls' Greatest Hits.

Symmetry and precedent demand that Goldie now sits upon a third chair – Java Jeremy's – and discovers it to be 'just right'. However, I'm afraid that this is where the normally reliable distribution of the Ikea company has let us down, for Jeremy's self-assembly pine dining chairs had yet to arrive at the Croydon warehouse, despite being on display in the showroom and having been ordered three weeks ago. What actually happened was that Goldie catapulted himself out of the sofa-ette and tripped over a length of Ethernet coax, which the boys had fed downstairs to a spare PC through a hole they had made in the ceiling. While picking himself up off the floor for the second time in about two minutes, his notice thus drawn to a serious breach of the tenancy agreement.

Goldie lived up to his nickname, and when they came back from the pub the lads were obliged to break back into the house by climbing into the upstairs loo while standing on the garage roof. But that wasn't the end of it, of course, and if you know of any decent rented accommodation in the Chelmsford or Great Baddow area, they would be most glad to hear from you.

Moral: Don't faff around with Thin Ethernet: buy a hub.

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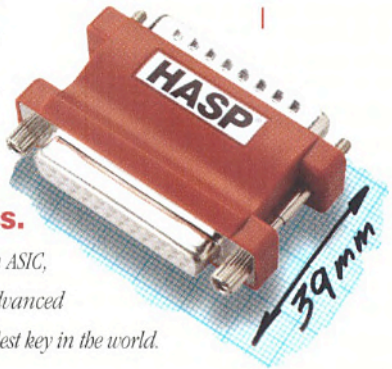

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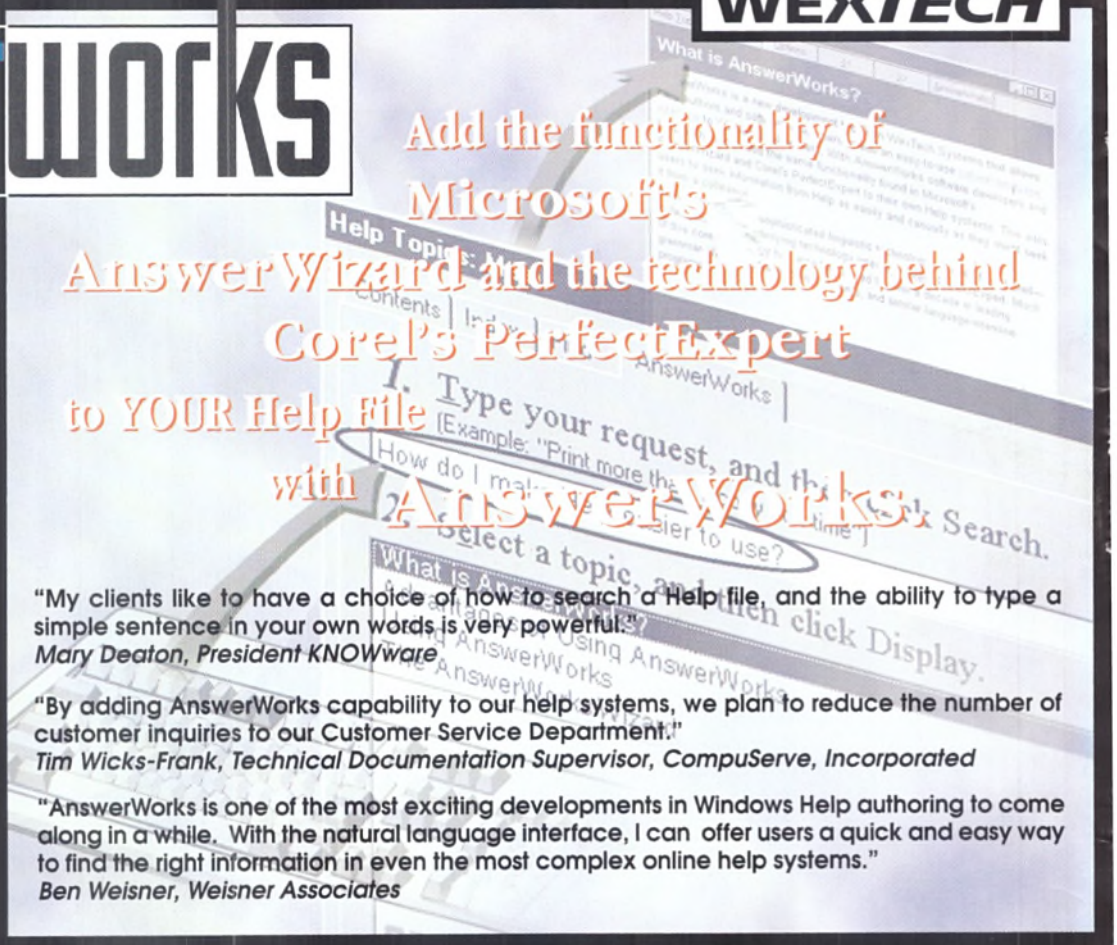

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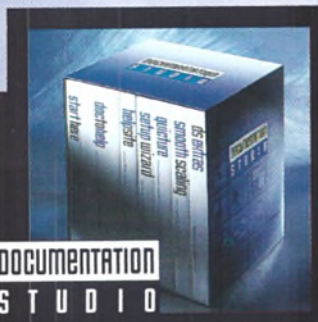

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