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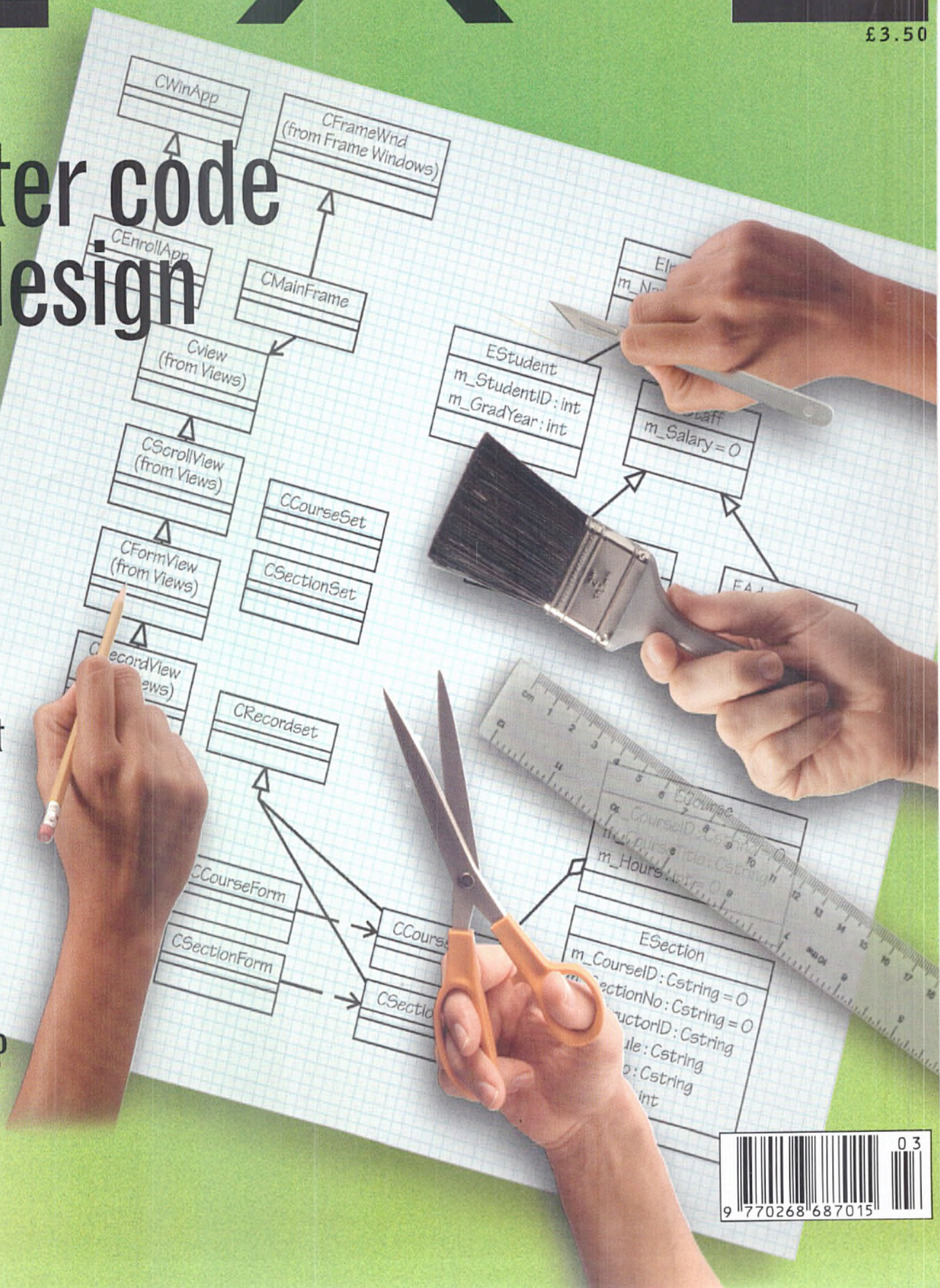
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News & Views

Spread 3.0

Do You Write Database Front-Ends?

Spread 3 is ideal if you want to create powerful database front-ends, manage the display and entry of two billion rows and columns, print and preview reports, perform calculations or take advantage of unparalleled cell-level formatting with twelve built-in cell types. All in one control.

New features include ADO binding (as well as DAO/RDO), Excel 97 import/export, HTML export, Print Preview, OLE drag & drop, text tips, load/save data from/to an integer or float array and IntelliMouse support. Spread 3 also fully supports Visual Basic 6 and Visual C++ 6.

Data Widgets 3.1

Award-Winning Grid For Visual Studio 6.0

Data Widgets 3.1 is a set of six ActiveX controls, including Sheridan's award-winning DataGrid, that fully support the OLE DB & ADO data sources available to Visual Studio 6.0 developers. OLE DB & ADO provide a uniform access method to a variety of relational & non-relational data sources. You can format and print reports directly from the DataGrid and export the DataGrid directly to HTML or to a delimited file. Also, masked editing is built directly into the DataGrid and DataCombo.

SpyWorks 6.0

Does Visual Basic Get In The Way Sometimes?

We all know that Visual Basic and other development tools do a great job of hiding the complexity of Windows programming (remember the horrendous "Hello World" program in Petzold's book?). However, they also hide some of the functionality of Windows which you occasionally need to use. SpyWorks exposes this hidden functionality so you can create application extensions, implement system-wide hotkeys or macro recorders and add other low level features to your applications.

This latest version has smaller ATL-based controls and supports cross-thread subclassing. Visual Studio 6.0 (including the new multi-threading features in Visual Basic 6.0), Windows 98 and Windows 2000. The Professional now includes a full WinSock control (with Visual Basic source code) and lets you create NT services in Visual Basic.

True DBSuite 6.0

Are You Developing Database Front-Ends With Visual Studio?

True DBSuite 6.0 is the essential suite of data-aware controls for those of you developing database front-ends in Visual Studio. The Suite contains True DBGrid Pro 6.0 (the official upgrade grid for Visual Studio), True DBInput 5.0, and True DBList Pro 5.0, which offer a complete set of data presentation, data input, and user interaction features to produce quality applications quickly and cost-effectively.

DevPartner Studio 6.1

Everything You Need To Improve The Quality Of Your Visual Studio Applications

DevPartner Studio 6.1 is a comprehensive suite of tools that can help you to improve the quality of your Visual Basic, Visual C++ and Java applications and components. It includes everything in DevPartner for Visual Basic, DevPartner for Visual C++ and DevPartner for Java and also includes Numega's outstanding advanced debugger, SoftICE for Windows 95/98/NT. It even includes the 16-bit DOS & Windows 3 versions of BoundsChecker and SoftICE for maintaining legacy code. This package is exceptional value for Visual Studio developers.

EDITORS

Codewright Prof 5.0	£150
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Sifting through the wreckage



Why are debuggers so bad? Why is it that software developers suffer impotent tools for debugging and maintaining their systems while all other aspects of the software development process are so well supported?

We have been used to code generation from domain-specific languages and design notations for at least ten years now. Testers have had plenty of tool support to make their life easier (see for example, *Tools for testing*, EXE, Jan 1999). Compiler technology, with project integration, configuration management, and GUI generation is very advanced compared to the rudimentary compile, link, and run sequence of the last decade. Despite this progress, debugger technology remains largely unaffected after almost twenty years of breathtaking progress in all other fields of software development. We are left to fight the bugs of the next millennium (not to mention the Millennium Bug itself) with the primitive debugging technology of the early 1980s.

This lack of technological support becomes all the more surprising when we consider the enormous amount of time spent on debugging and maintenance activities. Most industry estimates put the figure for total development time spent on software maintenance at between 50 and 70 percent.

Other aspects of the development process are well supported. Why is debugging such a poor relation? Perhaps it is simply a matter of image: to admit that we need good debugging tools is to admit failure; good programmers write bug-free programs, don't they? Alternatively, it could reflect the

natural conservatism of tool vendors. Many vendors tell me that they would like to put more sophisticated debugging technology into their static analysers. Sadly, debugging just doesn't feature on requirement check lists of customers. There is simply no market pull. It might even be that many developers are unaware of what tools could really do for them if their full potential were to be unleashed.

In a way, each of these factors acts to amplify the effects of the others. That is, because we do not

The debugger merely allows us to watch our program crash in slow motion.

demand better debugging tools, there is no pressure on tool vendors to develop them. Because these tools go undeveloped, there is little evidence for their true potential. Little evidence, little knowledge, little pressure on the tool vendors, and so the cycle repeats.

You may say 'but my debugging tools are sophisticated, I'm very happy with the support they provide'. It is true that source maps, multiple break points, walkthroughs, call hierarchies, and symbolic-level output allow us to move unhindered through the execution of our code. We watch its effect on the state of the machine and correlate our observations with the original program. Fine. I'm all in favour of that. But what exactly happens when the program goes wrong; when there is a bug? What does the debugger do? Does it debug? Who identifies the lines of code at fault? Who works out what the replacement code should be? Who checks that the replacement code does not cause harmful ripple effects to percolate through the system?

The debugger merely allows us to watch our program crash in slow motion, and to sift through the wreckage afterwards. The very word 'debugger' embodies the most optimistic claim for a system since Sinclair Research's quixotic advertising material claimed that the 1 KB RAM, ZX81 was capable of controlling a nuclear power station. The truth is, debuggers simply do not remove bugs, they do not even help us to identify them.

Here we have an enormous missed opportunity. There is no

reason why the debugger should not acquire the status it deserves. There is a well-developed and mature theory of source code analysis, and many prototype implementations that show what could be achieved. It would take comparatively little effort for a tool vendor to incorporate this technology into an existing tool set. Given the amount of time we all spend debugging, it might offer a clear market advantage to the first tool vendor to exploit this latent technology.

Two glaring omissions from current debugging tools are Slicing and Automated Algorithmic Debugging. Slicing (*A Piece of Cake*, EXE, October 1996, www.cs.tu-bs.de/~krinke/Slicing/slicing.html), allows the developer to home in on those lines of the program that could have contributed to the bug, ignoring those that could not be responsible. Automated Algorithmic Debugging (www.cs.nmsu.edu/~mikau/aadebug.html) automates the 'decision tree' process by which we home in on the precise line (or lines) that are responsible for a bug.

Next time you find yourself debugging some code, ask yourself whether you are following a repeated sequence of steps, in a disciplined, rule-based fashion in order to track down a bug. If you are doing this, then that's great. I'm sure we would all agree that this is the only proven technique for isolating bugs. But are not 'repeated rule-based steps' what computers are best at? Did we not invent them so that we would not have to bother with these tedious and error-prone tasks? The process I just described is that of human execution of an algorithm. If there is an algorithm, then it should be part of a tool, so that the human can concentrate on the harder, 'Eureka' leap of intuition that describes how to fix the bug.

I have witnessed developers working on Y2K projects, where the main debugging tool for checking for ripple effects produced by date fixes was 'grep'. The process consists of searching for all variables directly affected, then searching for all those affected by those directly affected and so on, until these 'ripples' reach the edges. These poor developers are wasting precious time, painstakingly 'hand automating' a process that could be performed so much faster and more reliably by machine. It is enough to make Babbage turn in his grave.

Next time you visit a tools fair, ask the vendors what support their tool set provides for automating the debugging process. Who knows, with a bit of a push from the developer community, we may get the tools to allow us to do the job. ■

Mark Harman, Department of Mathematical and Computing Sciences, Goldsmiths College, University of London, m.harman@gold.ac.uk



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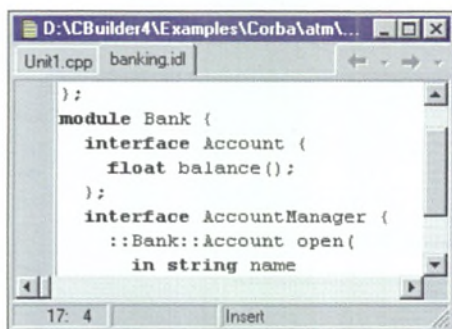
RAINBOW
TECHNOLOGIES

C++Builder 4 from borland.com

Inprise Corporation has formed two divisions: Inprise and borland.com (note the lowercase). The Inprise division will focus on enterprise solutions, while borland.com is intended to become 'the premier Web destination for software developers' and have a significant ecommerce component in its targeting of individual developers. Products covered by Inprise include: Inprise Application Server, AppCenter, VisiBroker, ITS, and Entera. Those covered by borland.com are: Delphi, C++Builder, JBuilder, and InterBase.

The borland.com division was launched with a new version of the C++ RAD system: C++Builder 4. New features include: extended support for distributed development (Corba and COM), full Ansi/ISO STL support, compiler enhancements that include Dynamic Compilation and Adaptive Compiler Technology to reduce build times, a fully customisable AppBrowser IDE, and

Internet tools with over 25 Internet protocol components. New code completion features are accompanied by a ClassExplorer with member creation wizards. EZ-COM is an



attempt to simplify C++ COM client development. There is support for the Oracle database server and Microsoft's SQL Server 7, ATL, and MTS. For Windows 98, there is support for multiple monitors, common controls, and docking forms.

Generally, Version 4 is designed to cover more 'backend' logic, providing rapid distributed development for Corba and COM – distributed object development time should be

reduced with two-way technologies and IDL tools. For example, the editor supports IDL syntax highlighting (pictured) and other features to simplify Corba development. A Midas 2 Development Kit is for the development and deployment of thin-client, distributed database applications.

Internet tools include ActiveForms for building C++ browser applications and WebBroker for building CGI, WinCGI, ISAPI, and NSAPI apps. The protocol components add support for HTTP, FTP, SMTP, POP, NNTP, HTML and TCP/IP.

In terms of debugging, there is remote debugging for Corba and COM, multi-process and cross-process debugging with debug inspectors, dynamic watch windows, and debug ToolTips.

Borland C++Builder 4 Enterprise and Borland C++Builder 4 Professional are available immediately from the Web. The former costs \$2,499, and the latter \$799.

www.borland.com

Objective Toolkit for **ATL** is a new addition to the **Stingray** product line. Features include XML document support, function call objects, thread encapsulation, SafeArray Wrappers, a visual editor for RGS Registry Scripts, and a Composite **Control** Layout Manager. It costs £795.

www.roguewave.com

Another version from Stingray is Objective Toolkit for **WFC 2.0**, which is integrated with Microsoft's Visual **J++**. The **docking** toolbar support builds on the docking window support, and there are border layout and split layout editors. It includes full source code.

www.roguewave.com

The WebCGM Profile has been released as a **W3C** Recommendation. The Profile reflects cross-industry agreement on the exchange of dynamic, hyperlinked Computer **Graphics** Metafile (CGM) files over the Web.

www.w3c.org

Jini – first step to reality

Sun has delivered the initial v1.0 of Jini, a connection technology to enable instant connectivity of any device to the network. This would spell the end of the dreaded device drivers. When a Jini device joins a network, to make its service available to other devices it sends Java objects (equivalent to a device driver) to a lookup service. When a Jini device wants to use the service of another device it proceeds to *discover* what is available from the lookup service and then download the Java objects for the device it wants to use. Then the communication goes directly between the two devices. There's no distinction between devices and services; everything is an object. This means an application can be Jini-enabled.

A Jini network can be created on a physical wired network but also via a wireless connection or even using the power lines. To ease the transition from the current situation to an ideal world where all devices are Jini-enabled, only one machine on the network *needs* to run a Java Virtual Machine. When non-JVM equipped devices are part of a Jini network they need a proxy with a JVM to send objects to the lookup service. All the code needed for Jini fits in 48 KB, the lookup service takes 30 KB. Sun has worked with HAVi (Home Audio Visual), JetSend (HP), and Bluetooth to ensure interoperability with these standards.

Much more can be found on the Jini website including the code and descriptions of the demos that were shown during the launch (all with Jini-equipped prototypes, including hard drives, cameras, coffee machines, washing machines, Palm III, mobile phones...)

www.sun.com/jini/

Fusing ecommerce

Version 4.0 of NetObjects Fusion, the website builder, is focused on the incorporation of e-commerce. To create web-based storefronts, there is a set of components for use with iCat Commerce Online, a system providing shopping cart functionality and online ordering capabilities.

As well as improved document display, there is support for cascading style sheet positioning (CSSP). And this version includes incremental publishing capabilities for quick page or section updates and management.

Fusion 4.0 includes IBM's HotMedia for the addition of dynamic multimedia content such as 3D objects, and Allaire's HomeSite for the hand coding and integration of HTML pages. NetStudio provides image editing. The RRP is £199.

www.unipalm.co.uk

With the release of its Java programming tool, JDeveloper 2.0, and the Oracle 8i database, **Oracle** claims to be the first vendor to support the newly Ansi-approved **SQLJ** standard in both development and deployment tools. SQLJ allows SQL statements to be embedded directly in Java.

www.oracle.com

DataDirect **Sequelink** Java Edition 2.0 is client/server data access **middleware**, providing data connectivity to major platforms and data stores. As well as JDK 1.2 and SSL security, it supports the data access standards of **JDBC 2.0**, ODBC 3.0, and OLE DB 2.0.

www.intersolv.com/datadirect

Suite success for Rational?

The RAI centre in **Amsterdam** is to host Microsoft's **Tech-Ed Europe '99**. In addition to over 200 sessions for developers targeting Windows, the event has been expanded to include 80 sessions focusing on IT operations management. For developers, the central theme will be Windows **DNA**.

www.microsoft.com/europe/teched/

MicroEdge's **Visual SlickEdit-Tornado Edition** is an add-on to **Tornado's** cross-development environment for **embedded** systems. Editing features include a class browser, dynamic tagging, a source code beautifier, colour coding, selective display, and syntax expansion.

www.windriver.com

Rapid Response is a 'survival kit' aimed at minimising the downtime related to **Year 2000** problems. It is a set of **Compuware** fault management and testing tools such as Abend-AID, File-AID, XPEDITOR, QA Center, QAHyperstation, and **NuMega**.

www.compuware.com

AutoPlay Menu Studio 2.0

Professional Edition is a visual development tool for creating multimedia **CD-ROM** AutoPlay menus for Windows 95, 98, and NT. The WYSIWYG tool from **Indigo Rose** has a Template Gallery and supports drag-and-drop development.

www.indigorose.com/autoplay2/

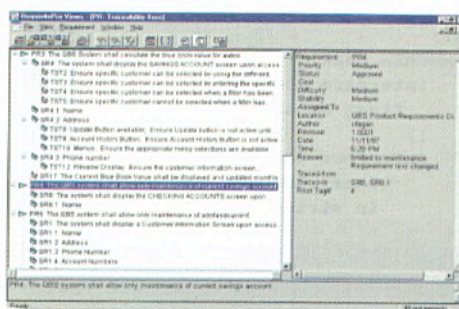
JustEdit Plus is a Java applet for the manual or automatic editing of **web** pages using a **web browser**. The tool, from Mainstay, is designed to facilitate on the fly updates by avoiding round-trips to a web server. It's \$99.95 for a single user.

www.mstay.com

The latest addition to the bundle wars comes courtesy of Rational Software, whose veritable empire of products now takes in many titles acquired in the merger with Pure-Atria last year. Taking advantage of the breadth of the range, Rational has come up with Rational Suite, which the company would have you believe is more than just a bundle. Rational Suite is all about teamwork, with the products integrated from the ground up and designed to fit the different functions of development team members.

Rational Suite Analyst-Studio (£2,700), for example, is targeted at analysts and managers, comprising the Requisite Pro requirements package (pictured) and Rose modelling tool. Development-Studio (£4,000) – for developers – includes Rose, the Purify error-detection tool, PureCoverage code-coverage testing tool, and the Quantify performance analysis tool. TestStudio (£4,000) – yes, it's for testers – in-

cludes Purify, PureCoverage, and Quantify, as well as the Rational Robot and TestFactory testing tools (see Ian Murphy's review of these products in *Tools for Testing*, EXE, January 1999). Completing the quartet of suites is Rational Suite Enter-



prise (£5,700), which includes all the products from all the suites.

In addition, every package includes the Rational Team Integration Architecture, which comprises SoDA, an automated reporting tool that interfaces with all the other components, RequisitePro, and the Rational Unified Process – guidelines and software to implement Rational's best practice standards.

For existing users with one or two Rational products, Suite may prove to be an ideal way to upgrade to the whole solution for a reasonable price. A deep level of integration between tools, plus an 'open' API set should ensure that all components of the development system can work together. Other than price, however, it's unclear why the software teams the company is clearly targeting – most of which should include analysts, developers, and testers anyway – would want to buy a complex mix of editions, when

they could simply invest in x number of Enterprise Suites and install the appropriate products for each seat. Given the success of the all-or-nothing bundle – Microsoft Visual Studio or NuMega's DevPartner Studio, for example – it remains to be seen whether the targeted approach will pay off.

www.rational.com

Its Progress for the Internet

Progress Version 9 sees a major upgrade of the Progress Software integrated development tools, application server, and RDBMS. A focus has been to accommodate distributed environments, ie the Internet and intranets.

The Progress 4GL and WebSpeed have been combined to form ProVision Plus for the development of Java, ActiveX, HTML, or Progress 4GL-based user interfaces. As well as development, debugging, source code management, and reporting features, there are new round-trip testing tools. Database and business logic can be separated from the user-interface to maximise the reuse of business logic and more easily accommodate multiple client platforms.

Open AppServer, also part of Progress Version 9, is an application server for managing and deploying shared components across application environments. It supports HTML, Java, ActiveX, and Progress 4GL clients, and a choice of databases that includes the progress RDBMS, Oracle ODBC, and DB2/400. There is support for load balancing and fail-over, and the management of stateless and 'state-full' connections for web-based applications. It enables application logic to be partitioned at runtime to support the application architecture that best meets user demands. Similarly, business logic can be split over any machine on the network for reducing network traffic and CPU load.

For Windows 95, 98, and NT, AS/400, and all major Unix platforms. It costs from £16,500.

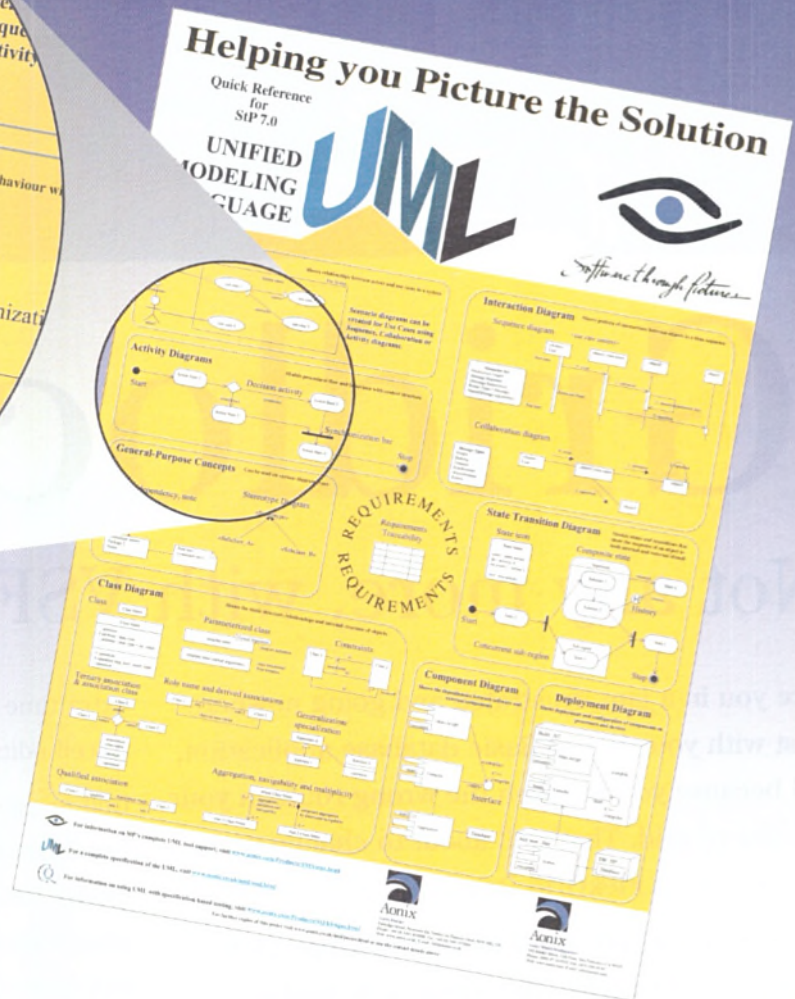
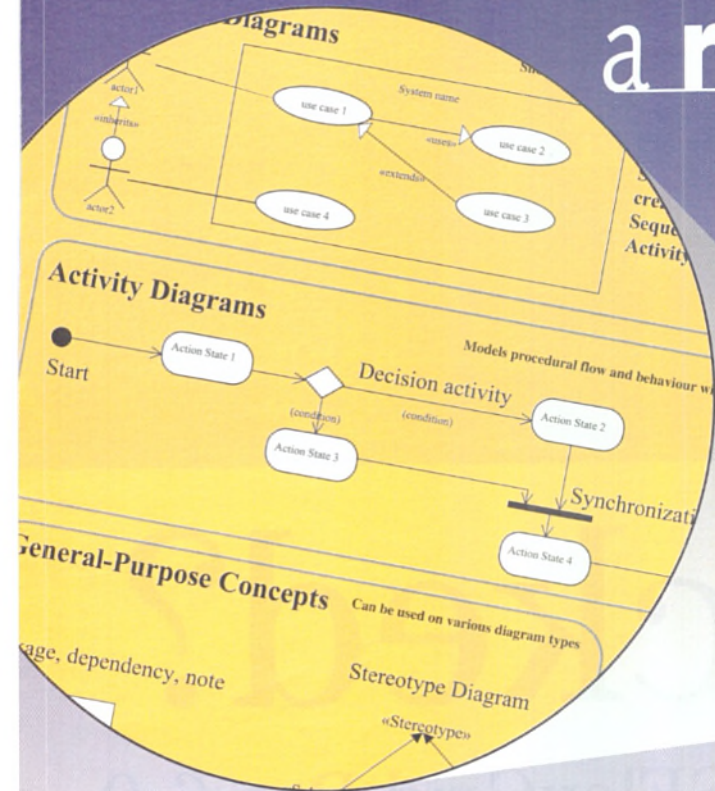
www.progress.com

Testing CSS1

One goal of the World Wide Web Consortium (W3C) is to encourage the use of style sheets, the benefits of which can include shorter documents, faster downloads, more attractive web pages, and easier site management. Its Cascading Style Sheets (CSS) specification is a widely supported style sheet language that describes how XML or HTML documents are presented. To help encourage its use, the W3C has released a CSS1 Test Suite (CSS2 has been released as a Recommendation). It should help developers improve CSS1 level support, and enable web page designers to verify the quality of support in browsers. The suite consists of nearly 100 pages, each of which documents a section from the CSS specification. Using words and images, the pages describe how the various CSS features should be rendered.

www.w3.org

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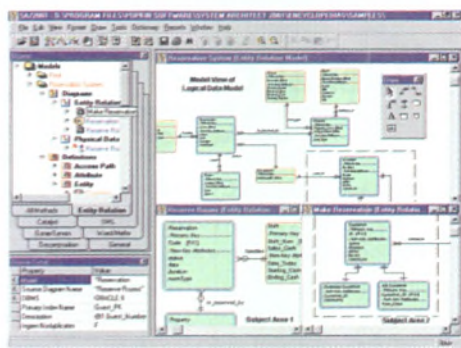
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The integration of modelling

System Architect 2001, from Popkin Software, is a Windows-based enterprise modelling tool. It is designed to integrate business, process, component, object, and data modelling techniques. The idea is to enable various areas within an organisation to use different techniques to build unique models, via the shared use of a repository. System requirements can be derived directly from these business models using the major analysis and design disciplines (SSADM, Yourdon, Ward Mellor, etc).

There is UML support for component and object modelling. Together

with System Architect's business model and data model, this can provide the first cut of the class model



for a system. There is forward- and reverse-engineering support for C++, Java, and VB.

A key feature of System Architect 2001 is the employment of Microsoft's VBA. This is to enable users to extend the tool into their own environments. Also included are links to workflow and simulation tools. HTML generation provides for model publishing over an intranet/extranet.

Along with SQL Server, there is schema generation for Oracle, Informix, and Sybase databases. PowerBuilder and Magic are also supported.

There is one edition only of the tool, and it costs £2,995. It runs on Windows 95, 98, and NT.

www.popkin.com

Optimizeit 3.0 Professional is a Java profiling tool for applications, applets, servlets, and JavaBeans. It supports **JDK 1.2**, and can be integrated with JBuilder and Visual Cafe. Available from the web for evaluation, it costs £299. www.pts.com/static/optimiz.html

BeanBuilder 1.0, from **NetObjects**, is the latest version of the IBM JavaBeans assembly tool formerly known as Lotus **BeanMachine**. The RAD product helps build database-aware applications with support for ODBC and JDBC. The RRP is £199. www.unipalm.co.uk

OpenSource '99 – Brooks' laws no more

The first Linux and Open Source Software (OSS) conference was attended by a couple of hundred people, mostly 'suits'. The fact that it was *not* a free event might explain the relatively low attendance and the fact that it wasn't the one traditionally associated with Linux. The keynote speaker, Eric Raymond, famous for his *Cathedral and Bazaar* paper and *Halloween* documents, clearly explained the open source phenomenon. OSS development has three main characteristics: face outward, ie take advice, accept patches, etc. Release early, release often. And praise in public people who contribute. This provides a context for peer review of the code and works because of the peer esteem participants get.

Here's how Eric Raymond describes it: 'Late 1993 when I first encountered Linux, it caused me a dilemma. There's a classical prescription for software engineering which derives from Brooks' laws: "adding more programmers to a late project makes it later" and "if you add n programmers onto a project the amount of work you can get done scales with n , but your complexity overhead, your communications overhead, your management problems, and your vulnerability to bugs scale with n^2 ".'

'All of these things scale with the number of communication paths between developers. Bugs tend to collect at interfaces, management problems tend to collect at interfaces between people. This is what I thought I understood about software engineering. And Linux caused me a bit of a problem because this set of notions predicted that anything that was developed by 40,000 semi-amateur hackers on the Internet with no software management should be unusably buggy. And yet when I first booted Linux up it was clear that not only was it not unusable rubble but I was in the presence of a general purpose operating system that was substantially more powerful and more robust than anything I've ever used and my reaction was how can this be? There's some horrible contradictions here. So I made two determinations: I'm going to get involved in this community and I'm going to figure out how we're getting away with it.'

OpenSource '99 – OSS everywhere

Some of the audience understood the principles of OSS but where non-plussed at the apparent advocacy for all software development to follow this model. Eric Raymond effectively considers that the situation might be different between algorithm and research intensive software versus implementation intensive software. The former often need some intellectual protection

while the latter would benefit from peer review.

The first highly visible move for a commercial company towards OSS was Netscape with Mozilla. Since then, IBM, Intel, Compaq, and many others have shown their interest in Linux. The next big public move could be from Sun, currently criticised for not having opened its Community licence enough. Eric

Raymond claims that Jeff Rulifson, a highly placed executive at Sun, told him that everyone developing a software project at Sun will have to either show a plan to open source their project within a year or justify why they should be an exception. EXE could not get any confirmation from Sun.

www.netproject.com

www.opensource.org

HTML2EXE v2.1 compiles websites into a standalone application, an **offline** browser that can be used by people without an **Internet** connection. It supports the use of frames, animated GIF images, and sounds. It runs on Windows 3.1, 95, 98, and NT. www.html2exe.com

Quartus Forth V1.1.0 is an on-board Forth compiler for 3Com **Palm** platforms, which runs on the handheld device itself. There is full control over system events, **GUI** features, an inline 68328 symbolic assembler, and a source library of extensions for graphics, sound, and pen input. www.interlog.com/~nbridges/

NS Basic/CE is designed to take advantage of **Windows CE** and the **handheld** computer environment. It includes a development and debugging environment that allows developers to test and modify code interactively. It costs \$99.95. www.nsbasic.com/ce/info

Vini, vidi, VCDC

CodeWarrior for PowerPC **Embedded** Systems Release 4 targets the **PowerPC** family of processors. New features include expanded hardware debugging, support for new Motorola and IBM microprocessors, and command line development support. There are enhanced optimisations in the C, C++, and **EC++** compilers. It costs from £1,660.
www.fullmoon.com

VB Mentor 1.0 is a Visual Basic add-in that automatically generates ActiveX business components and VB forms directly from a **database** schema. The forms provide a UI that creates, updates, displays, and deletes the **business** objects. It costs £599, but a Learning edition is available for free.
www.componentsource.com

Unify VISION **AppServer 5.0** integrates Microsoft-based Internet and Windows client/server applications with **Unix** application services. It supports server replication, fail-over and recovery, automatic load balancing, and asynchronous publish-and-subscribe. It supports the key components of Windows DNA.
www.unify.com

GeoScope Java is a toolkit for developers building **Internet** apps using vector and raster colour maps. Written in Java 1.1, it provides a variety of classes for interactive **mapping** with web browsers. A developer's licence is £1,750.
www.webmapserver.com

Over 1,250 people attended Microsoft's European Visual C++ Developer Conference (VCDC), held at the RAI centre in Amsterdam (900 had collectively attended the three separate events last year). The keynote speech, given by Mike Blaszcak from the Libraries Team, reviewed 'What's new in VC++ 6.0'. He emphasised that improvements in general programmer productivity should not be at the cost of performance, and promised further IntelliSense features. 'Pay as you go' was a recurring theme – that no cost should be involved with a feature that is not used. At one of the Q&A sessions, Blaszcak was keen to scotch the idea that Microsoft wanted to 'VB-ise' its implementation of C++ ('VB-ise C++? Man, what

colour is the sky in *that* world?'). The importance of COM and its centrality to all future Microsoft developments was strongly repeated from

Microsoft® Visual C++® European Developer Conference

the stage. Possible C++ language innovations for incorporating the services of COM+ were signposted in the closing talk.

The initial COM(+) talks were well attended, and with his authoritative knowledge of all things COM and a relaxed presentation style ('COM is *love*', apparently) Don Box was one of the stars of the event. However, perhaps the most popular session was 'Power

Debugging Techniques' given by Microsoft's Jay Bazuzi. There was no standing room, let alone sitting room, and the doors were barred. One further attendee was admitted, on the basis that it was her husband giving the talk.

On the whole, VCDC seemed well received and ran smoothly. People I talked to had found things of interest to justify their presence. And, of course, Amsterdam is a great city...

As well as a large Dutch contingent, the country breakdown of delegates revealed, perhaps surprisingly, that as many UK as German delegates had attended. Apparently, Germany was very keen to host this event – it is a very early tip for next year's location.

Microsoft declares its hand

One of the themes to emerge from the Visual C++ Developer Conference was the emergence of a 'declarative' approach to the ever-increasing complexity of modern-day Windows development. This relates to both of the more news worthy presentations given at the conference, which previewed future developments: Don Box (author and consultant) covering 'What's new in Windows 2000/COM+' and Dean Rowe (Microsoft, Development Lead on ATL) presenting 'VC++ language innovations for COM+ and beyond'.

Don Box, only half-humorously, characterised the ages of programming style. The eighties were a time of APIs: a special handle providing the key to individual items of functionality. The nineties are all about object models and interfaces. The future will see a more declarative approach to the problem domain, where interfaces represent a con-

tract of intention, and code will be tagged for the services required.

He defined COM+ as simply the name given for the next build of COM, a maturation of the COM programming model, to be delivered with Windows 2000. Components indicate their requirements declaratively, and each service has one or more attributes that control its behaviour. An absence of attributes tells COM that 'vanilla' behaviour is assumed. Furthermore, an interception mechanism is introduced that pre- and post-processes every call to provide the desired services. To support this, the concept of 'contexts' has been introduced. A context is a group of objects within a process, and they will be used to group compatible objects with one another.

Apparently, the functionality of Microsoft Transaction Server (MTS) will be integrated into the

core of COM+, reducing areas of duplication, and the MTS-style of programming will thus be available to all components. The Catalogue Manager will manage the attributes of configured components from an auxiliary configuration database, as a possible alternative to the use of Registry keys.

Similarly, a future generation of VC++ should have the ability to indicate COM+ requirements declaratively. (See *Attributes in VC++*, this issue.) It was stressed that the additional code generated by the proposed tagging method will be transparently available for investigation and debugging: the extensions will not break any code or change the semantics of C++ itself. Bjarne Stroustrup has apparently given his approval to this attempt to better integrate C++ into a large-scale framework for managing distributed components.

Books received this month

Publisher	Title	Author	ISBN	RRP
Wrox Press	ASP 2.0 Programmer's Reference	Alex Fedorov & Brian Francis	1-861002-45-9	£18.49
John Wiley & Sons	Bug Proofing Visual Basic	Rod Stephens	0-471-32351-9	£25.95
Cambridge Univ Press	Java Programming By Example	Rajiv Sharma & Vivek Sharma	0-521-64442-9	£20.95
O'Reilly	Learning Word Programming	Steven Roman	1-56592-524-6	£19.95
Cambridge Univ Press	Rethinking Smart Objects: Building Artificial Intelligence...	Daniel W. Rasmus	0-521-64549-2	£19.95



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Steady as she goes

Whether you have been a loyal reader for the past thirteen years, or this is your first issue of EXE, you have seen the work of Kate Adams. Apart from the first three issues, Kate has been responsible for EXE's design and illustration. But this is her last issue, and by the time you read this she will have left the magazine to travel the world.

EXE Magazine was started in February 1986 as a family business – the Adams family business. The Adams clan was all-pervasive among the staff, so for some years after she joined Kate billed herself on the magazine's masthead as 'Katey M' – a moniker intended to conceal the fact that she was yet another Adams and suggest instead a trendy design studio. In fact it just stood for her family nickname: 'Katey Matey'. She obviously enjoys using pseudonyms – when designing front covers and other illustrations for the magazine, Kate has over the years variously signed herself as Katerina Adams, Katey Matey, Katey McSkatey, K.M., Katey M., and Tijuana Kate (aka TJK, aka TK).

Kate's job has evolved with the march of technology. Initially EXE was 'laid out' using what now seems a practically medieval process of cut-and-paste – 'stick and lick' in Kate's lingo. To make an article fit its page allocation, Kate literally cut out words and rearranged lines with a scalpel. There was a special glue dispensed from a fat aerosol can that she used to stick down the little bits of paper – an evil smelling concoction comprising, I believe, 96% CFCs. An early Editor alleges that, when Kate was not struggling with some deadline, she used it to manufacture giant ersatz bogies, which she 'wore in her handsome flared nostrils'!

In time, Xerox Ventura and Corel Draw 2.0 replaced hand-drawn lines and crooked text. When EXE lost its initial dot and moved under the wing of Centaur to Soho, production moved onto Quark XPress, Adobe PhotoShop, and Illustrator... and a scanner. All this set Kate free to draw or compose many of EXE's illustrations, including covers.

A self-imposed part of her role has always been to create team spirit in the office, and one of the many prongs of her job description is to 'keep the editorial guys happy!' She has succeeded and her positive influence has extended as far as admin and advertising. Except when deadlines are dangerously near – when Kate turns into a

super-efficient copy-making machine with no time to spare for levity – she is the very embodiment of niceness.

Apart from fantastic design, layout and illustration work – not to mention generosity of spirit – she has one other peculiar accomplishment that deserves to be highlighted. Kate has the best handwriting of anyone we know. It is sickening (in the envy-making sense) to watch her write – even at full speed, scribbling a shopping list or something; it's all neat and symmetrical and beautiful. Over the years, Kate's hand has appeared many times in the magazine; it masqueraded for Bjarne Stroustrup's when his alleged diary appeared on the December 1989 cover and can be seen on the current subs flyer pretending to be Bill Gates'. Its most famous use was when, in an act of rather conscious eccentricity, we insisted that Kate write out the C and C++ code in Francis Glassborow's column. Whether the result was as sensible or as clever as we thought is a matter of debate, but Kate's hand-writing received an impressive and independent accolade when someone in a newsgroup admired the 'font' that we used. She did it month in, month out from July 1995 to May 1997.

From the days of the original family enterprise, Kate has carried the banner of all that the magazine stands for while other staff have come and gone. For this – and for everything else – those who have been, and those who are her colleagues warmly thank her. Kate is now heading westward to Central America, San Francisco, Fiji, and eventually New Zealand. Kate, from us all – fair winds, warm and westerly. ■

The Editorial Team



Patricia Deardorff

From where you and I stand, looking directly at the technology, it's very easy to be deceived into believing that the modern world owes its shape to computers. Computers are useful, and are sufficiently plentiful to be familiar to nearly everyone, but they're not everywhere. Silent, black special-purpose chippery (which, to be fair, is mostly digital) seems far more important in real life than the classic keyboard- and monitor-equipped general-purpose box, precisely because chippery lives and works inside the recesses of other equipment, silently and thanklessly going about its pre-ordained business. It's not computers that keep a laser in the tracks of a CD or mis-records your videos; it's chips. Right now, I'm sitting in an office devoted to one computer, but I'm wearing about a dozen chips in the various gadgets that represent modern jewellery.

But even chippery isn't the major stuff that shapes the world. Chips and computers owe their existence to the remarkable developments in plastics. We've become so used to the way that we can make anything we want in any shape we want that we can't recognise the wonder of it any more. The simple plastic-moulded bucket-style chair with steel legs that you see everywhere from cafeterias to schools is now regarded as cheap and utilitarian, yet when it was designed at the end of the fifties it was immediately hailed as a design classic, heralding a new era in product design.

Look at a modern monitor. Not the screen; the box it comes in. Look at the curves, the details, the venting in the top and the little pegs on the bottom, which hold the base on. Do you realise that these details cost *nothing*? All that subtlety, and all it requires is design. How different from TV sets from even the seventies, where the boxes were plain, wooden affairs and

the backs were made, as cheaply as possible, from pressed cardboard, and every detail, every screw hole, added cost to the finished item.

A more interesting contrast is cameras, where shapes are vitally important to the function. Plastics are used today to make the classical shapes more natural and softer, and to make the cameras easier to handle. Compared with a camera of the fifties, which relied mostly on sheet metal pressings and a few (expensive) Bakelite castings, modern cameras are cheaper, more reliable, and do more. Neither the disposable camera nor the sophistication of the APS system would be conceivable without plastics.

At the dawn of plastics, freedom of design and mass-producability were the things that everybody got excited about, and the product designers have learned to use these properties to the full. Some of the material's properties influence shape as well (for example, the chair only makes sense in ABS, and the monitor case only makes sense in styrene or nylon) but when we start looking at the impact on electronics, the material's properties – particularly of the composite plastics – become the outstanding features.

Look at chips. They make the chip, then they have to package it; they attach legs, wire the legs to the chip, and encase the whole assembly in dense, heavy plastic. It is airtight, watertight, doesn't shrink, and somehow doesn't destroy the tiny wires (too thin to be visible with the naked eye) as it's poured around the assembly. It sticks firmly to the legs, to the chip, and even to the wires, and yet it doesn't melt or crack when it's pelted with molten solder. Everybody thinks chip design is hard, but this packaging is mind-blowing!

Then look what happens to the chip; it's put into a circuit

Plasticity

Do you know what a computer is made of?

It's not silicon – actually, it's mostly plastic.

board. After the transistor, the printed circuit board is probably the greatest invention of the twentieth century. Originally, circuit boards were modest affairs, being made of epoxy-impregnated paper pressed together until it set hard. Cheap boards are still made this way, but they have all kinds of problems: the epoxy breaks down under heat, the paper breaks down, they're not very strong, and so on. Most boards today are made of fibreglass mixed with epoxy. There's an interesting property of this material – its thermal expansion is identical to copper, which means that no matter how much the temperature of the board changes, the tiny, tiny conductors that can be printed on the surface will never crack. This is a crucial property when making double-sided boards, because the thickness of the copper – both of a through-plated hole and of the joint between the hole and the track – is of the order of a thousandth of an inch. (By the way, the process by which they make these boards is quite fascinating. If you get the chance, take a tour of a PCB-making factory.) Not only that, the material conducts force nicely through the board even when the board is riddled with holes and solder-filled joints.

When they start making boards of more than two sides (where tracks are buried inside the thickness of the boards) a whole new set of problems appears. Standard PCB thickness is 1.6 mm, but if you're making a six-layer board, you're handling stock whose

thickness is only 1/4 mm. The stock sheets can be a meter or two on a side, so you can see that you need a special kind of fibreglass that won't simply fall to bits, or kink, or crease, or tear when you try to pick it up.

Then, when you've made the separate sub-boards, you've got to glue them together into a sandwich. You have to use a glue that sticks to fibreglass, and sticks to copper, yet which doesn't tear everything apart when it shrinks (as all glues inevitably do) and which will not damage the vanishingly-thin plating on holes passing through the entire sandwich. In fact, they use a glue that first expands and then shrinks, and only then goes hard.

I could tell you about the glue that holds picture tubes together, or the seals that hold LCD panels together, or the tiny plastic springs inside switches that are good for ten million operations, or any of a hundred other awesome materials. Someone designed each of these exotic and complex materials, and they did it because the electronics industry needed them as much as it needed new faster, cooler transistors, and the plants to make them in. These extraordinary achievements have been eclipsed by chip design, and that's a shame, because electronics needs plastics more than plastics needs electronics. ■

Besides programming and hardware, Jules does some product design. He can be contacted on 01707 662698 or at mayhem@jules.cix.co.uk.





Going with the MFC flow

Dear Sir,

I liked the comments of Jules on programming with the MFC (*Mayhem*, January 1999). Four years ago when I took early-retirement I upgraded my C skills to C++. Learning C++ was like being in heaven (nearly). Then I started to learn to program for Windows using the MFC. This was like being in hell (nearly)!

There is an admission by Microsoft that not every Windows application can best be produced via the MFC. It's in *MFC Developer's Workshop* by Frank Crockett and Joycelyn Garner. Chapter 3 on Document Templates: 'The document-view model is *only* a model and cannot be applied to all programming questions.'

I was very relieved to read that and began to understand why so many C and C++ gurus had shunned the MFC route. Even the great Charles Petzold is not using it in *Programming Windows 95*.

Having recognised that the tool is imperfect, I have found the best way is to 'go with the flow', initially. That is, build the app as Microsoft wants it to look and *then* tweak it from there, but never fight against the system.

With the MFC, the programmer is always in some cage called OnDraw or LButtonDown or OnTimer or OnFileImport. At great expense you wind up with 10 or 12 books on MFC programming gradually to realise that each

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book is adding only a few scattered pages of new info, but info essential to progress in application building.

As for the MFC help system on CD-ROM, you have to ask (search for) the right keyword – there are no synonyms recognised. For example, to draw 'fullscreen' see Desktop!

But it's great when you get there!

Alex Telford
Solarix Software
a.telford@dial.pipex.com

Thanks for the feedback.

[The preceding letter, as well as the following replies, form an email exchange – Ed.]

When I first started programming Windows, I followed Petzold and wrote in C. Once. After that, I decided to start writing my own compilers, and very successful they were for quite a time. The main thing about the compilers was that nothing at all was hard-coded, and distinctions were minimised as far as possible. I made no distinction, for example, between windows, dialogs, toolbars, and so on. Variables could be bound to windows, instances, or modules.

MFC came very hard after that. It tries to block me every step of the way. Check out this one: I wanted a progress bar that turns red when it overflows. Can I find out how to do that? No, I can't, because for no good reason that I can think of, progress controls don't use the WM_CTLCOLOR system. Also, the menus in dialog

controls don't drop-down initialise. The more I get into it, the more I hate it. I'm afraid I'm being tempted to dust off my compilers.

Jules May

Alex replies:

On the point of being blocked every step of your way, I get that feeling too. I think your disaffection with the MFC is part of an industry-wide disaffection with the direction of IT development. My experience is that Software Engineering reached its zenith in about 1975, and it has been downhill all the way since. I remember in 1969 with our PDP 8 we could inspect the *circuit diagrams* of the machine to check out what a particular machine code instruction actually did!

Your new compilers are perhaps just part of a wider need: The Millennium PC Project. An Industry wide collaboration defining a *specified* New PC (specified right down to the real-time interrupt level), a new language (D++?), new compilers for it, a new GUI, and new software.

The MFC inherits the hierarchical nature of C++. Electronics designers are not constrained in this way; they can set out a number of blocks (modules) and inter-wire them in any way they please. The difficulty is how to maintain the 'rat's nest' of interconnections: how to deal with complexity. Forcing it into cast iron straight-jackets is not the answer. Keep the faith!
Alex Telford

An example of BeOS

I was very interested in Duncan Wilcox's article on BeOS 4 (*The unbearable lightness of BeOS*, EXE, February 1999), but I was a little surprised by the C++ sample he quotes (Listing 1 – An extremely simple example of audio file playback).

C++ allows declaration of variables/objects near the point of usage, so there is no need to have them all at the start of the function, as the example does. If they had been declared where they were needed, there would have been no need to use a pointer, and therefore the leakage (of BSound) might have been avoided – the new'd object is not deleted.

Michael Mounteney
mounty@cix.co.uk

Placing variables and objects at the top of the function or method is certainly a matter of personal preference or style, except of course when constructing an object on the stack (the place where you declare it is the place where the constructor will be executed).

I will not further defend the placement of variables as I'm guilty of having snipped the code in question from a working sample :-)

The BSound object is indeed not leaked: it is deleted by the Media Kit because of the reference count.

The rationale is that the function is synchronous, but it could have been asynchronous simply by removing the WaitForSound call (and the player object would have been part of an object of which the playsound function was a method). Hope this helps.
Duncan Wilcox
Duncan@mclink.it

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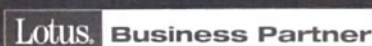
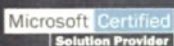
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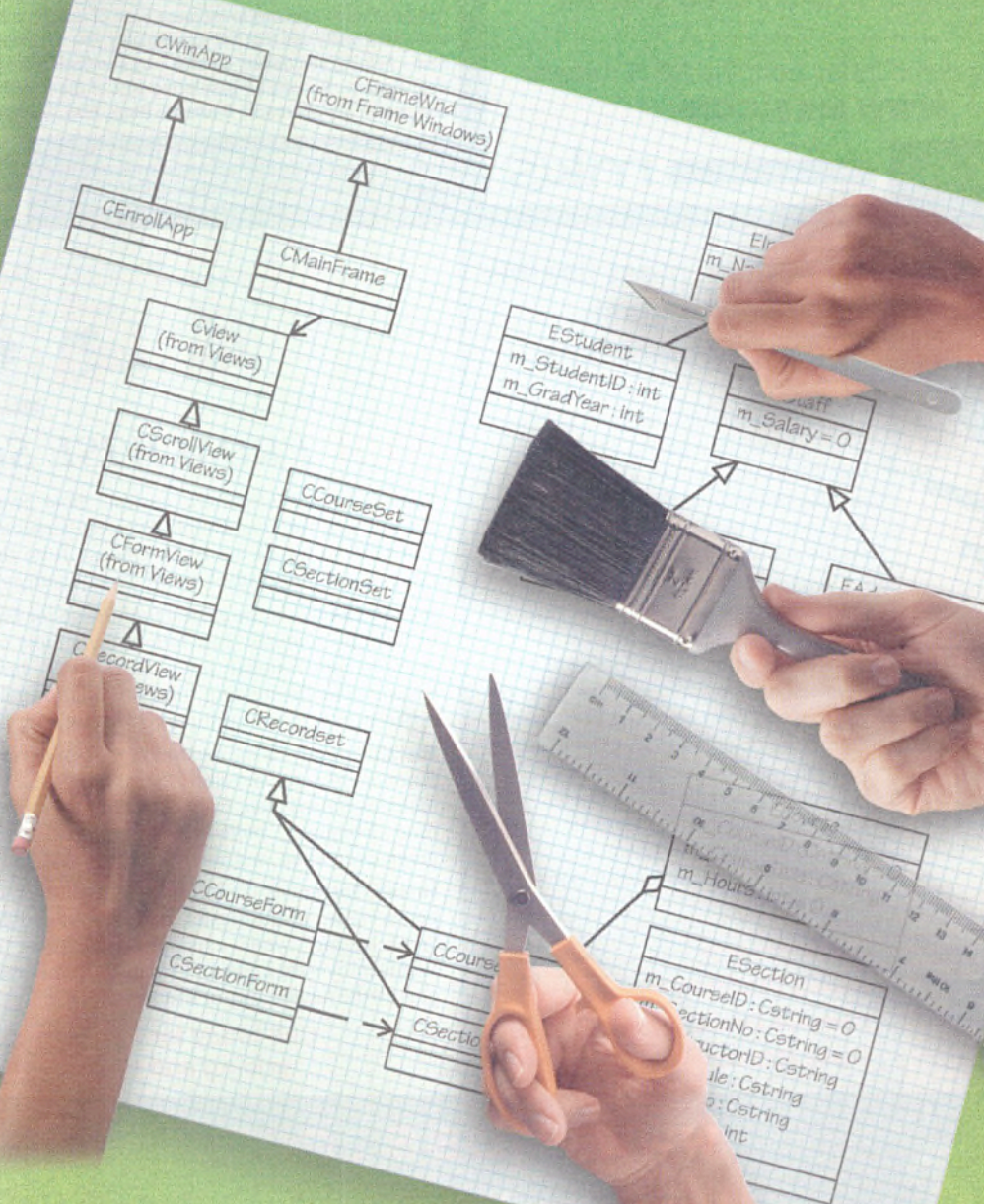
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Simplicity by design tools



The complexity of software today is truly frightening and much of this problem is caused by the need to maintain functionality while adapting to changing business requirements. To help developers cope with the speed of change we have seen new languages and new categories of software tools such as Rapid Application Development suites. We have seen new methodologies developed and many of these revolve around object-orientated languages with one common thread: componentisation. This move to developing small easily-maintainable components that can be slotted together to form larger developments is not new, but one thing has been significantly weak in all of this: the design-side tools.

Tools that are used within the design process need to be completely integrated into your development environment. That is, they must become part of the process rather than requiring special treatment by the process. In my earlier articles that focused on SCM and software testing, the need for transparency was talked about and in particular the need for iterative development. This is critical because during the actual coding and testing of any piece of software, even down to the component-level, things can change. When they do change, the change may be such that it requires a rethink of the actual requirements and design stages and this is why those tools must be integrated with the rest of the environment.

Another key goal for design-side tools is their accessibility. SSADM is an example of a perfectly good methodology made unusable by the way it was developed. I know many sites that have used SSADM, some successfully, although such a statement could be made about any approach. Unfortunately, even on the successful sites, SSADM was kept away from the development teams because it was deemed too complex for anyone but the most expensive contractor and experienced analyst. If we are to ensure that we break down our code at the component-level, then the tools must be accessible to everyone, without the need for years of training. And they must become part of the way that people work and not an imposition.

One of the reasons commonly cited for not reusing components is the lack of documentation and therefore the lack of trust in the quality of the component. To some extent this is understandable, but it highlights the failings of all those reverse-engineering tools because they obviously don't provide sufficient information when used against components. Design tools therefore need to ensure that the documentation is built up during the design phase and that any such documentation conforms to industry-expected standards as well as those standards implemented within the project team. Where diagrams are used, the design tool must conform to any symbols required by a standard because this is the easiest way of ensuring that anyone using the tool will be able to understand the output.

Lock-ins and add-ons

Absolute conformance to a standard is always difficult because all standards have both mandatory and optional components, and often portions of standards are in a state of constant flux, particularly as a standard moves towards maturity. In this instance, the design tool vendors need to ensure that they clearly document what they support and how they deal with unsupported portions of the standard if the tool interacts with other products that provide a more comprehensive support. Many vendors are less than happy about this statement, but once again we go to the need for trust by developers. Development teams do not swear life-long allegiance to tools and therefore they will switch. When this happens, they will want to take existing work with them, so part of the evaluation process of tools today is to test their import/export capabilities. If there is a hint of

Product details

Rational Software Rational Rose 98 Enterprise Edition – £2,850
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Visio Visio Enterprise – £699
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lock-in, the tool will often be rejected even if it is the best tool for the job at that particular time.

Simply designing the model, however, is not enough today, and here we have seen the development tool vendors taking a lesson from the database tool vendors. For many years, I have been using database design tools that not only do the normalisation of my relational model, but also create stored procedures and any code necessary to enforce referential integrity. Products such as System Builder and Creator that used to run on the Pick operating system would create an initial application for you to tune yourself. Going even further back, products such as Lotus Symphony and Smart from Innovative Software enabled you to create outline systems without having to write macros and code.

By 1994 these vendors had begun to offer add-ons for PowerBuilder and Gupta (now Centura), that went even further and produced sample code. As these two environments began to make significant inroads into the corporate development market, they began to offer a more object-orientated development environment. As a result, Erwin released a version of its design tools that actually generated a database design and code for certain types of objects depending on the values that were required in various fields. Rational Software in particular was quick to follow this move, and version 2.1 of Rational Rose was designed specifically for the Gupta SQL Windows market.

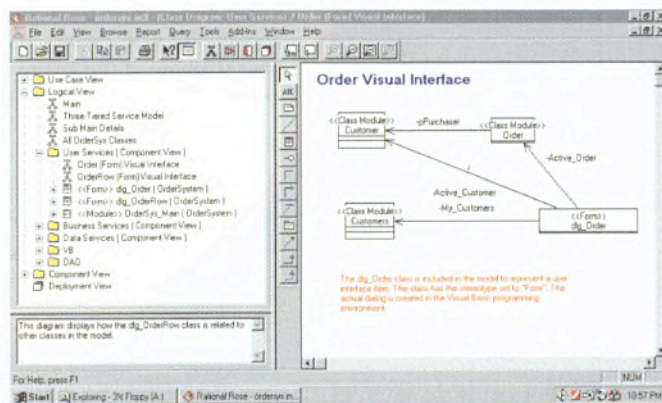


Figure 1 – Rational Rose 98 Enterprise Edition.



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It is this linkage to UML that has helped Rational promote Rose: as the standard has become

accepted, so has Rose.

Features and products

All of the tools looked at in this review claimed to be UML (Unified Modelling Language) compliant, although none of them claimed 100% compliance. This was generally due to the vendor's perspectives on what parts of UML were commonly in use and what parts were still under development and therefore of limited use to developers. The importing of existing code was extremely important because few people are likely to be starting from scratch and even if they were, importing known projects is a good place to start when you are looking at the functions of a new tool. Code generation was always going to be an important feature, as was integration with the rest of the development environment.

Having decided on what I wanted to look at, I asked several developers what products they felt should be considered and consulted several reports into design tools (many of the companies mentioned had merged since the reports were issued). In order to ensure that I didn't miss anyone who felt that they should at least be given a hearing, I even posted an outline of the article on Sourcewire (a media resource used by the vast majority of magazines, vendors, and PR agencies for just this purpose). As a result, I had some interesting responses. Eventually, after talking to various vendors further, I was left with four obvious candidates and one outsider who I felt deserved a mention because it is able to drive home the potential for diagramming.

The companies and products chosen are: Rational Rose 98 Enterprise Edition from Rational Software, Visio Enterprise from Visio, Select Enterprise from Select Software Tools, COOL:Jex 4.0 from Sterling Software, and HOW from Riverton Software.

Rational Rose 98 Enterprise Edition

Rational Rose has developed over the last few years into the leading software design tool on the market. One of the reasons for this success has been Rational's steady move towards an integrated environment across its product portfolio. However, despite a wave of recent announcements, complete integration is not quite to hand even if Rational is further down the line than any other player in the market. That move towards an internal integration has not stopped Rational from establishing links with many of the other leading development vendors.

Rose 98 provides a comprehensive design and development environment with full support for C++, Visual Basic, Java, and several other environments such as Centura and Delphi, as well as Microsoft's COM and ActiveX components. Rose also provides support for several high-end and true object-orientated products such as Versant and Poet and has ensured that a previous weakness, database support, has been addressed with Erwin and Oracle 8 links. This depth of product support allows Rational to position Rose as the essential software design tool, able to take you from small to corporate-sized developments.

Rose was one of the first products on the market to provide comprehensive support for UML and given the position of Rational on the standards committee it would have seemed extremely strange had they not provided comprehensive cover. It is this linkage to UML that has helped Rational promote Rose: as the standard has become accepted, so has Rose. In fact, this linking to standards has been taken further by Rational with its support for Java. Rose 98 provides full round-trip engineering of applications provided that they are based on JDK 1.1.x or earlier, although Java archive support will not arrive until the end of the first quarter, 1999. By avoiding being drawn into vendor-specific components that are not pure Java, Rose has become an acceptable tool to all camps.

It doesn't seem quite right to say that working with any product is fun, but Rose gives you that feeling of confidence that means you actually get on with your design rather than worrying about what each diagram does. You are not overburdened with options when you start a new project, although the first couple of times you find yourself wondering if that is all there is to it. The way that everything simplifies itself on your diagram can also seem a little disconcerting at first, as if there should be more to see. Once you realise that it is all there and you only need to double-click on the object to get the details, you discover that things don't have to be as complicated as some people would like to make out.

Importing and exporting of models is extremely simple, but they must be in an existing Rose format. Generating code from your model could not be easier. When you are ready to generate the code, go straight to the Tools menu, choose the relevant language, and start the code generation wizard.

Other features include the ability to support multiple languages in the same model and compare models. When you look at the complexity of many developments today, few are not facing the difficulty of supporting Java or COM for web development and C++, Java, or Visual Basic for the client-side code. I was unable to get any other vendor to prove that they could support multiple languages in the same model.

In addition, with a large development you are likely to have several designers working on the same piece of model. If this was simply a piece of source code, you would create a parallel development and then merge further down the tree. Rose now gives you the ability to do this with your models, so one designer can be looking at ways of optimising a design while another is making changes to reflect prob-

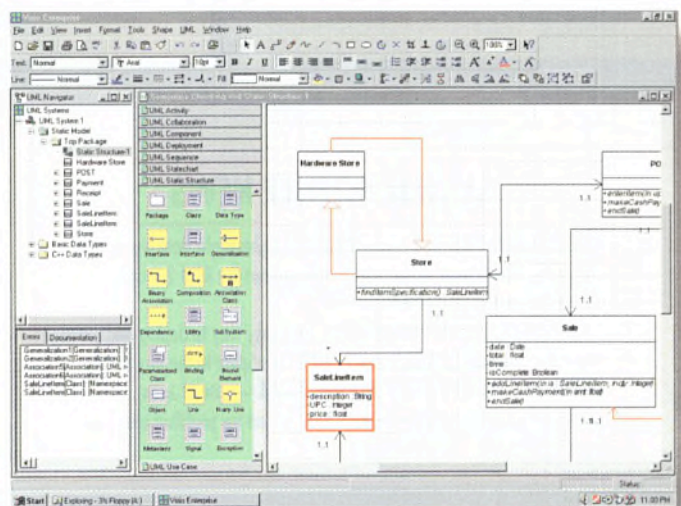


Figure 2 - Visio Enterprise.

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lems in the coding structure. This is particularly relevant when you are using Rose to support a generic product that is customised to meet the end-user requirements. Having supported such a system in the recruitment industry in the past, there is no doubt that this feature would have prevented us from having multiple unique systems with no real control over the source. The fact that Rose supports the use of source code control mechanisms for your diagrams further strengthens Rose in the complex design market.

The only downside for Rational at the moment is ensuring that there is adequate education in the market place as sales of Rose increase rapidly. As with all these tools, they can become a huge drain on resources if you do not train staff properly from the start, and it can be difficult to find public courses, with the exception of those run by Rational itself.

Visio Enterprise

Visio is a vendor better known for products that are used to create organisational charts, low-end CAD, and office layouts. Yet Visio is an extremely aggressive company in the visual tools market and it is now positioning itself firmly in the IT department. Among the tools that it now possesses just for this are flowchart templates and an extremely nice Internet suite that checks the stability of your website to identify broken links and other common problems. It has also added a number of network diagramming tools, and there is a project with Microsoft to provide a graphical mapping tool for Windows 2000 as well as its existing Novell tool. Of more importance for this article is its Software and UML templates. This new release comes at a time when it has integrated its recent acquisition of InfoModeler, and this is included within the Database templates.

For those who have an existing piece of VB or VC++, Visio will reverse-engineer your code into a UML diagram, and I was impressed with the ease with which I was able to do this. The Visio documentation includes all the steps required to locate, download, and install the add-ins required, and for VC++ you will need additional code from Microsoft. Once this is done you simply create a Browse Information file, and it is this file that the UML add-in uses to reverse-engineer your code.

Visio provides support for most of the major methodologies including Yourdon, Booch, and SSADM, and even has a COM and OLE template under its Software Diagram menu. This actually takes Visio a step further than any other product because you can load existing designs while learning how to port them into a new methodology. This provides great flexibility while people are learning a new skill, but it can also allow them to stay with what they know and this could make it harder to move people to a new methodology.

One of the problems that Visio is likely to face is credibility. It doesn't have a reputation for providing tools for developers, it makes no wild claims about its ability to build complex systems, and it doesn't allow you to mix multiple languages on the same diagram. The interface is also very cluttered, as if too much has been put in.

You can import and export your diagrams, within limits, to the Microsoft Repository, and the limitations here are those imposed on Visio by the Repository itself. Other than that, there are no links to SCM or Test Suites and therefore no round-trip engineering, unless you count reverse-engineering of code.

On the plus side, simplicity is the name of the game here. If you are looking for a tool to get your developers into the idea of working with diagrams, then Visio is a good purchase. While the more established players in this market are busy using add-ins from database companies to fill a gap, Visio has a tried and tested database design tool, and this means that it can provide a standard interface for all

your modelling needs. It also makes no claims to be a competitor to the more established companies in this market.

Select Enterprise

Select Enterprise comes with a number of built-in utilities and programs, turning it into a suite of programs rather than a single entity. Among those programs are a C++ generator and reverse-engineering tool, the Erwin forward- and reverse-engineering tool, a repository administrator, a SQL generator, a document generator, and several other tools. In addition, you will need to make sure that you have access to the latest patches if you are going to work with Visual Studio 6.

Configuring the product to the location of your program files can be less than intuitive. Despite the fact that Visual Studio was installed on the machine before Select Enterprise, it failed to locate the VC++ directory, and when asked to load the IDE it couldn't find the relevant file. The problem turned out to be that the IDE path was not correctly identified in the CPPGEN.INI file and I had to check all the INI files and correct them before proceeding. Picky? Perhaps, but things like this are easy to overcome and better documentation is desperately needed to resolve it.

The IDE also took some getting used to and I felt that a lot of time was spent getting comfortable with the different windows and their functions. Ironically, this is because Select has made so much information available to you. You don't have to have everything turned on of course, but I would not recommend using this product without having a screen resolution of at least 1024 x 768.

Once I managed to get the configuration sorted, working with Select Enterprise was very structured. As soon as you create a new model, Enterprise populates the Explorer windows with a very detailed project outline that you can then use to ensure that you add all the relevant components to your model. There are three Explorer windows for your project: diagrams, dictionary, and relationships, with the fourth window being a copy of the online help system.

The windows are dynamically linked, so as you work with the Diagram window to build your system, it automatically populates the Relationship window. As you chose different types of diagrams to create, the design toolbar changes automatically. Both of these features gave the product a feeling that you could really achieve something easily and this offset my initial unease at the complexity. However, there are so many different types of diagrams that for the first project I spent over a day just exploring what could be

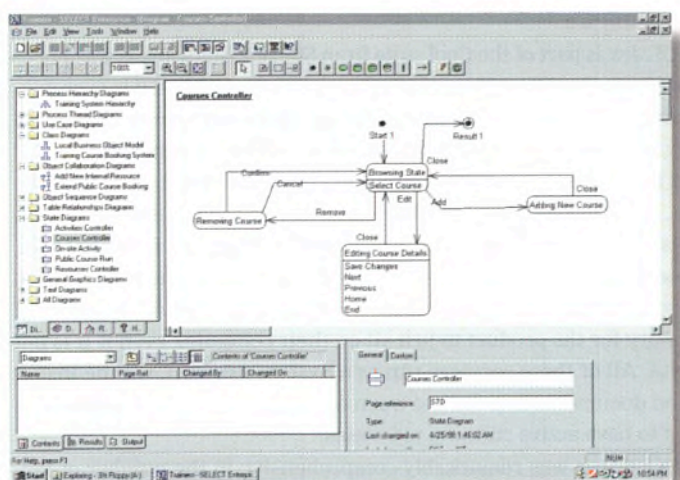


Figure 3 – Select Enterprise.



Each language module within COOL:Jex has been written in TCL, and the TCL interface is fully documented and

accessible if you want to configure, tune, and write your own modules.

added, how to make changes, and just getting an understanding of the project structure. I even found myself adding diagram types that I would not necessarily have thought I needed, because I didn't really need to make any special effort to add them. While I have a concern that this could lead to an overly complicated model, it certainly ensures completeness.

The Document Generator was similarly well structured and produced fairly comprehensive documentation that could easily be modified and extended. I tried it against several versions of Microsoft Word including Word 2000 and it worked perfectly. Good documentation does make a significant difference and it was nice to see that attention had been paid to this feature.

Select supplied me with an 'export to Mercury Test Director' add-in to provide the initial test plans. While this seemed to work well, it would be fair to say that in the limited time I had, I was unable to spend enough time carefully checking the accuracy of this add-in. What checks I was able to make showed no problems or omissions, but this wasn't checked as fully as it might have been.

What was missing was an obvious way to link Enterprise to an SCM product to provide round-trip engineering. At present there appears to be no way to do this. Once you actually generate your code you need to add it manually into your SCM product, and this could cause problems with code being overwritten or not properly added. Hopefully, Select will sort this problem out.

Overall, I liked Select once I had managed to get past some installation and teething troubles. There is no doubt that the power is there, but it needs to be better linked to the rest of the tools in the development environment.

COOL:Jex 4.0

COOL:Jex is part of the Cool suite from Sterling Software. It was previously known as ObjectTeam from Cayenne Software, and it is currently awaiting a facelift to remove the Cayenne and ObjectTeam details. Hopefully, by the time you read this review this will have taken place.

This product demanded attention right from the start of installation. As I installed it on NT 4 Workstation, it installed several services of its own and the Sybase SQL Anywhere - OT Service. Between them, these services took over 7 MB of RAM just to sit in the background. Anyone using this product needs to ensure that they allow plenty of memory for the product to just sit on their computer, even if it is not in use. All of these services run as a System Account, yet the installation documentation did not warn of this, nor did it warn about the need to have active running processes.

COOL:Jex was remarkably comprehensive in the number of languages for which it will create systems, with the usual support for Java, C++, and VB supplemented by Corba, Smalltalk, PowerBuilder,

VisualAge, and Delphi, to name just a few. The next version, which should be available by the time you read this, will be providing support for both COM and OLE.

One drawback was that the quality of documentation around each of these environments was not as comprehensive as I would like, but it was sufficient to allow you to begin constructing models. COOL:Jex also allows you to do forward- and reverse-engineering and in some environments, such as VB, you can even do synchronised development. This integrated round-trip engineering ensures that models and code are properly co-ordinated (a key requirement given the complexity of today's software and the pressures on developers to get product to market).

Creating diagrams with COOL:Jex was interesting because the interface is kept extremely clean. You begin with the diagram wizard, which is quick and easy - exactly what wizards were intended to be, and not the complicated objects that some products have. Each diagram is edited in a large window, the relevant icons are clear and easy to use, and the property sheets are kept functional rather than overcomplicated with excessive detail. As a result, you feel more in control of the process and able to concentrate on exactly what you are trying to do.

COOL:Jex has its own source code manager. This allows you to freeze your diagram at any given point as well as carry out parallel development. Even if you are working on your own project there are likely to be times when you may want to experiment with different approaches. In a team environment this is a serious bonus supported by very few vendors in this market. You can even export to an external SCM tool, and Sterling provides support for products such as PVCS and ClearCase. The documentation contains very clear instructions for setting up the SCM tool and activating the links. One let down was that COOL:Jex provides support only for one test suite: Segue Software's QA Organiser.

Each language module within COOL:Jex has been written in TCL, and the TCL interface is fully documented and accessible if you want to configure, tune, and write your own modules to extend COOL:Jex. These extensions could even allow you to develop your own interface to products that are not yet supported by Sterling Software. An example of this could be Mercury TestDirector, to fill the gap in test suites. For any large corporate looking to add a tool to their existing systems, this makes COOL:Jex a very desirable product.

HOW

Riverton Software has been around for just a couple of years yet it is already expecting to be in a position where it reaches profitability by

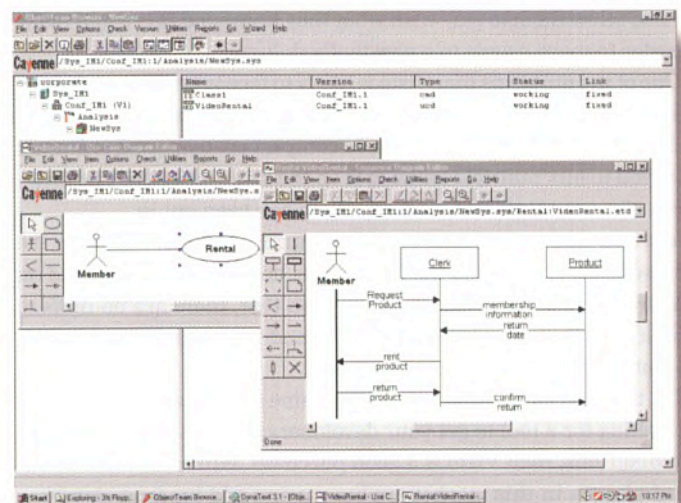


Figure 4 - COOL:Jex 4.0.



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the end of 1999. Very few companies reach profitability quickly and those that do often disappear inside larger organisations. One of the problems facing startup companies is that they are under extreme pressure to show a return on initial investment. Yet one of the things that makes Riverton stand out is that it has actually concentrated on building a vastly experienced design team and getting the product right before attempting to ramp-up its market position.

HOW is an extremely interesting product, not least because it is now coming out of the shadows of its initial market and into the development mainstream. Anyone who has been around the PowerBuilder market over the last two years should have come across HOW because it has quickly established itself as the dominant design tool in that market for developing distributed applications. Riverton already has a VB version and in the next set of releases, due in early 1999, is likely to add a Java version. The reason for no existing C++ version is that the company feels that it would need to support several different C++ compilers and for a small company the returns on investment and increased staff-levels are not sufficient.

One of the important issues for HOW is that it not only talks about componentisation and object-orientation but that it applies those terms to its own design. Take a close look at the repository and you will find that it is built on the object database Poet. This move sets Riverton apart from the crowd and means that it does not have to cludge objects into a relational model for storage. For those who are concerned that this might impact their ability to extract information from the database, Riverton do supply a utility that creates a relational schema of the database, thus ensuring that you can use all your existing reporting and SQL query tools.

What struck me when working through HOW is the architecture and how it constantly interacts with your design and delivery. One of the problems with many client/server development environments today is their inability to deal with more than two basic levels. The design tools that are often used may well support more than two levels but they make it difficult to design an effective n-tier application. HOW starts with the concept of separate presentation, business, and data tiers, so your design can be moved into different environments easily. While Riverton does not support everything in the UML standard it is careful to ensure that what it does provide is fully UML-compliant.

HOW does more than just design; it manages its own architecture that is used during the execution of code generated within HOW. When the client wants to execute a business object it can either execute that object via the application server or locally. Initial calls are made via the Shared Service Object (SSO), which then creates the link to the database using ADO. The Business Component Manager (BCM) is also called by the SSO and it, in turn, is responsible for the control of your business object. Some tools leave all of this sitting on the application server but the BCM is an intelligent agent. Much depends on how you call your business object. If the call is simply a read-only call for query or browse purposes, the BCM is run locally and this frees up the application server. Only if you want to change or write new data do you actually take resources away from the application server.

HOW uses five visual builders to capture requirements: the Use Case Builder, the Use Case View Builder, the Business Rule Builder, the Workflow Builder, and the Interaction Builder. The visual builders are fairly easy to use although I got lost in the options on a few occasions. The IDE is uncluttered and Riverton has ensured that you can filter whatever you are viewing at any given time. It has also built in a series of the most common filters to reduce the amount of information on the screen. Fortunately, Riverton supply an exceptionally good tutorial

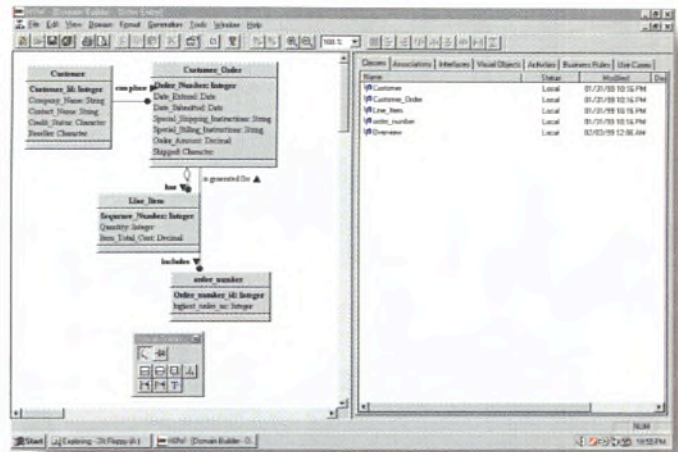


Figure 5 – HOW.

with HOW that guides you through the process in a careful manner; otherwise you could find yourself getting a little lost.

I found HOW a very interesting product although I feel it is not for the small project. The control it places over its business objects is quite clever and the distinction made between read-only and update/add and the impact on the transaction server is undoubtedly powerful. On the downside, I suspect that many sites will be put off by an underlying OO database, irrespective of the relational schema generator, because they are scared of what they don't know. I'm also concerned that the current very high level of technical knowledge among Riverton and the distributors will be difficult to maintain if the product gains a huge momentum. It really does need a lot of mentoring in the early stages to enable you to exploit its capabilities.

The right tool

The range of features offered by the different design tools featured in this article makes it very obvious that it would be all too easy to purchase the wrong tool. Rational Software, at present, has the most complete solution in that it can provide language-independent tools for the whole development cycle. Close behind it is Sterling Software and Select, but while they don't have a complete family in the same way as Rational, they have compromised by making their links with other vendors easier and more obvious. If you already have some tools in house, choosing either of these should mean not having to replace them.

As a relatively new player to the market Riverton Software is worth a very close look, particularly as it has a clear and obvious goal of aiming for n-tier development. Its deployment model certainly appears to be superior to its competitors, and with new versions shipping shortly (including full support for Java) I expect to see much more of Riverton during this year.

Visio is a very good bet if you are only interested in a low-end tool to give people a chance to get to grips with learning modelling. It may be that Visio will be seen as a learning program before developers move onto more complex products. However, do not underestimate its commitment to this market, and with InfoModeler and support for all of the major methodologies it already has a modelling set larger than any other player in this market.

Ian Murphy is a freelance journalist and trainer because it means getting lots of toys, access to some neat technology, and gives his ego an outlet. When pressed, Ian will go out and do consultancy. You can contact him at ianmurphy@fleet-street.com.



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Attributes in VC++

The Visual C++ Developer Conference saw Microsoft previewing VC++ language extensions. Alun Williams reports on how the use of attributes, along with new keywords, could ease the integration of C++ with COM+.

Despite the centrality of COM to Microsoft's vision of the future of Windows-based development, COM programming in Visual C++ is not straightforward. Do you know your CoMarshalInterface and CoUnmarshalInterface APIs, or the difference between CoCreateInstance and CoCreateInstanceEx? Do you know your packages from your apartments from your contexts? The world of COM, when you start to get down to an implementation-level of detail, can be forbidding. It becomes an important issue for Microsoft with a recent internal survey finding that 'only' 51% of VC++ developers use COM. With certain language extensions, Microsoft is aiming to unify the COM+ programming model with C++.

For the benefit of those who could not attend, the source material for this article is the recent presentation given by Dean Rowe of Microsoft (Development Lead on ATL) at the Visual C++ Developer Conference (V CDC), in Amsterdam. It was entitled 'Language innovations for COM+ and beyond', and the scope of the changes do indeed go beyond COM+ alone. When talking to Rowe beforehand, he stressed that things are not cast in stone, and that the approach is still evolving. An important aim was to signpost the developments to programmers, to remove any element of surprise with the next evolution of VC++. (For example, as a final demonstration, Rowe showed some attributes for database support, but these features already superseded the state of play in *Visual C++ 6.0 Technology Preview for COM+*, the CD release provided to delegates.)

The language extensions proposed are fourfold: the use of attributes, an interface keyword, a super keyword, and the use of properties. A declarative approach has been adopted, which is consistent with the line taken for COM+, with its emphasis on the configuration of objects through attributes (see *Microsoft declares its hand*, News, this issue).

Attributes

The VC++ attributes are 'declarative instructions' that guide the implementation. They are tags or 'hints' to be followed by the compiler or (as Microsoft has implemented it) a special separate pre-compiler called an Attribute Provider. (See *The Attribute Provider* for an example schematic.) They can lead to the in-place injection of code, the transformation of code across different methods, or the creation

of meta-data required by a framework. New classes or functions can be generated, new base classes can be added to a class, individual statements can be created, or even type libraries and IDL files can be generated. As an example of their format:

```
[ attribute_A ]
class CExampleClass {
public:
    [ attribute_B ] int ExampleFunc() {}
};
```

The `attribute_A` is applied to the scope of the class, while `attribute_B` applies to the particular class member. In fact, attributes can be applied to any declaration (but not to a particular instance of a type).

There can be three different styles of attributes: a simple name, a name-value pair, and a name and a set of properties that can act as parameters. (They will be shown in action when we move on to the interface keyword.) First, the simple name style:

```
[ com ]
interface IExampleInterface {
    HRESULT ExampleFunc( [ in ] int ExampleParam );
};
[ comobject ]
class CExampleClass : public IExampleInterface {
    // ...
};
```

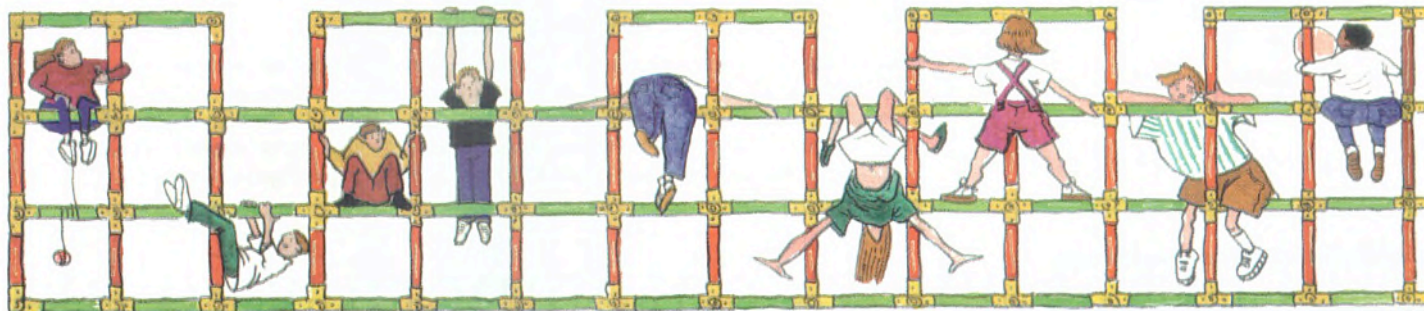
Second, for a name-value pair, the value can be an identifier, a string, or a constant:

```
[ uuid( "000214E2-0000-0000-C000-000000012468" ) ]
interface IExampleInterface {
    };
[ transaction( required ) ]    // a COM+ service
                                // attribute

class CExampleClass {
    };
```

Finally, for a name and set of properties, the properties can either be simple names or a name-value pair. For example, the `dll` parameter below specifies the creation of a DLL as opposed to a straight executable:

```
[ module( dll, name = "MyComponent" ) ]
```



In terms of attributes and the IDE, there is no intention to leave a gap in coverage. The IntelliSense feature should be attribute 'aware': the user should be able to manipulate attributes easily during editing. By the same token, post-injected code should be fully available to the debugger. Wizards should help to build an 'attributed' project.

The interface keyword

The `interface` keyword, is effectively a special C++ `struct`. It should help with the generation (though not exclusively) of COM interfaces. The restrictions placed upon it, in relation to a normal C++ `struct`, are: it can only inherit from another interface, it can only have methods (in the context of its use, having data members does not make sense), and the methods must be public, pure virtual, and can only be declared not defined.

For example, the code:

```
interface IExampleInterface {
    void ExampleFunc();
};
```

becomes equivalent to:

```
struct IExampleInterface {
    virtual void ExampleFunc() = 0;
};
```

Applying the `com` attribute to an interface makes it a COM interface and imposes COM-specific restrictions. These are that it must have an IID (interface ID, ie a 128-bit integer GUID), it must use a COM calling convention (ie `__stdcall`), and any inheritance must be from another COM interface.

For example:

```
[ com, uuid("...") ]
interface IExampleInterface : IUnknown {
    HRESULT ExampleFunc();
};
```

becomes equivalent to:

```
struct __declspec(uuid("..."))
IExampleInterface : IUnknown {
    virtual HRESULT __stdcall ExampleFunc() = 0;
};
```

Note that a COM interface defaults to a 'custom' interface. For a dual interface, the `dual` attribute must be used:

```
[ com, uuid("..."), dual ]
```

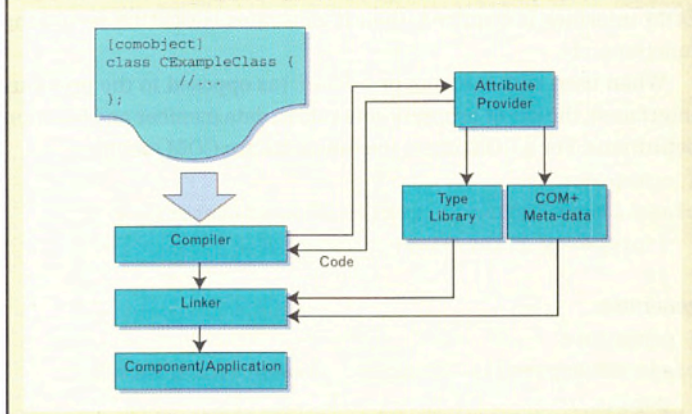
If no IID is specified, the Attribute Provider will generate one.

The super keyword

For the sake of completeness, we should cover the new keyword `super`. Microsoft foresaw a problem with the introduction of attributes: when a class is changed by the use of attributes, the user may not always know the exact base class involved in an overridden function call. The `super` keyword instructs the compiler simply to call the best match via the usual C++ overload resolution process.

The Attribute Provider

As can be seen from the schematic, the Attribute Provider is considered a separate entity to the compiler. Theoretically, there is no reason why the processing of attributes could not be incorporated within the compiler. It is, essentially, a form of preprocessing. However, the view taken was that the compiler developers are not COM specialists, and further complexity should not be devolved down to the compiler: the ATL team has implemented the Attribute Provider separately.



```
[ some_attribute ]
class CExampleClass :
    public CExampleBase< CExampleClass > {
    void ExampleFunc() {
        // previously: ??::ExampleFunc();
        // now: CExampleBase<CExampleClass>::
        //       ExampleFunc();
        super::ExampleFunc();
    }
};
```

Properties

Finally, there are properties. These are implemented using attributes and can be thought of as 'virtual' data members. They can be used to generate default get and put methods. For example, for a non-COM interface:

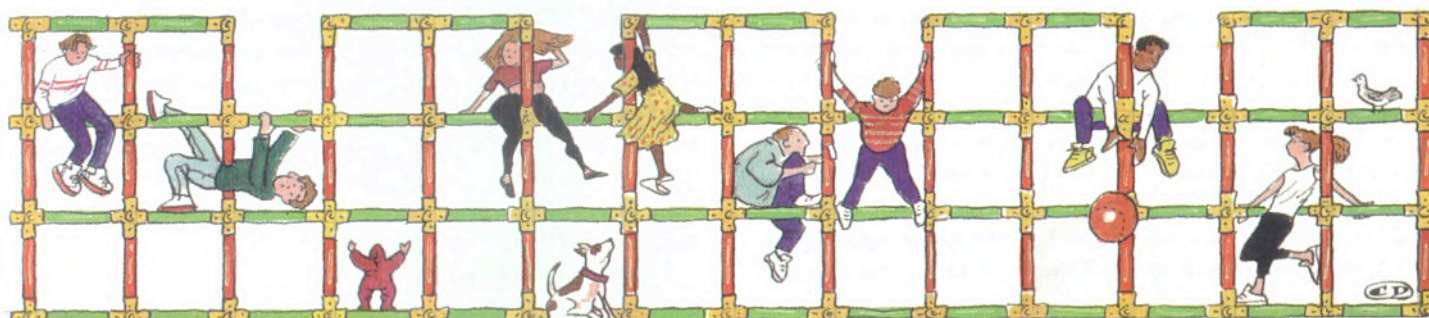
```
interface IExampleInterface {
    [ property ] int Size;
};
```

generates:

```
interface IExampleInterface {
    const int & get_Size() const;
    void put_size( const int & );
};
```

Alternatively, for a COM interface:

```
[ com ]
```



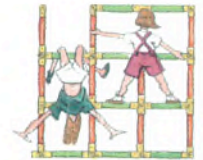

```
interface IExampleInterface {
    [ property ] int Size;
};
generates:
[ com ]
interface IExampleInterface {
    HRESULT get_Size( [ out, retval ] int * );
    HRESULT put_Size( [ in ] int );
};
```

Simply, the Attribute Provider knows the attributes involved: if a COM interface is required, then it generates HRESULT-returning functions, etc.

When used with a class or struct (as opposed to the previous interfaces), the use of property generates a data member and function definitions. For a COM class, the functions are COM specific:

```
[ comobject ]
class CExampleClass : public IExampleInterface {
    [ property ] int Size;
};
generates:
[ comobject ]
class CExampleClass : public IExampleInterface {
public:
    HRESULT get_Size( int *pval ) {
        if ( pval == 0 )
            return E_POINTER;
        *pval = __Size;
        return S_OK;
    }
    HRESULT put_Size( int val )
```

```
        __Size = val;
        return S_OK;
    }
private:
    int __Size;
};
```



It is possible for developers to override the default behaviour. For example, the convention [property(put=0)] would lead to the omission of a 'put' method: Size would become a read-only property.

Caveat emptor

It can be seen that the syntax for attributes has been based upon IDL (Interface Definition Language). But what language syntax has been broken to accommodate the changes? Ansi C++ would allow a parenthesis around a declarator:

```
void ExampleFunc( int ([]) );
```

However, apparently everything else is unchanged, and Microsoft reports that it hasn't seen a single C++ language test failure: it can build Word, Excel, and Windows NT.

The *readme* file for the *VC++ 6.0 Technology Preview for COM+* makes clear the still-evolving nature of the situation: 'This technology preview is pre-Alpha and provides a preliminary look at new technologies. Final versions of these tools may vary. Microsoft has not thoroughly tested this preview and does not provide technical support for this version. All attribute names are subject to change prior to final release.'

The object of the exercise for Microsoft is to flag its intentions with these changes. It wants developers to kick the features about, and provide feedback. Ideally, this means that anyone who is interested (be they an existing registered user) should be able to get their hands on the Technology Preview CD.

Further comments

Feedback

Microsoft has asked for feedback on these developments. I would chip in a few specific points.

First, as has previously been the case with type casts, it is good practice to make the operation explicit. The point has been made before about the difficulty of searching for the old style casts with the number of matching parentheses in C++ code. With the prevalence of array subscripting, searching for angle-bracketed attributes could represent a similar trap. It will be a common quest to identify all attributes used within a body of code. Why not use a more explicit syntax, eg `__attribute()`? These meta-codes or 'preprocessor additions' should be as distinguishable as possible. Ideally, the IDE will support separate colour coding.

Second, there is the question of the quality of the code that is auto-generated. This is an obvious point, but the example given at the conference of generating `printf` statements from a `trace` attribute shows how easy it would be to overlook C++'s I/O system, which can operate on user-defined objects, ie streams.

Finally, there is the very important issue of versioning. How will different versions of VC++ honour the code previously generated for attributes? Can we rely on a build of attributes with one version of VC++ matching that of a subsequent version? Or will we have to 'track' the implications for changes behind the `[comobject]` attribute, for instance. This could represent a horrendous versioning problem. Of course, the code automatically generated for an attribute will be available for inspection, but even so there could be hidden dependencies. I think guarantees to developers will have to be made in this area.

A question and answer session after the talk at the VCDC provided a few additional comments. The support of user-defined attributes was one idea raised from the audience. Apparently, such support is very likely. A by-product of user-defined attributes could be the ability to adopt company wide coding standards. A particular attribute representing a particular injection of standardised code.

One delegate feared code-bloat with the use of attributes. However, the ATL team is apparently reporting smaller builds for equivalent COM functionality. Dean Rowe's explanation was that the Attribute Provider can bring a fine-tuned focus to compilation, with default baggage being more easily omitted.

Another point raised was of VB and Java adopting a similar scheme of attributes. Again, this is anticipated, but VC++ was the primary test-bed, and any cross-language implications would be far down the line...

The logic of programming

On the whole, I find the changes represent an interesting attempt to aid the developer. Prolog programmers may smile at these developments. A more *declarative* approach to the problem domain? Whatever next – formal testing with Visual Z? But seriously, complexity must be managed, and I believe that the final responsibility for managing the growing complexity faced by Windows developers does lie with Microsoft. However wary purists may be of automatic code generation, professional developers do need all the help that they can get (especially in the world of COM).

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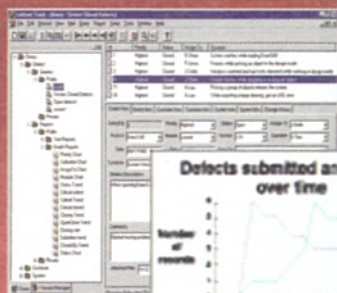


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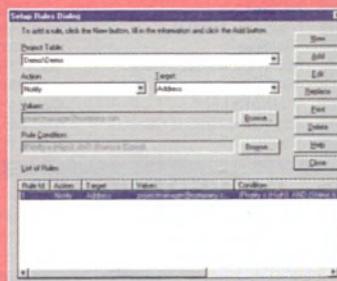
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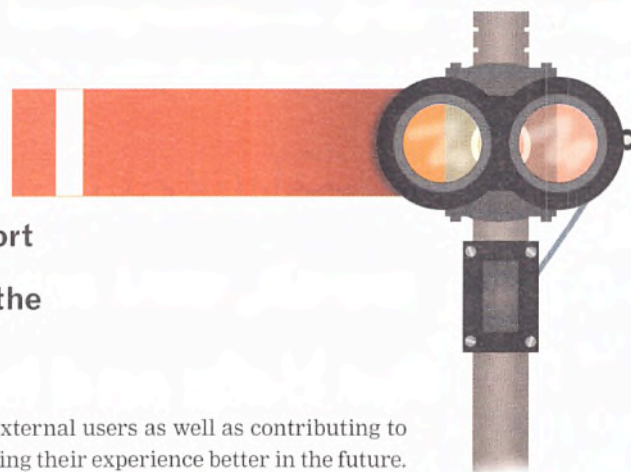
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Michael Deigman- Windows NT, October 1998



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Web central



What does it mean in practice for a website to support e-commerce? Jim Parsons provides an insight into the infrastructure of a Windows DNA-based system.

Succeeding on the Web today involves far more than just throwing up a few pages showing JPEG images of your head office and some copy from the latest product catalogue. A successful website is an application that is as essential to its users as their word processors and spreadsheets. It must deliver high quality data and services to those users while inspiring their trust, even though they may be located thousands of miles away and may have never spoken to anybody in your organisation. In short, you need to extend all of the functionality of your business systems from the desktops inside your enterprise to the desktops on every corner of the Net.

Ideally, the system must meet the needs of both external and internal users while maintaining a single set of source code. Most traditional website functionality is aimed at allowing internal users to transmit information to, or manage processes on behalf of, external users. It is helpful, when designing outward facing systems for the Web, not to think about allowing external access to internal systems. Instead, think about creating systems to meet external needs and extending them to fulfil those internal functions that would not normally be available to outside users. Internal users act as agents operating the system on behalf of people who for one reason or another cannot use the system via the Internet.

The benefits of working in this way are enormous; there is only one system to maintain, which means that any value-added services that you develop are available to both internal and external users at the same time. There are no consistency problems caused by differing internal and external processes or representations of data. And because there are no differences, the internal users are fully conversant with the systems used externally and are able to provide support

for external users as well as contributing to making their experience better in the future.

DNA architecture

To help achieve such a level of integration, this article provides an insight into our own system, which was deployed using Microsoft's Distributed interNet Architecture (DNA). This puts at our disposal a rich set of facilities for running an integrated system visible to both web-based and internal users. It comprises:

- Internet Information Server (IIS)
- Active Server Pages (ASP)
- Microsoft Transaction Server (MTS)
- Microsoft Message Queue (MSMQ)
- Component Object Model (COM)
- ActiveX Data Objects (ADO)

Using DNA we can create a fully distributed, component-based system that will scale to cope with the tens of thousands of visitors that use our site each day and still provide ample performance for our internal users. All of our systems run on Windows NT. (See Figure 1.)

Security

To achieve a secure implementation of an integrated system it is safer to run with at least one public server outside the firewall to be accessed by web users and one private server inside the firewall for internal users. This configuration allows the code that drives sensitive functions such as payment processing to be completely omitted from the public server, thus giving no opportunity for a security breach. Code can also be written that is sensitive to where it is being

```

Part 1 - Posting the message
Dim objMSMQQueueInfo As New MSMQQueueInfo
Dim objQueue As MSMQQueue
Dim objMessage As New MSMQMessage
objMSMQQueueInfo.PathName = "Server\LowPriTasks"
Set objQueue = objMSMQQueueInfo.Open(MQ_SEND_ACCESS,
    MQ_DENY_NONE)
If objQueue.IsOpen Then
    objMessage.Label = "OrderFinalise"
    objMessage.Body = "MTSLib.clsMTSInvoice-CREATE-123"
    objMessage.Delivery = MQMSG_DELIVERY_RECOVERABLE
    objMessage.Ack = MQMSG_ACKNOWLEDGMENT_NONE
    objMessage.Send objQueue
    objQueue.Close
End If

Part2 - The Queue Listener
Private queMSMQ As MSMQQueue
Private WithEvents evtMSMQ As MSMQEvent

Private Sub Form_Load()
    Dim infoMSMQ As New MSMQQueueInfo
    infoMSMQ.Label = "LowPriTasks"
    infoMSMQ.PathName = "." + infoMSMQ.Label
    Set queMSMQ = infoMSMQ.Open(MQ_RECEIVE_ACCESS,
        MQ_DENY_RECEIVE_SHARE)
    Set evtMSMQ = New MSMQEvent

    queMSMQ.EnableNotification evtMSMQ
End Sub

Private Sub evtMSMQ_Arrived(ByVal queQueue As Object, ByVal
    lCursor As Long)
    Dim msgMSMQ As MSMQMessage
    Dim queLocal As MSMQQueue
    Dim strProgID As String
    Dim strMethod As String
    Dim strData As String
    Dim objCall As Object

    Set queLocal = queQueue
    Set msgMSMQ = queLocal.Receive
    ExtractElements msgMSMQ.Body, strProgID, strMethod, strData
    Set objCall = CreateObject(strProgID)
    ObjCall.RunAsynch strMethod, strData
    Set objCall = Nothing
    queLocal.EnableNotification evtMSMQ
End Sub

Part 3 - The Asynchronous Component
Public Sub RunAsynch(Method As String, Context As String)
    Select Case Method
        Case "INVOICE"
            Call CreateInvoice(Context)
    End Select
End Sub

```

Listing 1—The use of MSMQ to achieve asynchronous instantiation of components.

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run in order to make decisions about what functions to enable. Each server can access the common business rules server so that only ASPs and minor components need to be deployed on the web servers. Further security can be achieved by tailoring the security parameters of components containing sensitive functionality so that they are inaccessible from the public servers.

Browser-based interfaces

A web-based system must provide an HTML, browser-based interface for web users and so, to meet the integration goals set out above, the same interface is deployed internally. This yields benefits in the form of improved manageability and reduced installation time as the system is installed centrally on servers rather than desktops. This is particularly beneficial for organisations with far-flung offices and teleworkers that, being browser-based, enjoy significantly reduced set up and maintenance costs. Furthermore, running only a web browser does not stretch the desktop CPU power requirement.

In our implementation of this architecture, the HTML user interface is created by running ASP scripts on the web server. Preferably, this is all that ASPs are used for because they very quickly degenerate into spaghetti if they are used to encapsulate business logic. ASPs were designed to use COM components and this is where the business logic is best kept in order to reap reuse and performance benefits. An example of this would be the requirement for a user to log in to a website before being allowed to access sensitive functionality. A web page allows entry of username and password information that is submitted to the web server by clicking a link or button. The server script runs a login component to compare the password supplied against the corresponding value held on the database. The script then builds the output page using the results of the transaction. Many ASPs could use this component, each giving the operation a totally different appearance.

Should you wish to maintain a more traditional desktop client for internal users then it's easy to integrate it with the components that are created for a web-integrated system. This is because components

coming from a server-centric environment completely encapsulate the required functionality in a single call by the client. A commercial website, for example, will offer its users a number of options that represent available services. A link or button will drive each option on the page, which in turn will drive one or more transactional components on the server. These components provide a complete service such as running a query and then returning the results to the client for display.

The end result of component-based development for the Web is a set of high-level or 'coarse-grained' components that define the services visible to users. These coarse-grained components will in turn rely upon medium and fine-grained components that perform specific tasks for many clients. A successful component implementation will often lead to a hierarchical structure similar to that shown in Figure 2.

In general, the coarse-grained components will be custom built as they reflect the individual nuances of your data structures and process. Medium and fine-grained components are increasingly likely to be single-focus components that may be used by several different coarse-grained components within your system. They might be bought 'off the shelf' from a third party (such as the SMTP protocol wrapper and address matching components) or drawn from a central repository of internally developed components.

Performance and MSMQ

In an integrated web system such as this, performance is always a major issue and there are many ways to ensure that an application performs well through correct database implementation, adequate hardware investment, careful resource usage, and disciplined coding. There can however be times when the sheer number of tasks to be performed places a more stringent limit on transaction duration. For example, look at the steps involved in a typical e-commerce order-taking scenario:

1. Create the order in the order database.
2. Check that there is sufficient stock available.

```
Private mlngCustomerNo As Long
Private mstrName As String
Private mstrLine1 As String
Private mstrLine2 As String
Private mstrCity As String
Private mstrCounty As String
Private mstrPostCode As String
Private mstrEmail As String

Public Property Get CustomerNo() As Long
    CustomerNo = mlngCustomerNo
End Property

Public Property Let CustomerNo(vData As Long)
    mlngCustomerNo = vData
End Property

Public Property Get Name() As String
    Name = mstrName
End Property
Public Property Let Name(vData As String)
    mstrName = vData
End Property

Public Property Get Line1() As String
    Line1 = mstrLine1
End Property

Public Property Let Line1(vData As String)
    mstrLine1 = vData
End Property

REM Cut for space, see EXE OnLine for the full version...

Public Property Get Email() As String
    Email = mstrEmail
End Property

Public Property Let Email(vData As String)
    mstrEmail = vData

End Property

Public Property Get Contents() As Variant
    Dim objPropBag As New PropertyBag
    WriteProperties objPropBag
    Contents = objPropBag.Contents
    Set objPropBag = Nothing
End Property

Public Property Let Contents(ByVal vData As Variant)
    Dim objPropBag As New PropertyBag
    Dim byteArr() As Byte
    byteArr = vData
    objPropBag.Contents = byteArr()
    ReadProperties objPropBag
    Set objPropBag = Nothing
End Property

Private Sub ReadProperties(PropBag As PropertyBag)
    mlngCustomerNo = PropBag.ReadProperty("CustomerNo", 0)
    mstrName = PropBag.ReadProperty("Name", "")
    mstrLine1 = PropBag.ReadProperty("Line1", "")
    mstrLine2 = PropBag.ReadProperty("Line2", "")
    mstrCity = PropBag.ReadProperty("City", "")
    mstrCounty = PropBag.ReadProperty("County", "")
    mstrPostCode = PropBag.ReadProperty("PostCode", "")
    mstrEmail = PropBag.ReadProperty("Email", "")
End Sub

Private Sub WriteProperties(PropBag As PropertyBag)
    PropBag.WriteProperty "CustomerNo", mlngCustomerNo, 0
    PropBag.WriteProperty "Name", mstrName, ""
    PropBag.WriteProperty "Line1", mstrLine1, ""
    PropBag.WriteProperty "Line2", mstrLine2, ""
    PropBag.WriteProperty "City", mstrCity, ""
    PropBag.WriteProperty "County", mstrCounty, ""
    PropBag.WriteProperty "PostCode", mstrPostCode, ""
    PropBag.WriteProperty "Email", mstrEmail, ""
End Sub
```

Listing 2 – A data object to represent the properties of the customer.

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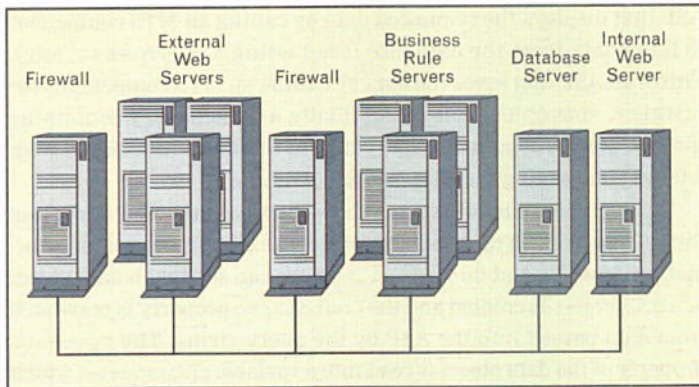


Figure 1 – A single web server provides the user interface for internal users while on the Internet side of the firewall, where load is less predictable, there is a cluster of web servers than can scale to 32 machines. This allows the meeting of any demands as well as providing total resilience for the service. All of the web servers access a central group of business component servers that sit behind the firewall, and a SQL Server database provides data persistence.

3. *Allocate the stock to the order.*
4. *Process the credit card authorisation.*
5. *Trigger re-order notification if re-order levels have been exceeded.*
6. *Produce a receipt.*
7. *Produce shipping documentation.*
8. *Send email notification of order status.*

With credit card validation alone taking several seconds to complete it is obvious that the user will be subject to a considerable delay while all of these steps are carried out. If we look at what actually needs to be done to let the customer know that their order can be accepted, then our list looks more like this:

1. *Create the order in the order database.*
2. *Check that there is sufficient stock available.*
3. *Allocate the stock to the order.*
4. *Process the credit card authorisation.*

The rest of the tasks can happen after the customer has been notified that all is well: to give our customer the fastest possible response we need to remove half of the tasks from the transaction. The issue now is how to complete those tasks that have been removed! We could use batch jobs, but they are very inflexible and may lead to further delays in shipping or re-ordering low stock items. We could poll the database every so often to find half-processed orders, but this is notoriously inefficient as it places unnecessary strain on the database and processors.

The best answer is to use Microsoft Message Queue, which allows asynchronous messages to be sent between processes on different machines with guaranteed delivery. In simple terms this means that a message containing a request can be sent and the sender can continue without waiting for the request to complete. In this example, MSMQ could be used to activate, asynchronously, components that will carry out the remainder of the work offline from the main process. This is more flexible than a batch job because the work can be carried out fairly soon after the transaction is processed, and it's more efficient than a polling mechanism because work only gets done when it's required. What's more, because MSMQ is distributed it allows you to queue non-essential tasks to other servers where they won't hinder the essential tasks on your mainline servers.

To drive MSMQ, your main transaction needs to post one or more messages to predetermined queues. Once MSMQ has acknowledged that the message was received, then the main transaction can proceed without further concern. A listener process is required on the other end of

the queue to receive the messages sent by the transaction and take appropriate action.

In order for a general purpose queue-listener to activate a variety of components a basic protocol is required so that the queue-listener can decide what action to take and in what context. We have found that a simple solution is to pass a text string on the queue that contains three elements. First, it contains the 'Program ID' of the component to be instantiated. Because the tasks are low priority, it's perfectly acceptable to use `CREATEOBJECT(strProgID)` to fire up the task. Second, there is the name of the method to be activated. And third, some kind of context information that can be passed to the method so that it will know which entity to operate on.

Each component should have a method with a standard name that the listener can call, and this method should accept as parameters the name of the final method to be run and the context data. The standard method can then call a function of the component according to the parameter data.

Listing 1 illustrates a simplified example of the use of MSMQ to achieve asynchronous instantiation of components. There are three parts to this example. First, the fragment shows the code necessary to send the message from the main transaction. Note the message body, which uses a delimited string to tell the listener which component, method, and data to call. Second, it illustrates how the queue-listener program receives the message and uses the first part of the message body to create an instance of the component. Once the component has been instantiated a method is called and the other two parts of the message body are passed as parameters to the method. And third, this fragment is the standard method of the called component. It uses the first parameter to decide which function to call, and passes the second parameter as data.

Scalability and MTS

Scalability is another big factor in the performance of an integrated system, and with this in mind, we have chosen to deploy our COM components within Microsoft Transaction Server (MTS). It provides a context on the business-rules server to enable 'in-process' components to be run on a remote machine. This is far more scalable and robust than instantiating 'out-of-process' components on the remote business-rules server for each client request. MTS can also pool components and database connections, which further improves scalability.

A side effect of object pooling is that components inside MTS are stateless. That is, properties cannot be reliably used to store informa-

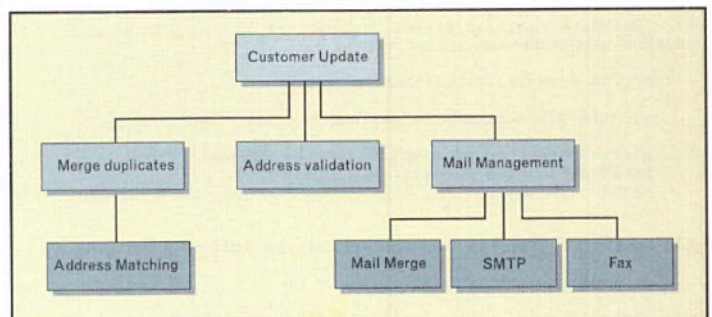


Figure 2 – A coarse-grained component represents the service 'Customer Update'. This contains specific steps such as saving to the database and recording the time of the transaction. It also uses components in the medium-grained level to perform merging of duplicated addresses, validation, and mail management. Similarly, components in the medium-grained level use fine-grained components to perform specific tasks such as address matching and protocol wrapping.

tion about an object. Using the components' method parameter list for exchanging data with the client usually circumvents this. However, this can lead to maintenance and readability problems because components requiring a lot of data items may have a parameter list that runs on for many lines. As a compromise solution, we decided to use data objects to represent entities (such as customers and suppliers) that can be created outside MTS. These are instantiated as 'in-process' components in the context of the caller. They have virtually no code inside them and are simply a set of data properties to represent the required object. Each of these objects has a method to copy all property values into a property bag that can be passed around in a single variable. The same method works in reverse, to populate the properties of an object from a property bag. This system enables complex objects to be exchanged between MTS components and ASPs in a consistent and straightforward manner. Although there is a small instantiation overhead in creating such a DLL without using MTS, the ease of use and maintenance attained far outweighs this downside.

An example application

As an example, a simple application is shown that allows web users to add and maintain their address data in a database. There are four parts to the application. First, a data object that runs on web servers and business-rules servers to represent the properties of the customer (see Listing 2, `DATLib.clsDATCustomer.CLS`). Second, an

ASP that displays the requested data by calling an MTS component to fetch data from the database (see Listing 3, `CUSTOMER1.ASP`). Third, an ASP that saves the data by calling an MTS component (see Listing 4, `CUSTOMER2.ASP`). And finally, a class library containing the two MTS components that perform the tasks associated with fetching and saving the data (see `EXE OnLine`).

This very simplistic example shows how both the ASP client and the MTS server use the local data object to exchange customer information. If we look at `Customer1.ASP`, we can see that a data object `odatCustomer` is created and the `CustomerNo` property is populated from data passed into the ASP by the query string. The `Contents` property of the data object is read into a variable `pbCustomer`, which can now be passed into the `MTSCustomer` component as a parameter to the `Retrieve` method. Following completion of this method, the property bag is passed back into the `Contents` property of the data object, which causes the remaining properties of the data object to be populated for use on the output web page.

Once data has been modified, the user will press the Update button, which will cause the form to be submitted to the server as part of a request for a new page. The `<FORM ACTION>` tag of the initial page specifies the name of the new page, in this case `Customer2.ASP`. Listing 4 shows how `Customer2.ASP` takes care of updating the data passed in from the initial form. Once again, it creates a data object, and the values from the initial form are used to populate its properties. The `Con-`

```
<!-- Fetch data if existing record requested -->
<%
If Request.QueryString("CUSTNO") <> 0 Then
    Set odatCustomer =
        CreateObject("DATLib.clsDATCustomer")
    Set omtsCustomer =
        CreateObject("MTSLib.clsMTSCustomer")
    odatCustomer.CustomerNo =
        CInt(Request.QueryString("CUSTNO"))
    pbCustomer = odatCustomer.Contents
    odatCustomer.Contents =
        omtsCustomer.Retrieve(pbCustomer)

    strName = odatCustomer.Name
    strLine1 = odatCustomer.Line1
    strLine2 = odatCustomer.Line2
    strCity = odatCustomer.City
    strCounty = odatCustomer.County
    strPostCode = odatCustomer.PostCode
    strEmail = odatCustomer.Email
    Session("CUSTNO") = odatCustomer.CustomerNo
    Set odatCustomer = Nothing
Else
    Session("CUSTNO") = 0
End If
%>
<HTML>
<HEAD>
<TITLE> Sample customer database application</TITLE>
</HEAD>

<!-- Validate required fields present -->
<SCRIPT LANGUAGE="JavaScript"><!--

function Form_Validator(theForm)
{
    if (theForm.custname.value.length < 1)
    {
        alert("Please enter a value for the \"Name\" field.");
        theForm.custname.focus();
        return (false);
    }

    REM Cut for space, see EXE OnLine for the full version...

    if (theForm.email.value.length < 1)
    {
        alert("Please enter a value in the \"Email\" field.");
        theForm.email.focus();
        return (false);
    }

    return (true);
}
//-->
</SCRIPT>

<!-- Specify what to do on submit -->
<FORM Action="Customer2.asp" Method=post onsubmit=
    "return Form_Validator(this)">

<!-- Display the form -->
<H1>Customer data sample application</H1>

<TABLE align=center border=0 cellPadding=1 cellSpacing=1
width=100%>

<!-- Name -->
<TR>
    <TD align=middle noWrap width=5%
        STYLE="COLOR: red"><BIG>*</BIG></TD>
    <TD align=left noWrap width=15%>Name</TD>
    <TD align=left noWrap width=80%><INPUT id=txt1
        name="custname" size=30 maxlength=30
        value="<%= strName %>"></TD>
</TR>

<!-- Address Line 1 -->
<TR>
    <TD align=middle noWrap width=5%
        STYLE="COLOR: red"><BIG>*</BIG></TD>
    <TD align=left noWrap width=15%>Address</TD>
    <TD align=left noWrap width=80%><INPUT id=txt1
        name="line1" size=30 maxlength=30
        value="<%= strLine1 %>"></TD>
</TR>

REM Cut for space, see EXE OnLine for the full version...

<!-- Email Address -->
<TR>
    <TD align=middle noWrap width=5%
        STYLE="COLOR: red"><BIG>*</BIG></TD>
    <TD align=left noWrap width=15%>Email</TD>
    <TD align=left noWrap width=80%><INPUT id=txt1
        name="email" size=30 maxlength=30
        value="<%= strEmail %>"></TD>
</TR>
</TABLE>
<BR>

<!-- Submit button -->
<TABLE align=center border=0 cellPadding=1 cellSpacing=1
width=100%>
<TR>
    <TD align=middle noWrap width=20%
        STYLE="COLOR: red">&nbsp;</TD>
    <TD align=left noWrap width=80%><INPUT type="submit"
        value="Submit" id=submit1 ></TD>
</TR>
</TABLE>
</FORM>
</BODY>
</HTML>
```

Listing 3—An ASP that displays requested data by calling an MTS component.

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tents property of the data object is assigned to a variable that is passed to the MTS component as the parameter of the Save method.

Listing 3 illustrates the way in which the MTS components receive property bags from the client and use them to complete a request. With Retrieve, the property bag is passed in containing the lookup key required to retrieve a customer record. A query is run and the resulting recordset is used to populate the properties of a data object. The Contents property of this data object is then passed back to the client to be displayed. With Save, a property bag is received contain-

ing the data to be saved. This is fed into the Contents property of a data object that can then be used to populate and save a recordset.



A better service on the Web

Although longwinded in the context of this example, the architecture depicted above provides structure and consistency when working with a large number of ASPs and database tables. Moving the business logic out of ASPs and into components will result in improved reusability, better security, easier management, less complex maintenance, and faster performance.

If you adopt this architecture, there are a number of ways to increase the benefits. The data objects in the example given here are capable of persisting themselves by using property bags, but it would be very straightforward to do exactly the same thing with ADO recordsets to create a simple database wrapper. The same idea works for translation to and from XML, simplifying data exchange in cross platform or text-only environments.

As Internet use continues to expand and e-commerce gains ever-wider acceptance, the pressure to offer customers and partners a better service on the Web will grow. Fortunately, the tools and technologies available today will make this a far easier evolution to accommodate than was the case with earlier client/server models. ■

Jim Parsons is Chief Technology Officer at ComponentSource, and can be contacted at jimp@componentsource.com. This article is based on the

E X E system implemented at ComponentSource. The listing
ONLINE code is available at ftp.exe.co.uk/pub/exestuff/9903_web.

```
<%
Set odatCustomer = CreateObject("DATLib.clsDATCustomer")

odatCustomer.CustomerNo = Session("CUSTNO")
odatCustomer.Name = Request.Form("custname")
odatCustomer.Line1 = Request.Form("line1")
odatCustomer.Line2 = Request.Form("line2")
odatCustomer.City = Request.Form("city")
odatCustomer.County = Request.Form("county")
odatCustomer.PostCode = Request.Form("postcode")
odatCustomer.Email = Request.Form("email")

Set omtsCustomer = CreateObject("MTSLib.clsMTSCustomer")
omtsCustomer.Save(odatCustomer.Contents)

set omtsCustomer = Nothing
Set odatCustomer = Nothing
%>
<HTML>
<HEAD>
<TITLE> Sample customer database application</TITLE>
</HEAD>
<BODY>

<H1> Request accepted</H1>
</BODY>
</HTML>
```

Listing 4 – An ASP that saves data by calling an MTS component.

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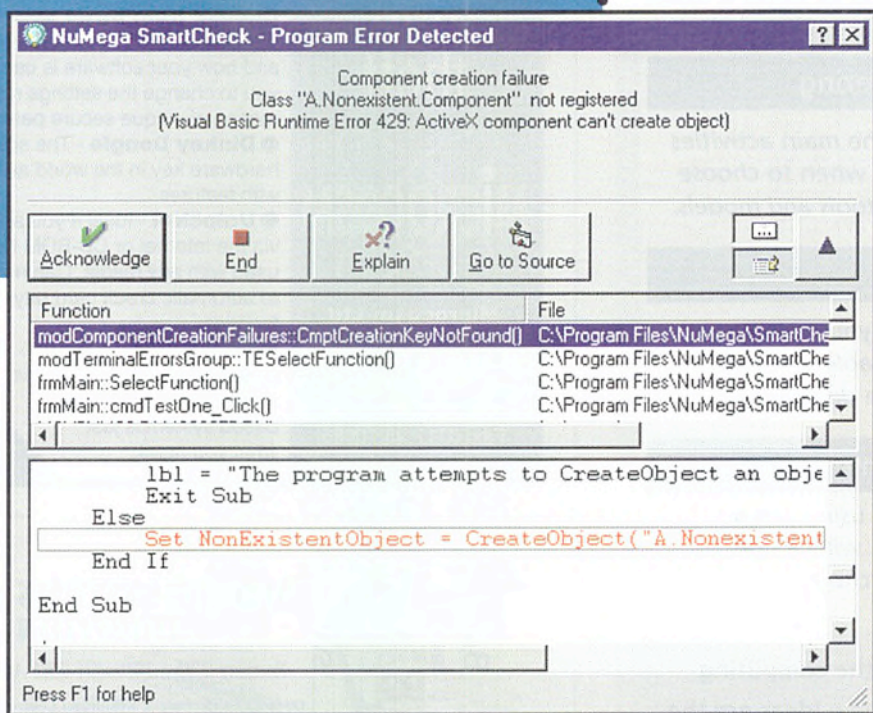
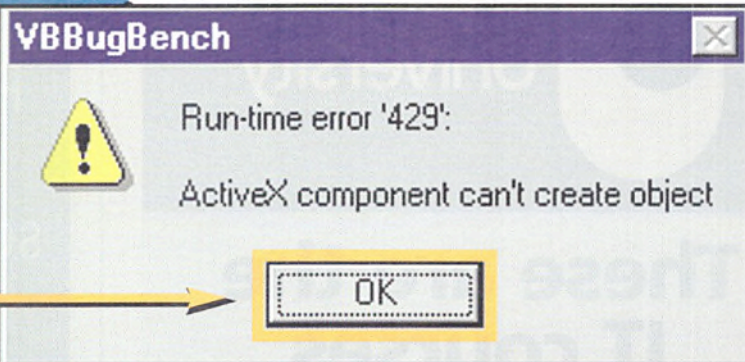
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Serving up SQL

With the availability of SQL database servers and scripting support for data access, Peter Collinson gets relational for a wine merchant's web project.

Daren Mason

In September of last year I reviewed MSQL (*MSQL – a database for webmasters*), which I've been using in several web projects in the last year or so. Actually, the use of relational databases was something I'd managed to miss over the years. I suppose that I had vaguely heard about SQL (Structured Query Language), and had seen some syntax, but I'd never really got to grips with it. Generally, if I wanted a database, using the term loosely, I'd hack something together from the tools at hand, which usually meant Unix text files possibly indexed by Ken Thompson's DBM library (see *Bucket overflow*, EXE, February 1998). Mostly, this solution works well. You have the source, all bugs are your bugs, and so all bugs are theoretically fixable.

Databases like Oracle, Sybase, or Informix have always seemed to be the tool used in business computing, for managing other people's desks and other people's business activity. They seemed to be closed systems of little interest to me. A couple of things have changed this.

First, there is the emergence of freely available (or almost freely available) SQL database servers. I've already mentioned MSQL from Australia. It requires a licence fee of \$250 for commercial use and is free for academics. The other is MySQL, which emanates from Sweden. MySQL is free on Unix platforms, but costs \$200 after a 30-day trial for Microsoft platforms. If you are deploying it in a commercial application on a Unix platform, the company would like you to pay for support. Both systems come with source, so there's a good chance that anything that is broken can be fixed, or at least you can read the code and find out why that odd behaviour is happening. I haven't looked at MySQL, although the folklore that I have picked up makes very encouraging noises about it. What follows leans heavily on my MSQL experience.

The second change is that you can now access these systems through scripting languages. There is a standard Perl module, called

DB, that provides the Perl programmer with a method of querying database servers. The actual mechanism used to access your specific database is subclassed from the DB library, so the API is constant(ish). The DB module provides basic hooks for MSQL and MySQL, along with many other systems. I suppose that MSQL was originally attractive to me because it comes with its own scripting language, Lite, which is somewhat C-like, and integrates very well with your web server.

In both of Perl and Lite, you create a string that is a SQL query and send that string to the SQL server via a function call. The server performs the necessary task and returns a reply to your script. If the task results in retrieving a table, then the table is returned as a chunk, and you generally process it row-by-row. Each column in a row is placed into an array element. Because you have access to a reasonably complex scripting language, with included processing primitives, it's not so necessary for the server to be able to do the full range of the complex tasks that SQL permits.

Getting started

Well, the first thing that you will want to do is create a table to hold the data that you are going to store. This is done with the `CREATE` clause. You'll say something like:

```
CREATE TABLE size (
  id      INT,
  name    CHAR(16),
  abbrev  CHAR(1),
  litre   REAL
);
```

This creates a table with four entries intended to store wine bottle sizes and their volume in litres. Incidentally, the examples used in this

Further information

Looking up SQL on the Web is a loss. Search engines supply a flood of links to pages from companies who are prepared to run a course to teach you SQL, but the pages contain no real information on SQL itself. I've found only one source of basic SQL syntax and semantics on the net, so you can teach yourself, it's by James Hoffman at <http://w3.one.net/~jhoffman/sqltut.htm>. He seems to be maintaining it, judging by the 1999 date. The contents have been taken by a training company called Willcam, and prettified a little: <http://willcam.com/sql/default.htm>, although I've not checked on which version it represents of James Hoffman's pages.

The home page for MySQL can be found on <http://www.mysql.com>, and the official home for MSQL is <http://www.Hughes.com.au>.

article are all taken from a real database that I am using to support a local wine merchant on the Web. I need the size of the bottle in litres because the shop sells wine in cases. A case is not just 12 bottles any more; it's defined to be 9 litres. I've included a semicolon at the end of each statement, as this appears in some of the example pages I've seen. It doesn't seem to be a requirement for MSQL.

You can see from the example that entries in tables are typed, and actually the range of available types varies considerably from implementation to implementation. Most systems that I've looked at seem to supply at least `INT` and `CHAR`. Character strings are fixed in length, and this can be a pain. Implementations often offer variable length text fields, with the drawback that they are not indexable.

Variables of type `REAL` are actually an MSQL-ism. Other types can be used to contain dates and times (allowing comparison), and fixed-point decimal numbers (which are useful for fields containing money). I tend to store money in pence, as it makes for easier VAT computation. Some systems have Boolean values as a primary type. When this is not available, it's conventional to use a `CHAR(1)` storing `Y` or `N`.

I generally always number the rows in my tables, providing a unique numeric key even if I don't initially plan to use it. I often find later that I am constructing links in HTML and can use:

```
http://www.....page.msql?idnumber
```

with impunity, giving me a link to a page whose key is simple to find. I don't have to translate the key into the standard scrambled form where non-alpha characters are translated to a percent followed by two hex digits.

In general, you can give a table entry a further attribute of being 'not null', and have the database system complain when you attempt to create a table entry with an empty value in the specific field. Actually, I tend not to do this when writing scripts. I think that it's better to provide defensive checks in the code rather than have the database bomb out on you.

Once you have created a table, you can then create some indexes into the table that are used behind your back to give fast access. I am likely to search the table above using the `id` field, so will say:

```
CREATE UNIQUE ix1 ON size (
    id
);
```

Notice that I've told the system that this index should contain unique values, and now the system will barf when I attempt to create an entry with a duplicate index value. This is actually a useful check.

Indexes can be complex, consisting of several fields. If you have a last and first name in a record and plan to search or sort on these values, you could say:

```
CREATE ix2 ON table (
    lastname,
    firstname
);
```

which will speed up a common action. Incidentally, some systems don't use the indexes and will ignore the statements.

Having created the table, we can now insert some values:

```
INSERT INTO size VALUES (1, 'Half-Bottle', 'H', 0.375);
INSERT INTO size VALUES (2, 'Bottle', 'B', 0.75);
INSERT INTO size VALUES (3, 'Magnum', 'M', 1.5);
```

MSQL also allows you to say:

```
INSERT INTO size (id, name, abbrev, litre)
(1, 'Half-Bottle', 'H', 0.375);
```

which is not much help in this example, but allows you to load a table with incomplete information with not much grief. Note that strings

are always quoted and numeric values are not. MSQL uses a backslash to act as an escape character, enabling you to enter a quote or a backslash character into a text string. Quoting characters and conventions seem to be a moveable feast, being different in different implementations.

Searching

Once you have your tables established, you can start searching. To give you some realistic examples, I need to define a more complex table used to store each type of wine:

```
CREATE TABLE wine (
    id INT,
    producer CHAR(64),
    colour CHAR(1),
    vintage INT,
    size INT,
    price INT,
    bottles INT,
    name CHAR(64),
    notes TEXT(32),
    tasting TEXT(64)
);
```

Each wine entry comprises: a numeric id; the name of the producer; its colour (the shop never buys Rosé; so `R` and `W` is sufficient); its year of manufacture; an index into the size table; its price in pence (I could have used the `MONEY` type); how many bottles the shop has in stock; the name of the wine in a searchable text field; and two fields with associated text information.

I can now search the database by using the `SELECT` statement:

```
SELECT * FROM wine
WHERE price = 810;
```

This finds all the wines that are priced at £8.10. If there are none, nothing will be returned, otherwise the script will see a bunch of records and can step through them. The contents of the records are determined by the text after the `SELECT` keyword. By using an asterisk, I am saying 'return all the data from the table in the order in which it was specified'. I can pick specific fields:



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```
SELECT producer,name FROM wine
WHERE price < 1600;
```

This returns the producer and the name of the wine where the price is less than £16.00 per bottle. I might want to sort the list that is generated:

```
SELECT producer,name,vintage FROM wine
WHERE price <= 1600 AND colour = 'R'
ORDER BY producer,name;
```

which gives me the producer, the name, and the vintage for all the red wines priced less than £16.00.

SQL has a fuzzy match capability for strings:

```
SELECT * from wine
WHERE name LIKE 'Morgon%';
```

finds all the wines named for the hamlet of Morgon in the Beaujolais region. The percent character is used to mean 'any string here', and can be placed anywhere in the match string. You can use `NOT LIKE` to find the inverse of the selection. MySQL also has `CLIKE`, which matches in a case-independent manner. This is the match string I tend to use. It also supports regular expressions and Soundex matching, though I've not used these features, yet.

Incidentally, when the table contains several fields, processing results can become confusing in scripts. The results from the `SELECT` will be placed into an array in sequence:

```
SELECT producer, name, vintage ...
```

This will result in your `ROW` array containing the `producer` value in `ROW[0]` and the `name` in `ROW[1]` and so on. Subsequent code can quickly become unreadable. I've taken to loading static variables with the same name as the fields, so in Perl I'll write something like:

```
($producer, $name, $vintage) = @row;
```

In Lite, it's a little more complicated because the language is simpler:

```
$i = 0;
$producer = $row[$i]; $i++;
$name = $row[$i]; $i++;
$vintage = $row[$i]; $i++;
```

Using an auto-incrementing index means that changes can be made more easily when `SELECT *` is used and the database has altered.

Joining tables

I think that most people start using one table for all their data. The real power of relational databases becomes apparent when two or more tables are dynamically 'relationally joined' internally in the server, allowing information to be picked up from each table. Let's say we want to find all the white wines, and see the full name used for the size, and be supplied with the size in litres of each type of bottle. We'd say:

```
SELECT wine.producer, wine.name, wine.size, size.litre
FROM wine,size
WHERE wine.size = size.id AND wine.colour = 'W';
```

Note that we have to use the 'dot' notation to specify which field name refers to which table. Some systems don't insist on this syntax when the field names are unique across all tables. However, thinking 'I'll always use unique names' may be poor engineering, it's too easy to forget this type of requirement and break all the code in the world.

The `FROM` clause tells the database engine to construct a new table that is the combination of both tables, so each row in `wine` is combined with each row in `size`. The result could be immense, so care needs to be taken to ensure that the `WHERE` clause restricts the final table.

In the example, we will only generate table entries that match the unique `id` value by testing the `size` value in the `wine` table against the `id` in the `size` table. Actually, there is no specific reason to use a numeric ID. In general, string matching in database engines is fast and I could have dispensed with the `id` value in the `size` table using the abbreviation field as a key in the `wine` table. All of which would have made a dump of the table to be somewhat more readable. However, care does need to be taken when you are joining tables, I once managed to get my database server clogged with disk I/O by emitting an injudicious command containing a 'join'.

The result from the search above will generate a bunch of entries that are unique, but there are situations where you are likely to create duplicate entries and wish to suppress them:

```
SELECT DISTINCT size.id,size.name,
FROM wine,size
WHERE wine.size = size.id AND
wine.bottles <> 0;
```

This gives us the range of bottle types that we have in stock, with their full names. Without the `DISTINCT` we are presented with a table containing every matching entry, which can be vast. The `DISTINCT` attribute removes duplicates from the list. Incidentally, the not-equals operator is sometimes `!=` (as in the C language). Thinking about this example, here's a good case where using a meaningful key rather than an `id` number would have helped. I am still learning.

The SQL standard allows you to nest `SELECT` statements, so you can perform complex nested joins to obtain the result that you need. However, the 'M' in MySQL stands for 'Mini', and it doesn't support nested `SELECT`s.

Joining tables in this way allows you to structure your data in a sensible form, where information in the database is spread across several tables. The active wine database has `size` and `wine` tables as I have described. And there are tables for `producer` and `region` information. Combinatorial information from all of them can be obtained and used in the final product.

Data management

Well, we can create new tables, add new values into them, and search them, but what about changing the data?

The `DELETE` statement is used to remove table entries:

```
DELETE FROM wine
WHERE bottles = 0;
```

This removes all the entries in the `wine` table where there are no bottles left in stock. The standard gamut of possibilities exist for the `WHERE` clause. Beware of emitting a `DELETE` statement without a `WHERE` clause unless you really want to delete all the entries.

The `UPDATE` statement is used to change an existing row in the table:

```
UPDATE wine SET name = 'Julienas'
WHERE id = 167;
```

This changes the `name` field to the new value. Again, you need to beware of the `WHERE` conditions that you use. You can easily update more than one table entry unless you are careful. Furthermore, you'll change every table entry if you omit the `WHERE` clause, and this can be embarrassing. This is another good reason for ensuring that each row



in the table has a unique numeric key. Of course, you can change more than one value:

```
UPDATE wine SET name = 'Julienas',
  producer = 'CHATEAU BONNET'
WHERE id = 167;
```

Some systems allow you to add new fields into a table using the ALTER statement:

```
ALTER wine ADD (special CHAR(32));
```

MSQL doesn't allow this, probably because it's hard to ensure that the table update is atomic.

With MSQL, you can take a complete text dump of a database and reload it later. This means that when I want to change a table, I'll take a dump of it, edit the text file, delete the database, and rebuild it. However, this is a discontinuous event, the database disappears from view for some small time, and contains inconsistent data for some other short period. If you have a complex system, this may be the best that can be done. The moral here is that you must attempt to design enough flexibility into the database from the start.

When I wanted to change a table on a smallish live MSQL system, I created a new table with the new contents, and then changed the software to use the new table. Later I deleted the old table.

You can delete whole tables and indexes from the database using the DROP statement:

```
DROP TABLE oldwine;
```

which removes the table and all its definitions from the database. This can be drastic so care is needed. It is useful to have a DROP command. For some applications, I want to take a CSV (comma delimited) file and update an existing table, inserting some new values depending on a key, and replacing some old values where the key matches. I tend to import the CSV file into a new table, and then mess with the values. Being able to DROP these upload tables allows this type of system to be implemented.

Living with SQL

Actually, I find that the SQL syntax leaves things to be desired. The inclusion of syntactic fluff words to make 'English' sentences is very inconsistent and I live with the MSQL manual permanently open so I can work out that it's INSERT INTO, DELETE FROM, and INSERT table SET. And it seems that quoting is different on different systems, so you'll need to look hard at your manual to

determine what style of quotes you will need.

However, we are using the relational database more and more to generate searchable pages for membership lists and product catalogues. We have large portions of several distinct websites materialising from the database. The potential of using SQL via the Web should not be ignored. ■

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

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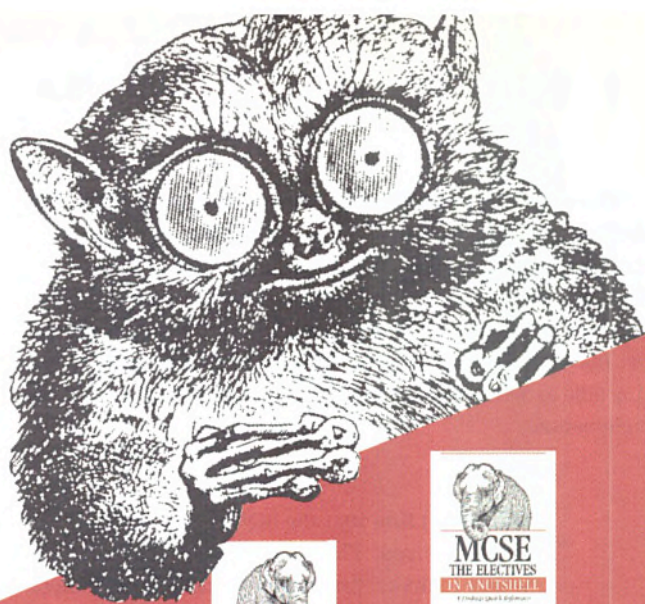
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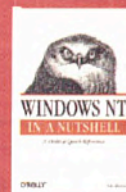
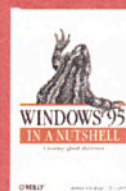
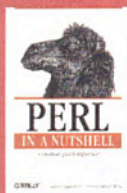
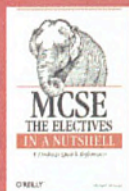
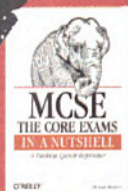
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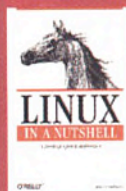
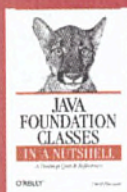
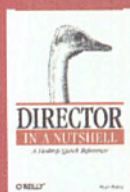
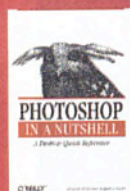
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The right direction for redirection



Francis Glassborow tackles the question of I/O redirection, and shows how you can get the power of the `iostream` library *and* the flexibility of redirection at runtime.

When I present C++ training to experienced C programmers I am frequently faced with the question: 'How do I redirect my output?' I must confess that until very recently I have not been giving very good answers to that question. Let me expand on this a little and show you that there is an excellent answer if only someone shows you where to look.

Many Unix programmers know that redirection of the standard C console streams can be done on the command line that invokes a process. In other words, you can write your program to use `printf()` and `scanf()` and then change the sink and source used by those functions at the time when you run your program. That isn't actually as useful as it sounds. If you redirect input so that it is taken from a file, about all you can do is run the program in batch mode.

However, rather more useful is that you can use `fprintf()` etc, with the first parameter selecting the source/destination. If you want to send to the screen, ensure that the first parameter identifies `stdout`. In other words in C you can use the various `fxxx()` functions and select the source and sink during the execution of the program. Of course you could do the same in C++, but the cost would be the loss of all the power of the C++ `iostream` library. The question can be refined to: 'How can we get the power of the `iostream` library and the flexibility of redirection at runtime?' Here is a poor first cut:

```
#include <iostream>
using std::cout;
std::ostream & myout = cout;
int main () {
    myout << "Message" << std::endl;
}
```

The problem with this is that it only supports redirection at compile-time. Fine if you first want to check a program and then alter it to send the output somewhere else, but not much good if you want to redirect it at runtime.

The following is marginally better:

```
#include <iostream>
std::ostream & choose();
int main () {
    std::ostream & myout = choose();
    myout << "Message" << std::endl;
}
```

You may wonder why the initialisation of `myout` is done via a function call. Try binding a reference at runtime without using this mechanism and I think you will appreciate the problem. However, do not spend too long on it because the whole idea is a blind alley based on a limited understanding of the C++ stream mechanism.

Buffer classes

Many of the better books on C++ mention the existence of a hierarchy of buffers for use by `iostream` objects, and then rapidly move on to something else on the grounds that they are intended for use by

designers of stream classes. Sadly, few if any take the time to describe how the buffer classes work with the stream classes.

In simple terms, the stream classes are responsible for providing format facilities for input/output. It may come as a surprise to learn that they are not responsible for the input/output itself. The latter is the responsibility of the buffer classes. I am not going to go into minute detail here, just enough so that you will be able to manage redirection more effectively in future.

At the root of the buffer hierarchy, you will find a template class `basic_streambuf`. You will also find a `typedef` that provides an instantiation of `basic_streambuf` for `char` and names it `streambuf`. Similarly, you will find that there is a `typedef` that provides `filebuf` as an instantiation of `basic_filebuf` for `char`. Note that a `filebuf` is a `streambuf`, but not the other way round. A `filestream` requires something that is at least a `filebuf`, so the buffer that `cout` uses by default will not do for an `ofstream` object.

All we need to know for now is that there are things called `streambufs` and that every input/output object has an associated `streambuf` of a type that can manage the input/output source/destination. There is an overloaded member function, `rdbuf()`, of the stream classes that allows us to manage the relationship between a stream and its buffer. Both versions of `rdbuf()` return a pointer to the stream buffer at the time of the call. One version also takes a pointer to a suitable buffer that will be used to replace the existing buffer. In other words, you can request to know where the buffer is, or you can provide a new one and get back the address of the old one. This is the core of redirection because we can use `rdbuf()` to swap around the buffers being used. We will have to be careful. For example, ensure that streams are not sharing buffers when they are destroyed. If they are, then the second one destroyed is going to exhibit undefined behaviour. The destructor for a stream calls the destructor for the associated buffer.

For this example, I am going to use the resources provided by `sstream`. Including this header provides you with input and output streams based on buffers that use instances of `string` rather than the arrays of `char` that the older `strstream` used. Look at the following:

```
1 #include <iostream>
2 #include <sstream>
3 using namespace std; // introduces namespace std
4 int main(){
5     ostringstream outfile;
6     streambuf * cons = cout.rdbuf(outfile.rdbuf());
7     cout << "This is not displayed yet" << endl ;
8     cout.rdbuf(cons);
9     cout << "This is displayed first" << endl;
10    cout << endl << outfile.str();
11    outfile << "And this is some more";
12    cout << endl << outfile.str();
13 }
```




There are far too many 'too clever by half' uses of the preprocessor advocated by

those who should know better.

Lines 1 and 2 simply make the necessary definitions available. Note that `stringstream` classes are provided by `sstream` not, as you might guess, `stringstream`.

I never use line 3 in real code because I do not want to inject all the identifiers in `namespace std` into global space. I have used it here simply to avoid having either to write a bundle of `using` declarations or explicitly qualify the names with `std::`. I most strongly advise you to use one or other of these mechanisms. Personally, I introduce common identifiers such as `cout` via `using` declarations and less common ones with explicit qualification.

Note line 4, despite the behaviour of several well-known compilers, `main` is required to return an `int`. The C++ Standard gives a special dispensation to `main` so that lazy programmers can leave out the `return 0`. If you fall off the end of `main`, it is deemed to be the same as executing `return 0`.

Line 5 creates `outfile` as an `ostream` object. The constructor will construct an appropriate buffer.

Line 6 creates `cons` as a pointer to a `streambuf`, initialises it to point to the original buffer of `cout`, and makes `cout` share `outfile`'s buffer. I do not recommend this sharing in general as it can get confusing, with output getting interlaced.

Line 7 results in `cout` using the buffer that belongs to `outfile`. Note that the message does not appear on the screen until after the message from line 9 (when the original buffer for `cout` has been restored by line 8).

Lines 10, 11, and 12 simply illustrate that you can use the `str()` member function of `stringstream` to access the current string being used as a buffer, and that such access does not change the contents of the buffer.

There are a lot of other useful features provided by the twin hierarchies of `iostream` and `streambuf` and it is well worth making an effort to explore them.

Last month's problem

While browsing through some code I came across the following:

```
Mytype a(0), b(2), c(3);
bool test = a || b && c;
```

What do I need to check in order to understand the significance of the second line and what side effects may result from its execution?

The first point to note is that the assumption that this cannot be C source code is false. For it to be C, I must be using the preprocessor, with suitable macros and possibly a `typedef`. For example:

```
#define a(x) var##x = x
#define b(x) count##x = x
#define c(x) c##x = x
typedef int Mytype;
```

This will result in that first line being processed to:

```
int var0 = 0, count2 = 2, c3 = 3;
```

Despite appearances, the second line of source code has nothing to do with the first.

We can play all kinds of silly games with the preprocessor, which is why you should always check that you understand what `#included`

user-written files are doing to your code. You and I might wish that third parties avoided using lower case in macro identifiers, but some will and there are far too many 'too clever by half' uses of the preprocessor advocated by those who should know better.

Let me examine that code as C++. Assuming that we do not have to contend with the preprocessor rewriting the code, the first question we must answer is: 'Is `Mytype` a user-defined type or an alias for a built-in type (or in C terminology, derived from a built-in type)?'

Actually, what we really need to know is if `a`, `b`, and `c` have built-in `||` and `&&` operators. The expression being used to initialise `test` will be parsed as: `a || (b && c)`. As both `||` and `&&` contain internal sequence points, the normal rules for order of evaluation of sub-expressions do not apply. First `a` must be evaluated as true or false. If it evaluates as true, no further evaluations take place (to see the implications of this, imagine that we replaced `a`, `b` and `c` with function calls). If `a` evaluates as false, `b` must be evaluated. If and only if `b` evaluates as true, `c` must be evaluated.

Let me consider the case where `Mytype` provides its own overloaded operators for `||` and `&&`. The source code must then be rewritten as:

```
// both member functions
bool test = a.operator|| (b.operator&&(c));
or possibly as:
```

```
// both global functions
bool test = operator|| (a, operator&&(b, c));
```

Or as either of the two possible mixtures. Fortunately, these different rewrites do not change the fundamental substance that `a`, `b` and `c` can be evaluated in any order and that all must be fully evaluated. (Again, think of the case where the simple parameters are replaced by functions.)

And we have one more case to consider: user-defined types that can, but do not have to, use the built-in operators. These can come about in two ways: `enum` types and other types that provide a conversion operator to a type that can use built-in `||` and `&&` operators. What happens if the implementor of `Mytype` only overloads one of the two operators? The code then parses as either:

```
bool test = a || b.operator&&(c);
or as:
bool test = a.operator|| (b&&c);
```

I leave it as an exercise for the reader to determine the evaluation rules in these cases.

One conclusion to be drawn from the above is that you should always provide overloads for both or neither of `||` and `&&`. Furthermore, you should do so in the same place (global or in class).

This month's problem

Look at the above. Can you spot a rather subtle (and frequently overlooked) requirement when you elect to provide overloaded logical operators for a type? ■

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Speed is the key

Mark Smith has built a performance test application, **SpeedTest**, to drive a range of database engines.



Continuing from last month's performance-oriented piece, I want to turn to database performance, focusing on how to make your Delphi application get the most out of the database. While producing absolute performance statistics for database server engines is fraught with difficulties, I feel that we can and should be able to make an informed decision about database access strategies, if not actual database engines.

Database application do four fundamental things – create, read, update, and delete data – and for each of these operations there are two aspects to consider: what is being done and how long it takes. We can gain detailed knowledge about what is going on using the SQL Monitor that ships with Delphi Client/Server, which traces calls made by the Borland Database Engine on the client PC. If working with SQL Server, you can use the SQL Trace utility to see much the same thing, though this works by receiving information from the server itself. You can also turn on ODBC trace logging to record whatever your ODBC data source is doing. One problem with all of these tools is that they are diagnostic in intent, showing you what is going on, but not how long it takes. In this article I want to develop an application that gives us detailed performance information as well as showing database operations. Naturally, this application works with a number of popular databases.

To decide what databases to concentrate on, I ran a small survey on the Cix conferencing system (<http://www.cix.co.uk>) in the Delphi forum. The results are shown in Table 1. As you can see, client/server systems (Oracle, SQL Server, and InterBase) represent half of the responses, Paradox represents another quarter, with dBase and Access making up the majority of the rest. As part of this survey, I also asked what middleware people used to talk to the database. The BDE won three-quarters of the vote, with ActiveX Data Objects (ADO) getting six votes for second place.

BDE and ADO

The BDE is the backbone of most Delphi database applications, having drivers that allow a Delphi or C++Builder application to talk to many different databases. The VCL wraps BDE calls in an object hierarchy, exposing three classes (TTable, TQuery, and TStoredProc) for table scans, SQL queries, and stored procedure calls respectively. The received wisdom is to use TTable when using Paradox and dBase tables, reserving TQuery and TStoredProc for client/server systems

such as Microsoft SQL Server or InterBase. One of the goals for the test program is to allow a re-evaluation of this strategy in the light of the changes that have taken place since Delphi first appeared.

Despite the name, ADO is not a set of ActiveX controls that you can put on a form. Rather, it is a database layer built on top of another piece of Microsoft tech-

nology called OLE DB. It is interesting because as well as allowing access to regular databases like SQL Server and Oracle, it is supposed to allow database-like treatment of other data repositories such as email systems or XML (extensible markup language) data stores. Inprise (oops, borland.com) has said it is considering how best to incorporate ADO into Delphi, and my own view is that ADO will replace BDE as the data access method of choice for new database applications within the next year or so. To run the ADO tests, you will need to have ADO 2.0 installed. It is available as a download from the MSDN section of Microsoft's website. See the test program itself for more details of how to work with ADO, as well as the performance results.

Building a performance test application

The test application (SpeedTest, available on EXE OnLine) uses table, query, stored procedure, and ADO objects to interact with a range of databases. The three BDE-based access methods use standard BDE aliases, while the ADO test uses ADO COM objects. Since ADO does not use the BDE, you can only get an indication of what it is doing by using the SQL Server trace utility, or using the tools in the ADO SDK.

To get performance information I use the excellent freeware profiling tool, GpProfile, reviewed in last month's article and available from <http://members.xoom.com/primozg/gpprofile/gpprofile.htm>. To put the tests on an even footing data-wise, I wrote a simple table creation and population routine and copied the data to each of the databases using the Datapump utility. This is built into the application, accessible on the Table Create tab.

For SQL-Links and ODBC databases, we can obtain a wealth of information about what the BDE is doing. Normally you might use SQL Monitor to do this, but it is limited since you cannot insert your own notes into the trace log. The best way to overcome this is to install a callback into the BDE, which gives us the ability to spy on your application in the same way as SQL Monitor. And since we are fully in control, we can insert our own information into the log too. This trace gives us the qualitative information about what the BDE is doing, while the GpProfile trace gives accurate quantitative information about how long it takes. Registering a BDE trace callback is surprisingly simple – the only problem being identifying the structures you need to pass to the BDE. Examine the procedures TSpeedTestMain.RegisterTraceCallback and TraceCallback in the main form of the test application for the details. The pTRACEDesc record is declared in BDE.INT, to be found in the /DOCS directory of your Delphi installation.

Figure 1 shows a partial trace log for a SQL Query running on SQL Server. As you can see, the first thing the BDE does is check for the existence of the table by examining the sysobjects table. The second query (which happens to be what we asked the BDE to do) is run, but the result set is only looked at to retrieve the column names and then the query is closed. Finally, the BDE runs a query with all the columns explicitly named, and it is this query that is used to get the data. Note, you should not trace the BDE's actions while you are trying to mea-

SQL Server	21
Paradox	14
dBase	6
Oracle	5
MS Access	4
InterBase	3
SQL Anywhere	2
Other	4

Table 1 – What databases people use (59 respondents).



Retrieval is probably the place where you can make the biggest impact on your user's perception of how your application performs.

sure performance, since the trace messages take far longer to process than the query itself.

Selecting tests

Retrieving data is the most fundamental part of any database application. Chances are that retrieving and presenting data occupies a significant part of your programming efforts and that retrieval is probably the place where you can make the biggest impact on your user's perception of how your application performs.

Table 2 lists the performance results for all the BDE tests. While these figures may look surprising, bear in mind that all that was being changed between tests was the name of the alias, table index, or SQL ORDER BY clause. What can we deduce from these tests? My own view is that the most useful results are the worst ones, generally the first retrieval – after all, most users do not run exactly the same query repeatedly.

The first figures are the SQL-Links ordered table retrievals. Normally, the BDE is instructed to fetch only enough rows to fill the display, plus a few to allow scrolling. With both Sybase and Microsoft SQL Server, this results in locks being placed against 2 KB pages of data.

Database	Best, worst, and average time for open FetchAll, Close 500 rows (milliseconds).		
SQL Server – SQL-Links Table	772	1681	826
SQL Server – SQL-Links Table order by 1st	1297	2408	1373
SQL Server – SQL-Links Table order by 2nd	190	3283	983
SQL Server – SQL-Links Select * from FRED	769	871	781
SQL Server – SQL-Links select Integer1, String1, Float1, Date1, StringA1 from Fred	766	883	777
SQL Server – SQL-Links select Integer1, String1, Float1, Date1, StringA1 from Fred order by Integer1	766	899	775
SQL Server – SQL-Links Stored Procedure	767	784	771
InterBase ISQL	1330	1380	–
SQL Server w/SQL	311	550	–
SQL Server ODBC Table	38	350	54
SQL Server ODBC Table order by 1st	14	1199	99
SQL Server ODBC Table order by 2nd	33	1916	224
SQL Server ODBC Query	35	1814	47
SQL Server ODBC Query ordered on PK	35	148	50
Paradox Table order by 1st	5	121	11
Paradox Query	21	820	61
Paradox Query ordered on PK	29	843	71

Table 2 – Sample performance results.

```
SQL Execute: MSSQL - select user_name (uid),
    object_name (id), type, crdate from sysobjects
    where type in ('U', 'V', 'S') and id = object_id
    ('sa.FRED')
SQL Stmt: MSSQL - Fetch
SQL Stmt: MSSQL - EOF
SQL Stmt: MSSQL - Close
SQL Execute: MSSQL - SELECT * FROM FRED
SQL Stmt: MSSQL - Close
SQL Execute: MSSQL - SELECT Integer1, String1,
    Float1, Date1, StringA1 FROM FRED
SQL Stmt: MSSQL - Fetch
```

Figure 1 – Trace output for the query "SELECT * FROM FRED"

These locks block other users, and the only way to remove them is to cancel the query or read all of the rows. Since these tests are supposed to mimic database access in the real world, we use the `FetchAll` method after opening a dataset. Calling `FetchAll` for a query or stored procedure gets all of the rows back, removing the read locks on the way. But with tables, `FetchAll` results in slightly more subtle behaviour: if you don't specify an index, it retrieves all rows like a query does. If you do specify an index, the call to `FetchAll` closes the table and re-executes the underlying query adding an ORDER BY DESC clause to get the data in reverse order. This sneaky technique is apparently supposed to save a lot of time but does not result in all the data being returned to the client. Furthermore, it still leaves the locking problem, so you're still blocking data on the server.

SQL Servers' performance with the ODBC driver merits further investigation. Running select statements in w/SQL, the SQL Server interactive utility, gives a query time of about 330 ms with an order by clause or 550 ms without. One would suspect that the ODBC driver should not be able to out-perform w/SQL, yet the SQL Server ODBC driver gives far better results than the best times obtainable. Looking into the trace log reveals the ODBC driver retrieving batches of twenty rows with the `SQLExtendedFetch` ODBC API call. This should be faster than the BDE's row-by-row approach, but I'm mystified by the huge performance difference between the slowest (first) run and the subsequent ones. Perhaps the driver is buffering data. Perhaps the rumours of a secret API in the SQL Server client library are true. Perhaps it just is really that fast by virtue of excellent programming. Our role is merely to exploit the performance offered, and I know I'll be revisiting the ODBC driver for my next SQL Server project.

Paradox also seems to be very fast, but these results were based on only five hundred rows of data held locally, to which the BDE had exclusive access. Running filtered queries across a network (not shown) was significantly slower with large result sets. Clearly, TTable is still the way to go with Paradox.

Extending the tests

The test application has options for specifying different properties for the data retrieval tests, as well as filter, update, and delete tests not described here. SpeedTest should run as-is against other BDE and ODBC databases, including Oracle and MS Access, but you will need to produce appropriate stored procedures if you want to measure stored procedure performance.

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JNI – going native II



Tom Guinther continues his look at the Java Network Interface, getting down to the details of integrating production-quality native code with Java.

There is a variety of different aspects to JNI, a necessity given that it is the primary interface between Java and native code. Being all things to all people is difficult at the best of times, but don't be deterred by the scope of functionality provided.

JNI class and object operations

JNI offers a limited set of methods for performing class operations. The `FindClass` method is one of the more useful as it allows you to load or obtain a reference to a class. The `IsAssignableFrom` method allows native code to determine if a class can be safely cast to another class. This is useful for parameter validation. The `DefineClass` method allows you to provide the VM with a binary image of a class file for loading. This is an extremely powerful feature, but it would typically be used only by very sophisticated programs, for example, those involved with instrumentation.

Related to class operations are the object operations that provide functionality for allocating new objects and testing object relationships. The methods `AllocObject`, `NewObject`, `NewObjectA`, and `NewObjectV` provide different ways to create new Java objects. The primary difference between the methods is the manner in which arguments are passed to the object constructor. For the `NewObject` methods, the specific constructor to be called is specified by a `methodID`, which is obtained by calling the JNI method `GetMethodID`. When calling `GetMethodID` pass the value `<init>` for method name, and `"V"` for the method return type. For example, `pEnv->GetMethodID(myClass, "<init>", "V")`;

In the case of `AllocObject` a constructor isn't explicitly called, so before using the new object you need to use the JNI method `GetMethodID` to obtain an ID for a constructor and call it using `CallVoidMethod`. This obviously requires an extra step, so using one of the `NewObject` methods is recommended.

Outside of creating new objects, you can also obtain the class object (the C/C++ type `jclass`) for an instance of an object using `GetObjectClass`. This is useful because there are quite a few JNI methods that require a `jclass` as a parameter. For example, `GetStaticFieldID` method requires a `jclass` for the object because static members are actually members of the class, not individual instances of the object. Finally, `IsInstanceOf` determines whether an object is of a specified class. Its functionality is similar to `IsAssignableFrom`, and I recommend it for parameter validation. This should help make your implementation more robust, which is very important if other programmers use your code.

Java exceptions

Dealing with Java exceptions is as germane to native code as it is to pure Java programming. Many JNI functions are implemented in Java and can throw Java exceptions that you may or may not want to handle in your native code. In some cases you have to handle the exception in order to continue normal processing because JNI functions won't work if an exception is pending in the Java VM. Use the `ExceptionOccurred` method to determine if an exception is currently pending. The return value is the C/C++ type `jthrowable`, which is equivalent to a Java object of type `Throwable`. If your code handles the exception, you should clear

it using the `ExceptionClear` method, otherwise do nothing so that it gets passed back to Java code. For debugging purposes, you can use `ExceptionDescribe` to get a stack dump to the console, and if things are *really* bad, then `FatalError` can be used to kill the virtual machine.

If your native code needs to throw a Java exception back to the calling Java code, then use the `Throw` and/or `ThrowNew` methods. The former takes an object of type `jthrowable`, which can be any object derived from class `Throwable`. Of course, you are responsible for the creation of the object and you can use the previously discussed `NewObject` method to create it. On the other hand, you can simply call `ThrowNew`, specifying the class of the exception you wish to throw and the error message used during construction of the object. If you need to initialise the exception object with something other than a formatted error message, then you don't have much choice but to create an exception object directly.

One thing that I find useful for `ThrowNew` is to `#define` the class names. I tend to fine-tune the specific exceptions that are thrown as I evolve the code towards production and being able to change the exception in one place is much more convenient. Also, I often find myself throwing exceptions when a Win32 API fails. Because Win32 uses error codes, I need to translate those codes into human readable text. The Win32 API provides the `FormatMessage` function to do just that, and the following code shows the normal conversion process.

```
#define CLASS_IO_EXCEPTION      "java/io/IOException"
PSTR TranslateErrorMessage(DWORD errorCode) {
    char *pszResult = NULL ;
    FormatMessageA (
        FORMAT_MESSAGE_ALLOCATE_BUFFER |
        FORMAT_MESSAGE_FROM_SYSTEM |
        FORMAT_MESSAGE_IGNORE_INSERTS,
        NULL, errorCode,
        MAKELANGID(LANG_NEUTRAL, SUBLANG_DEFAULT),
        (PSTR) &pszResult, 0, NULL );
    return pszResult ;
}

void JavaThrowIOException(DWORD lastError) {
    char *message = NULL ;
    _try {
        message = TranslateErrorMessage(lastError) ;
        pEnv->ThrowNew( pEnv->FindClass(CLASS_IO_EXCEPTION),
            message ) ;
    } _finally {
        if (message) LocalFree(message) ;
    }
}
```

One thing you might notice in the call to `ThrowNew` is that I use the `FindClass` method to obtain the class object for `java/io/IOException`. It is probably better not to do this inline since if the function were to fail it could cause further, hard to detect errors.

JNI synchronisation

JNI provides two functions for native code to manage synchronisation with Java objects: `MonitorEnter` and `MonitorExit`. To syn-

chronise the current thread on a Java object call `MonitorEnter` passing the reference to the object. If no other thread owns the object, then the current thread attains the monitor and any other thread that attempts to acquire it blocks until the current thread releases it using `MonitorExit`. The monitor is reference counted so it is safe for a thread to acquire the monitor more than once, but a corresponding `MonitorExit` must balance each `MonitorEnter`.

One of the reasons that you might need to use the `Monitor` functions is that declaring a native function with the `synchronized` keyword doesn't have any effect. That is, unlike a pure Java function, the Java VM does not automatically acquire the lock for the object. Any native method that is declared with the `synchronized` keyword should have the appropriate `MonitorEnter/Exit` prologue and epilogue or risk the consequence of hard-to-debug synchronisation issues.



String methods

The JNI String methods, after the exception methods, are the ones that I use most frequently. Java makes using strings so easy that they become the prevalent data type in most Java applications. Because the Java VM internally encodes strings in the 16-bit Unicode character set, half of the functions are related to translating from Unicode to Ascii, or more correctly, UTF8 an 8-bit encoding. The methods `GetStringLength`, `GetStringChars`, `ReleaseStringChars`, and `NewString` have a corresponding UTF method. Which character set you use simply depends on whether your target environment (eg Windows NT) supports Unicode. If you are supporting multiple targets (eg Windows 95/98 and Windows NT), then you might need to choose the least common denominator 8-bit encoding. Windows 95 and Windows 98 superficially support Unicode, but relying on that support would ultimately lead to disaster for your application.

The methods `GetStringChars` and `ReleaseStringChars` (as well as their UTF counterparts `GetStringUTFChars` and `ReleaseStringUTFChars`) are a matched pair designed to allow the Java VM to track references and to provide optimal memory management. When native code calls `GetStringChars` the Java VM has the freedom to copy the string to a separate memory buffer or 'pin' the actual string data in the Java heap. When the calling code no longer needs access to the string memory it calls `ReleaseStringChars` to remove the reference and allow the Java VM to perform any cleanup work, such as freeing the buffer used to make a copy of the string.

Both `NewString` and `NewStringUTF` are very straightforward; they allow you to create Java String objects from C/C++ Unicode and ASCII strings.

JNI array methods

The JNI array methods are quite numerous, but many of them have equivalent semantic functionality - they just operate on different types. To begin, there is a distinction between manipulating arrays of objects versus primitive types. There are eight different primitive types and five base methods, for a grand total of 44 different methods. The following table summarises the available methods for arrays.

<code>New<type>Array</code>	eg <code>NewByteArray</code>
<code>Get<primitive>ArrayElements</code>	eg <code>GetFloatArrayElement</code>
<code>Release<primitive>ArrayElements</code>	eg <code>GetBooleanArrayElement</code>
<code>Get<primitive>ArrayRegion</code>	eg <code>GetIntArrayRegion</code>
<code>Set<primitive>ArrayRegion</code>	eg <code>SetLongArrayRegion</code>
<code>GetObjectArrayElement</code>	Retrieve an element of an array of objects
<code>SetObjectArrayElement</code>	Assign an object to an array
<code>GetArrayLength</code>	Return the length of an array

The `New<type>Array` functions allow you to construct an array of a specified type. For primitive types, the initial values are set to the default for that type. The `NewObjectArray` allows you to specify an initial value for all elements. Typically, this value would be null.

Both `Get<primitive>ArrayElements` and `Release<primitive>ArrayElements` function in a manner similar to that described for the string functions, allowing the Java VM the freedom to manage array memory in the most convenient or optimal form. When you call `Get<primitive>ArrayElements` you are requesting direct access to the array elements and your native code can manipulate that data like any other C/C++ array. The one caveat is that any changes you make to the array elements may not be reflected to other Java or native components until you call `Release<primitive>ArrayElements`. Calling `Release<primitive>ArrayElements` has the effect of (optionally) updating any changes you have made to the array if the Java VM made a copy for your use. It also releases any reference count that would keep the Java object from being garbage-collected. As far as whether changes are automatically reflected by native code, this is 100% dependent upon whether the Java VM made a copy of the elements. I would try to avoid any dependencies one way or the other, but if you need to know the Java VM will tell you whether it made a copy or not.

The following code snippet is taken from a JNI application that writes data to a memory-mapped file. It accesses an array of bytes using `GetByteArrayElements` and calls `ReleaseByteArrayElements` upon completion. Notice that upon release I specify a flag `JNI_ABORT`. This flag informs the Java VM that if it did make a copy I don't want the original array to be updated. This is because I didn't make any changes to the data (ie I treat it as read-only) so an update would be pointless.

```

_try {
    if (pData = (char *)
        pEnv->GetByteArrayElements(data, NULL)) {
        result = WriteFile(hFile, offset,
            &pData[dataOffset], length) ;
        if ((result == -1) && (GetLastError() != NOERROR)) {
            JavaThrowIOException(pEnv, GetLastError()) ;
        }
    }
} _finally {
    if (pData) {
        pEnv->ReleaseByteArrayElements(
            data, (signed char *)pData, JNI_ABORT) ;
    }
}

```

JNI exploration

We've covered a lot of ground in a very small space so I encourage you to explore JNI on your own. It is an extremely powerful tool for Java programmers and is well worth the time invested to learn it. I will say (again) that you should look for alternate, pure Java solutions before choosing JNI. However, in many cases JNI is the only reasonable answer, and when that day arrives you will be well prepared.

Thanks to everyone who participated in the Cryptogram quiz. The winners will be announced in next month's article on Java and XML. ■

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Installation issues

Jon Perkins provides some background information on the installation of Visual Basic 6 applications.



Developers who used version 3 of Visual Basic might remember the first implementation of the setup wizard. Although it was supposed to be a Windows application, it would spawn DOS windows when it ran the command-line file compression utility, which gave the impression of a rather Heath Robinson implementation. Furthermore, it was notoriously buggy. The setup wizard has undergone some major facelifts since this time, but has now been superseded in Visual Studio 6 by the Package and Deployment Wizard (PDW). In this month's column, I'm taking a look at some of the issues surrounding application and component installation.

Since the advent of ActiveX technology, the steps that go into the installation of an application or a component are somewhat more involved. Gone are the days when a few files could just be copied onto the hard disk. Anything that exposes an ActiveX interface must be registered, applications must be given shell links, and care must be taken to ensure that all required files or subsystems are present – something that cannot be taken for granted. Furthermore, there are components that are destined for an Internet environment, which requires a somewhat different installation approach.

The `setup.exe` program that is launched during a typical application (ie non-Internet) installation is chiefly responsible for ensuring that the core Visual Basic runtime files are installed. It's possible that earlier versions of some of these files might already exist on the machine, in which case a reboot will be required to complete the replacement and allow these new files to be loaded. The `setup.exe` executable then passes control over to `setup1.exe`. As with previous setup wizards, a default `setup1.exe` is provided, although it can be replaced with a customised version built from the supplied Visual Basic project. Both `setup.exe` and `setup1.exe` use a parameters file – `setup.lst` – that lists all of the files that need to be installed, and where they should be placed. The `setup1.exe` program makes use of an additional library file called `vb6stkit.dll`, which provides several useful pieces of functionality. If you're not in the habit of 'rolling your own' `setup1.exe`, then it's still worth having a look through the source code for the underlying project because there are quite a few routines that could well come in useful for other projects.

Each file is installed by making a call to `VerInstallFile`, a general Windows API routine. This function checks the version number of a file to be copied and, if it finds a file of the same name in the destination target, confirms that the replacement file is actually newer. For this reason it is important to increment the version number of a component when it is modified – an updated file with the same version number won't necessarily be copied over the existing file. The `VerInstallFile` routine is also capable of decompressing the file if necessary.

Files that are installed into common areas, such as the Windows directory, are generally treated as shared files, that is they can be used by different applications. For each shared file, a usage count is stored in the Registry under `\HKEY_LOCAL_MACHINE\SOFTWARE\Microsoft\Windows\CurrentVersion\SharedDLLs`. When an application is installed, `VerInstallFile` increments the usage count for

each component that is used. This usage information is generally provided by dependency files, which we'll come back to a little later.

Windows logo compliance

As a means of guaranteeing to the user community that any given application behaves in a manner consistent with previous experience, Microsoft supports a Windows logo programme. While this can't be enforced, it provides a form of certification for third-party software companies by allowing the display of the 'Designed for Microsoft Windows NT and Windows 95' decal. In order to earn this certification a software release must be verified by an authorised testing centre as conforming with certain implementation specifications. Apart from core specifics, such as 'it must be true 32-bit code', the logo program states certain expectations about the installation of the application. The setup program for the application must itself be a 32-bit, Windows-based (ie graphical) utility. Furthermore, it should detect at runtime the version of Windows that it is running on, and install the correct version of the application (if appropriate) automatically.

One of the facilities that Microsoft is keen to push in this area is the use of the AutoPlay facility when dealing with CD-ROM installations. When a CD-ROM is placed in a drive Windows will detect the change of state, read the file list of the root directory, and search for a file called `autorun.inf`. These files are normally very small and simple, and provide the name of an executable that should be run in order to provide the master application setup routine. Once the application has been installed, it is then up to the third-party developer to decide whether any subsequent loading of the CD-ROM will display anything.

Another important requirement is the provision of an uninstaller. When the PDW installs an application or component, it also copies a file called `st6unst.exe` into the Windows root directory if it doesn't already exist, and an installation log file called `st6unst.log` into the application directory. This log file contains information such as the directories that were created for this installation, the Registry entries that were made, and the shell links that were created. The setup program then registers this application-removal facility into the list of applications that are shown within the Add/Remove Programs applet in the Control Panel. This information is stored at `\HKEY_LOCAL_MACHINE\SOFTWARE\Microsoft\Windows\CurrentVersion\Uninstall` and, for each registered application, contains two pieces of information: the display string for the Add/Remove Programs applet, and the command line to execute to start the uninstallation. By the way, `st6unst.exe` will complain if you attempt to run it as a standalone application.

When something is uninstalled, the usage count on any shared components should be decremented by a value of one. If, after this has happened, the usage count has dropped to zero then the application may decide (possibly by asking the user) whether actually to delete these files. This process does contain a couple of caveats however. First, the usage count decrement should never let the value fall below zero. This could lead to a problem at some future time where a com-



ponent that is still needed is inadvertently deleted. The second stipulation is that this usage count decrement should not be applied to what Microsoft refers to as 'core components, in particular Microsoft Foundation Class Library (MFC) DLLs, as well as ODBC and DAO DLLs'. Microsoft maintains a formal list of all such files at <http://msdn.microsoft.com/developer/winlogo/downloads.htm>.

Packages and dependencies

The earlier setup programs used to compress each file in an installation kit and then expand it again as it was copied over onto the target machine. Nowadays groups of files are collected into *packages*. A package can be of two types: a *standard package* is intended for distribution via floppy disk, CD, or network share, whereas an *Internet package* speaks for itself. Both types of packages contain one or more files collected together into structured storage files with a *cab* extension (short for 'cabinet').

The PDW isn't solely concerned with creating application packages. It also creates *dependency files*. These files exist for reference purposes and catalogue certain information about components or applications. Listing 1 shows the pertinent part of the dependency file that is supplied along with the *richtx32.ocx* control (dependency files have the same name as their code-counterparts, but with a *dep* extension). The information in Listing 1 shows that it is dependent upon the *riched32.dll* and *comcat.dll* files being present in order to run. This information is stored within the OCX itself, but is extracted into a handy reference format by the PDW. When a package is being created a master list of dependencies can then be compiled to ensure that all required files are included in the setup package.

Visual Basic itself comes with a somewhat larger dependency file called *vb6dep.ini*, which stores the dependency information for the entire development environment. When the PDW runs, it looks in this file as well as individual dependency files in order to resolve all dependencies. If it cannot do this, then there is no guarantee that an additional, unidentified file will not be required by the application at runtime (which might cause its failure). When this happens you get a warning and can decide the best course of action to take.

If your project is using ADO then the PDW will bundle in an additional install program called *mdac_typ.exe*. This program

checks whether the ADO libraries, and the underlying OLE DB subsystem, have already been installed and, if not, will do so. A copy of this program is installed into the *Wizards\PDWizard\Redist* directory of the Visual Basic installation, and is transferred from there into PDW-generated setup packages. It's worth keeping an eye on the download site for this file (http://www.microsoft.com/msdownload/uda/mdac_typ.asp) as Microsoft updates it from time to time. If this installation program is applied against a Windows 95/98 target, then you will also need to provide the Distributed COM installation routine. This ships with Visual Studio, but is additionally available from <http://www.microsoft.com/com/dcom.asp>.

Testing a setup routine

When a setup routine is created, it should of course be tested. I've already written a fair amount of material on this subject in a book (see the biography at the end of the column), some of which will be relevant background reading for this topic. Since I wrote the last edition of my chapter, I've set up a very efficient test environment for my own work. My notebook computer has removable hard disks, which means that I can maintain separate environments on different disks. I've dedicated one such disk for testing purposes. On this disk I use a product called Drive Image, which is designed to store a compressed copy of a partition on another partition, or on some other media such as a Zip disk. Using this concept I have backups of a clean basic Windows NT 4 installation, another Windows NT4 installation that has had the full IE4 installed, a clean copy of Windows 98, a Windows 2000 beta, and so on. Using Drive Image I can restore a backed-up copy of my target platform within a couple of minutes and can thus be sure of installing into virgin territory. This is an excellent way of ensuring that you have not omitted any key files that would probably be present on your development machine anyway. When you perform your regular builds (you *do* perform regular builds, don't you?) you also get the opportunity to ensure that your setup program gets checked for correctness.

Other tools

Although the PDW is a competent deployment utility, it does still have a few shortcomings. The ability to modify the *setup1* source files provides a means of overcoming this, but a more elegant solution can be to use one of the third-party utilities for the creation of setup programs. InstallShield Express provides a graphical approach to the creation of slick-looking installation routines that have more flexibility than the PDW. For example, the ability to add custom Registry keys, to spawn external programs (such as the ADO installer mentioned earlier), or to create different setup types (eg Complete and Minimal) is very straightforward. The big brother product to this, InstallShield Pro, offers everything that InstallShield Express does but also includes a powerful scripting language for more complex installations. ■

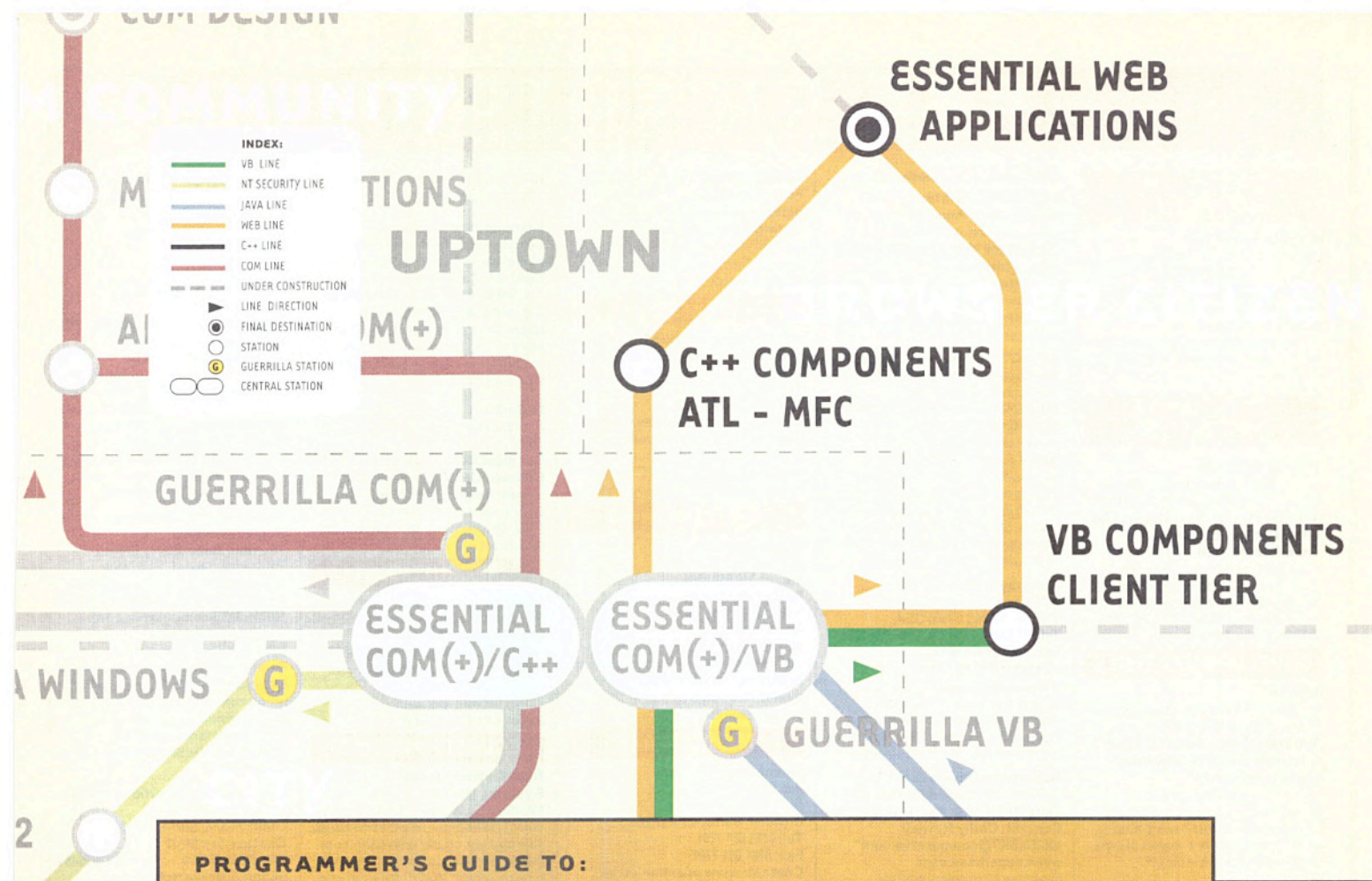
*Jon Perkins is a freelance Visual Basic developer and a Microsoft Certified Solution Developer. He is a contributing author of *Advanced Microsoft Visual Basic 6.0* by The Mandelbrot Set, published by Microsoft Press. Contact him at <http://www.jonperkins.com>. Further information about InstallShield Express and InstallShield Pro can be found at www.installshield.co.uk, they cost around £135 and £500 respectively. Drive Image details can be found at www.powerquest.com and it costs around £35. All of these products are available from most major software suppliers.*

```
[RichTx32.ocx]
Dest=$(WinSysPath)
Register=$(DLLSelfRegister)
Version=6.0.81.69
Uses1=RichEd32.dll
Uses2=ComCat.dll
Uses3=
CABFileName=RichTx32.cab
CABDefaultURL=
    http://activex.microsoft.com/controls/vb6
CABINFFile=RichTx32.inf

[ComCat.dll]
Dest=$(WinSysPathSysFile)
Register=$(DLLSelfRegister)
Uses1=

[RichEd32.dll]
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Listing 1 – Dependency information for RichTx32.ocx.



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Windows NT Workstation Fundmtls 3	24/05/99	Call	£850	call	VERH	Paradox for Windows Object PAL - Intermediate	Regularly	2	£700	Call	DU TH
Windows NT Workstation Fundmtls 3	21/06/99	Call	£850	call	VERH	Paradox for Windows Object PAL - Advanced	Regularly	2	£700	Call	DU TH
Windows NT Workstation Fundmtls 3	19/07/99	Call	£850	call	VERH	dBASE for Windows - End-user	Regularly	2	£700	Call	DU TH
Windows NT Workstation Fundmtls 3	23/08/99	Call	£850	call	VERH	dBASE for Windows - Programming	Regularly	3	£900	Call	DU TH
Windows NT Workstation Fundmtls 3	20/09/99	Call	£850	call	VERH	Access End-user - Beginning	Regularly	1	£275	Call	DU TH
Windows NT Workstation Fundmtls 3	18/10/99	Call	£850	call	VERH	Access End-user - Intermediate	Regularly	1	£275	Call	DU TH
Windows NT Workstation Fundmtls 3	15/11/99	Call	£850	call	VERH	Access End-user - Advanced	Regularly	1	£275	Call	DU TH
Windows NT Workstation Fundmtls 3	20/12/99	Call	£850	call	VERH	InterBase	Regularly	5	£1,600	Call	DU TH
Windows NT 4 Workstation Domain3	22/03/99	Call	£795	call	VERH	Access Programming - Introduction Developers Course	Regularly	1	£275	Call	DU TH
Windows NT 4 Workstation Domain3	26/04/99	Call	£795	call	VERH	Access Programming - Advanced Developers Course	Regularly	4	£1,200	Call	DU TH
Windows NT 4 Workstation Domain3	28/06/99	Call	£795	call	VERH	Database Analysis and Design	Regularly	3	POA	Call	QA TR
Windows NT 4 Workstation Domain3	26/07/99	Call	£795	call	VERH	Building a Data Warehouse	Regularly	4	POA	Call	QA TR
Windows NT 4 Workstation Domain3	31/08/99	Call	£795	call	VERH	Microsoft Access Development	Regularly	3	POA	Call	QA TR
Windows NT 4 Workstation Domain3	27/09/99	Call	£795	call	VERH	Introduction to Microsoft Access	Regularly	2	POA	Call	QA TR
Windows NT 4 Workstation Domain3	25/10/99	Call	£795	call	VERH	Programming with Microsoft Access Basic	Regularly	2	POA	Call	QA TR
Windows NT 4 Workstation Domain3	22/11/99	Call	£795	call	VERH	SQL Language	Regularly	2	POA	Call	QA TR
Windows NT 4 Workstation Domain3	12/12/99	Call	£795	call	VERH	Microsoft SQL Server and Transact-SQL Programming	Regularly	3	POA	Call	QA TR
Windows NT Desktop	19/04/99	2	£495	call	VERH	Microsoft SQL Server 6.5 Administration	Regularly	5	POA	Call	QA TR
Windows NT Desktop	14/06/99	2	£495	call	VERH	Implementing a Database Design on Microsoft SQL Server 6.5	Regularly	5	POA	Call	QA TR
Windows NT Desktop	13/09/99	2	£495	call	VERH	GROUPWARE AND OFFICE SYSTEMS					
Windows NT Desktop	08/11/99	2	£495	call	VERH	Lotus Notes/Domino R4.5 Application Development 1	Regularly	3	POA	Call	QA TR
Introduction to Novell LANs	19/04/99	3	£795	call	VERH	Lotus Notes/Domino R4.5 Application Development 2	Regularly	4	POA	Call	QA TR
Introduction to Novell LANs	12/07/99	3	£795	call	VERH	Lotus Notes/Domino R4.5 Application Development 3 and LotusScript	Regularly	4	POA	Call	QA TR
Introduction to Novell LANs	13/09/99	3	£795	call	VERH	Lotus Notes/Domino R4.5 System Administration 1	Regularly	4	POA	Call	QA TR
Introduction to Novell LANs	08/11/99	3	£795	call	VERH	Lotus Notes/Domino R4.5 System Administration 2	Regularly	2	POA	Call	QA TR
Understanding TCP/IP	24/05/99	3	£795	call	VERH						
Understanding TCP/IP	19/07/99	3	£795	call	VERH						
Understanding TCP/IP	20/09/99	3	£795	call	VERH						

SOFTWARE TRAINING GUIDE

Course	Date	Days	Cost	Place	Company	Course	Date	Days	Cost	Place	Company
Introduction to LotusScript in Notes/Domino	Regularly	3	POA	Call	QA TR	NETWARE					
Microsoft Exchange Server 5.5 - Concepts and Administration	Regularly	3	POA	Call	QA TR	NetWare 3 Support and Administration	Regularly	4	POA	Call	QA TR
Microsoft Exchange Server 5.5 - Design and Implementation	Regularly	5	POA	Call	QA TR	IntranetWare Support and Administration using Windows NT	Regularly	5	POA	Call	QA TR
Supporting Microsoft Exchange 5.0 - Core Technologies	Regularly	5	POA	Call	QA TR	IntranetWare: NetWare 4.x Administration	Regularly	5	POA	Call	QA TR
Microsoft Exchange Server Performance and Troubleshooting	Regularly	2	POA	Call	QA TR	IntranetWare: NetWare 4.x Advanced Administration	Regularly	3	POA	Call	QA TR
Groupware Development with Microsoft Office Technologies	Regularly	5	POA	Call	QA TR	NETWORKING					
Domino Administration for Lotus Notes 4.6 and the Internet	Regularly	2	POA	Call	QA TR	Understanding ATM	Regularly	2	POA	Call	QA TR
Internet Development with Lotus Notes Domino 4.6	Regularly	3	POA	Call	QA TR	Introduction to Data Communications	Regularly	2	POA	Call	QA TR
VBA Programming with Microsoft Excel	Regularly	4	POA	Call	QA TR	Enterprise-wide Communications and Networking	Regularly	4	POA	Call	QA TR
GUI DEVELOPMENT						Local Area Network Implementation & Management	Regularly	4	POA	Call	QA TR
Application Development using Borland Delphi V3	Regularly	5	POA	Call	QA TR	Network Primer	Regularly	1	POA	Call	QA TR
Advanced Programming with Visual Basic Enterprise Edition	Regularly	4	POA	Call	QA TR	OBJECT ORIENTED TECHNOLOGY					
Building Object-Oriented Applications with PowerBuilder V5	Regularly	3	POA	Call	QA TR	Advances in OOD and ISO C++	Regularly	1	300	On-Site	Clip
Fast Track to PowerBuilder V5	Regularly	4	POA	Call	QA TR	UML	Regularly	1	300	On-Site	Clip
Microsoft Visual Basic Primer	Regularly	1	POA	Call	QA TR	Rational Unified Development Process	Regularly	1	300	On-Site	Clip
Application Development using Visual Basic	Regularly	4	POA	Call	QA TR	Practical Object Oriented Analysis & Design Using UML 19/04/99	5	995	Newbury	CRA	
INTERNET						Practical Object Oriented Analysis & Design Using UML 17/05/99	5	995	Newbury	CRA	
E-Commerce Infrastructure	Regularly	1	300	On-Site	Clip	Practical Object Oriented Analysis & Design Using UML 21/06/99	5	995	Newbury	CRA	
Active Server Pages for IIS	Regularly	1	300	On-Site	Clip	Practical Object Oriented Analysis & Design Using UML 19/07/99	5	995	Newbury	CRA	
MS Interdev	Regularly	3	£900	Call	DU TH	Advanced IBM Smalltalk	25/1	5	1375	London	OBJE
MS FrontPage	Regularly	1	£275	Call	DU TH	Advanced IBM Smalltalk	22/3	5	1375	Southampton	OBJE
Programming with JavaScript	Regularly	2	POA	Call	QA TR	Advanced IBM Smalltalk	17/5	5	1375	London	OBJE
Creating and Configuring a Web Server using Microsoft Tools	Regularly	3	POA	Call	QA TR	Building Applications using VisualAge for Smalltalk Technology	18/1	5	1375	Southampton	OBJE
Internetworking with Microsoft TCP/IP on Windows NT 4	Regularly	5	POA	Call	QA TR	Building an Application Server using VisualAge/Smalltalk Server	3/3	3	895	Southampton	OBJE
Internet Fundamentals	Regularly	3	POA	Call	QA TR	Building an Application Server using VisualAge/Smalltalk Server	26/5	3	895	Southampton	OBJE
Intranet Design and Migration	Regularly	3	POA	Call	QA TR	Introduction to VisualAge	11/1	5	1375	London	OBJE
Internet and Intranet Security	Regularly	3	POA	Call	QA TR	Introduction to VisualAge	8/2	5	1375	Southampton	OBJE
Building an Effective Web Site	Regularly	3	POA	Call	QA TR	Introduction to VisualAge	8/3	5	1375	Southampton	OBJE
Netscape SuiteSpot Server v3	Regularly	5	POA	Call	QA TR	Introduction to VisualAge	12/4	5	1375	Southampton	OBJE
Internetworking with TCP/IP	Regularly	4	POA	Call	QA TR	Introduction to VisualAge	7/6	5	1375	London	OBJE
Programming with Visual Basic Script	Regularly	2	POA	Call	QA TR	Programming in IBM Smalltalk	15/2	5	1375	London	OBJE
LANGUAGES						Programming in IBM Smalltalk	26/4	5	1375	London	OBJE
Immersion in Advanced MFC	Regularly	1	300	On-Site	Clip	Programming in IBM Smalltalk	14/6	5	1375	Southampton	OBJE
Immersion in ANSI C	Regularly	2	600	On-Site	Clip	VisualAge for Smalltalk Programmers	1/2	5	1375	Southampton	OBJE
Immersion in ISO C++	Regularly	2	600	On-Site	Clip	VisualAge for Smalltalk Programmers	10/5	5	1375	Southampton	OBJE
Immersion in MFC	Regularly	2	600	On-Site	Clip	Round-trip Engineering with VisualAge/Smalltalk UML Designer	Call	3	call	Southampton	OBJE
Immersion in Visual Basic	Regularly	2	600	On-Site	Clip	Enabling Persistence with VisualAge/Smalltalk Object Extender	Call	3	call	Southampton	OBJE
Advanced C	Regularly	4	POA	Call	QA TR	MVS Smalltalk:Transaction Managed Objects	Call	3	Call	Southampton	OBJE
Advanced C++ Development Techniques	Regularly	4	POA	Call	QA TR	Building & using Java Beans	6/5	2	650	Southampton	OBJE
C++ for non-C Programmers	Regularly	5	POA	Call	QA TR	Building Distributed Applications with VisualAge for Java 22/4	2	650	Southampton	OBJE	
C++ for C Programmers	Regularly	4	POA	Call	QA TR	Building Distributed Applications with VisualAge for Java 17/6	2	650	ptSouthamon	OBJE	
C++ Primer	Regularly	2	POA	Call	QA TR	Building Applications using VisualAge for Smalltalk	15/3	5	1375	Southampton	OBJE
C Primer	Regularly	2	POA	Call	QA TR	Building Applications using VisualAge for Smalltalk	19/4	5	1375	Southampton	OBJE
C Programming	Regularly	4	POA	Call	QA TR	Building Applications using VisualAge for Smalltalk	21/6	5	1375	Southampton	OBJE
Developing JavaBeans	Regularly	5	POA	Call	QA TR	Team Programming using VisualAge for Smalltalk	7/1	2	650	Southampton	OBJE
Java for non-C Programmers	Regularly	5	POA	Call	QA TR	Team Programming using VisualAge for Smalltalk	8/4	2	650	Southampton	OBJE
Java Primer	Regularly	2	POA	Call	QA TR	Team Programming using VisualAge for Smalltalk	3/6	2	650	Southampton	OBJE
Java for C/C++ Programmers	Regularly	4	POA	Call	QA TR	OO Programming with VisualAge for Java	21/6	5	1250	Southampton	OBJE
Mastering Microsoft Visual Java J++	Regularly	5	POA	Call	QA TR						
Database Development using Symantec Visual Café	Regularly	3	POA	Call	QA TR						

SOFTWARE TRAINING GUIDE

Course	Date	Days	Cost	Place	Company	Course	Date	Days	Cost	Place	Company
Building Applets & Applications with VisualAge for Java	26/4	5	1250	Southampton	OBJE	Delphi - Component	Regularly	2	£700	Call	DU TH
Building Applets & Applications with VisualAge for Java	24/5	5	1250	Southampton	OBJE	Delphi - Advanced Client/Server Techniques	Regularly	3	£900	Call	DU TH
Building Applets & Applications with VisualAge for Java	28/6	5	1250	Southampton	OBJE	Visual Basic - Introduction	Regularly	2	£700	Call	DU TH
Team Programming using VisualAge for Java	8/4	2	650	Southampton	OBJE	Visual Basic - Database Programming	Regularly	3	£900	Call	DU TH
Object-Oriented Modelling with VisualAge/Smalltalk UML Designer	8/2	4.5	1450	Southampton	OBJE	Visual Basic - Advanced	Regularly	3	£900	Call	DU TH
Object-Oriented Modelling with VisualAge/Smalltalk UML Designer	10/5	4.5	1450	Southampton	OBJE	Delphi - Midas	Regularly	5	£1,600	Call	DU TH
OO Programming with VisualAge for Java	17/5	5	1250	Southampton	OBJE	Delphi - Multi-tier	Regularly	2	£700	Call	DU TH
Team Programming using VisualAge for Java	1/6	2	650	Southampton	OBJE	Developing Windows NT Server Applications	Regularly	5	POA	Call	QA TR
Building TOPLink Enabled Java Applications	14/4	3	1150	Southampton	OBJE	Mastering Web Site Development using Visual InterDev	Regularly	5	POA	Call	QA TR
Building TOPLink Enabled Java Applications	14/6	3	1150	Southampton	OBJE	Win32 Programming Essentials	Regularly	5	POA	Call	QA TR
Object-Oriented Concepts Analysis & Design	Call	3	Call	Southampton	OBJE	Developing ActiveX Controls and Components	Regularly	5	POA	Call	QA TR
Object-Oriented Analysis and Design using the Booch Method	Regularly	4	POA	Call	QA TR	Windows Programming in C	Regularly	5	POA	Call	QA TR
Object-Oriented Analysis and Design using Rumbaugh's OMT	Regularly	5	POA	Call	QA TR	Windows Programming with Visual C++ and the MFC Library	Regularly	5	POA	Call	QA TR
Developing CORBA Applications	Regularly	3	POA	Call	QA TR	Building Applications with MS Transaction Server	Regularly	5	POA	Call	QA TR
Object-Oriented Design for C++ Development	Regularly	5	POA	Call	QA TR	Fasttrack Windows NT 5 for Developers	Regularly	2	POA	Call	QA TR
Overview of Distributed Objects	Regularly	1	POA	Call	QA TR	Windows OLE Programming with the MFC Library	Regularly	5	POA	Call	QA TR
Object-Oriented Primer	Regularly	1	POA	Call	QA TR	Developing OLE/ActiveX Controls with the MFC Library	Regularly	5	POA	Call	QA TR
Object-Oriented Software Development	Regularly	3	POA	Call	QA TR	Windows OLE System Programming	Regularly	5	POA	Call	QA TR
Object-Oriented Analysis and Design using the Unified Modelling Language	Regularly	5	POA	Call	QA TR	Assembler	01/03/96	4	£995	call	VERH
						Assembler	26/04/99	4	£995	call	VERH
						Assembler	26/07/99	4	£995	call	VERH
						Assembler	13/09/99	4	£995	call	VERH
						Assembler	18/10/99	4	£995	call	VERH
						Assembler	29/11/99	4	£995	call	VERH
						Structured COBOL	19/4/99	4	£895	call	VERH
						Structured COBOL	21/06/99	4	£895	call	VERH
						Structured COBOL	09/08/99	4	£895	call	VERH
						Structured COBOL	20/09/99	4	£895	call	VERH
						Structured COBOL	25/10/99	4	£895	call	VERH
						Advanced COBOL	04/05/99	4	£895	call	VERH
						Advanced COBOL	05/07/99	4	£895	call	VERH
						Advanced COBOL	04/10/99	4	£895	call	VERH
						Advanced COBOL	08/11/99	4	£895	call	VERH
						Visual Age COBOL	Call	3	POA	call	VERH
						COBOL LE370	Call	2	POA	call	VERH
						PL/1	10/05/99	5	£1195	call	VERH
						PL/1	11/10/99	5	£1195	call	VERH
						REXX	08/03/99	4	£895	call	VERH
						REXX	16/08/99	4	£895	call	VERH
						REXX	04/05/99	4	£895	call	VERH
						REXX	15/11/99	4	£895	call	VERH
						JSP	10/04/99	3	£895	call	VERH
						JSP	14/06/99	3	£895	call	VERH
						JSP	13/09/99	3	£895	call	VERH
						JSP	18/10/99	3	£895	call	VERH
						SMP/E	02/06/99	3	£750	call	VERH
						Visual Basic 5 Programming	22/03/99	5	£995	call	VERH
						Visual Basic 5 Programming	10/05/99	5	£995	call	VERH
						Visual Basic 5 Programming	12/07/99	5	£995	call	VERH
						Visual Basic 5 Programming	13/09/99	5	£995	call	VERH
						Visual Basic 5 Programming	01/11/99	5	£995	call	VERH
						Visual Basic 5 Advanced	19/04/99	5	£995	call	VERH
						Visual Basic 5 Advanced	14/06/99	5	£995	call	VERH
						Visual Basic 5 Advanced	09/08/99	5	£995	call	VERH
						Visual Basic 5 Advanced	04/10/99	5	£995	call	VERH
						Visual Basic 5 Advanced	08/11/99	5	£995	call	VERH
						C Language Programming	29/03/99	4	£895	call	VERH
						C Language Programming	24/05/99	4	£895	call	VERH

OFFICE SYSTEMS

MS Office General	Regularly	2	£700	Call	DU TH
MS Office Word - Introduction, Intermediate, Advanced	Regularly	3	£700	Call	DU TH
MS Office Word - Mailmerge, Forms and Desktop Publishing	Regularly	2	£500	Call	DU TH
MS Office PowerPoint - Introduction	Regularly	1	£245	Call	DU TH
MS Office PowerPoint - Advanced	Regularly	1	£245	Call	DU TH
MS Office Project - Introduction	Regularly	1	£245	Call	DU TH
MS Office Project - Advanced	Regularly	1	£245	Call	DU TH
MS Office Publisher - Using	Regularly	1	£245	Call	DU TH
MS Office Excel - Worksheets	Regularly	1	£245	Call	DU TH
MS Office Excel - Advncd, Charting & Organising Data	Regularly	2	£450	Call	DU TH

PC SUPPORT

Advanced PC Support	Regularly	4	POA	Call	QA TR
PC Fundamentals	Regularly	3	POA	Call	QA TR
PC Support	Regularly	4	POA	Call	QA TR

PROGRAMMING

COM/Automation/ActiveX	Regularly	1	300	On-Site	Clip
Active Template Library (ATL)	Regularly	1	300	On-Site	Clip
ActiveX with Visual Basic	Regularly	1	300	On-Site	Clip
DCOM	Regularly	1	300	On-Site	Clip
MTS	Regularly	1	300	On-Site	Clip
Windows Shell Namespace Extensions	Regularly	1	300	On-Site	Clip
MFC and ActiveX Document Editing	Regularly	1	300	On-Site	Clip
Internet Content Delivery with DirectX	Regularly	1	300	On-Site	Clip
Usability Engineering	Regularly	1	300	On-Site	Clip
Diagramming, ImagineModelling & Simulation	Regularly	1	300	On-Site	Clip
Direct3D	Regularly	1	300	On-Site	Clip
MMC Snap-Ins	Regularly	1	300	On-Site	Clip
Delphi - Introduction	Regularly	3	£900	Call	DU TH
Delphi - Advanced	Regularly	2	£700	Call	DU TH
C++ Builder - Introduction	Regularly	2	£700	Call	DU TH
C++ Builder - Advanced	Regularly	3	£900	Call	DU TH
JBuilder Foundation	Regularly	5	£1,600	Call	DU TH

SOFTWARE TRAINING GUIDE

Course	Date	Days	Cost	Place	Company	COMPANY DETAILS
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C Language Programming	19/07/99	4	£895	call	VERH
C Language Programming	Call	4	£895	call	VERH
C Language Programming	29/11/99	4	£895	call	VERH
C++ OOP	06/04/99	4	£895	call	VERH
C++ OOP	25/11/99	4	£895	call	VERH
Visual C++	Call	4	POA	call	VERH
JAVA	15/03/99	5	£1,195	call	VERH
JAVA	07/06/99	5	£1,195	call	VERH
JAVA	27/09/99	5	£1,195	call	VERH
JAVA	06/12/99	5	£1,195	call	VERH
MS SQL Server Programming	15/03/99	3	£750	call	VERH
MS SQL Server Programming	24/05/99	3	£750	call	VERH
MS SQL Server Programming	04/10/99	3	£750	call	VERH
Object Oriented Design	17/05/99	4	£895	call	VERH
Object Oriented Design	06/09/99	4	£895	call	VERH
Delphi 2	Call	4	POA	call	VERH
SmallTalk and Visual Age	Call	4	POA	call	VERH

PROJECT MANAGEMENT

Managing Enterprise Software Development Projects	Regularly	3	POA	Call	QA TR
DSDM Practitioner	Regularly	3	POA	Call	QA TR
Project Management Skills	Regularly	4	POA	Call	QA TR

UNIX

UNIX Fundamentals	Regularly	4	POA	Call	QA TR
UNIX Programming	Regularly	5	POA	Call	QA TR
UNIX Systems Administration	Regularly	4	POA	Call	QA TR
Mastering UNIX Shell Scripts	Regularly	4	POA	Call	QA TR
Solaris Systems Administration	Regularly	4	POA	Call	QA TR

WINDOWS NT

Advanced Win32 Multithreading	Regularly	2	600	On-Site	Clip
Win32 Systems & Network Programming	Regularly	2	600	On-Site	Clip
Windows 2000 Security Programming	Regularly	1	300	On-Site	Clip
Administering Microsoft Windows NT 4.x	Regularly	3	POA	Call	QA TR
Supporting Windows NT Server 4.x - Enterprise Technologies	Regularly	5	POA	Call	QA TR
Supporting Windows NT 4.x - Core Technologies	Regularly	5	POA	Call	QA TR
Supporting Microsoft Systems Management Server	Regularly	5	POA	Call	QA TR
Supporting Microsoft SNA Server V4	Regularly	5	POA	Call	QA TR
Windows NT 4.x Essentials	Regularly	4	POA	Call	QA TR
Windows NT 5 Essentials	Regularly	5	POA	Call	QA TR
Supporting Windows NT 4.x Servers	Regularly	4	POA	Call	QA TR
Implementing Windows NT 5 Active Directory	Regularly	3	POA	Call	QA TR

GROUP TRAINING COURSES

OBJECT ORIENTED TECHNOLOGY

Practical Object Oriented Analysis and Design Using UML	Call	5	Call	Call	CRA G
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REAL TIME EMBEDDED SYSTEMS

Object Oriented Analysis and Design Using UML for Realtime Systems	Call	5	Call	Call	CRA G
Structured Analysis and Design for Real-time Systems	Call	4	Call	Call	CRA G

Key CRA G CRA G Systems

178 Bath Road, Thatcham, Berkshire, RG18 3HJ

Tel: 01635 873670 Fax: 01635 868557

Email: exelist@cragssystems.co.uk

Web Site: <http://www.cragssystems.co.uk>

CRA G Systems provides both public and on-site training courses and consultancy for the object oriented and structured analysis and design of both business information and real-time embedded systems. The object oriented method is based on the industry standard syntax of the Unified Modeling Language (UML). The structured method is based on the industry standard Yourdon method with Ward-Mellor real-time extensions. Stress is placed on the practice of defining requirements and turning them into an integrated model that can be implemented in the specified target environment. Students spend a large part of each course creating models of real requirements and solutions using a suitable case tool.

Key DU TH Dunstan Thomas

Enterprise House, Isambard Brunel Road, Portsmouth, PO12RX

Tel (01705) 822254 Fax 01705 823999 Web Site: www.dthomas.co.uk

Dunstan Thomas are a leading business IT consulting, systems integration, software development and training organisation. With an excellent track record since 1986 we provide a complete and comprehensive set of services to meet all the IT needs of our customers. Being Microsoft, Inprise/Borland and ISO9002 accredited, Dunstan Thomas can provide over 150 different end-user, power-user, and programmer training courses as well as special tailored tutoring. The courses can be run at our own training centre or on customer sites

Key CLIP Clipcode Ltd

24 Thomastown Road, Dun Laoghaire, Dublin, Ireland.

Tel: 0800-973420 Fax: +353-1-2350423 Email: training@clipcode.com Web:

<http://www.clipcode.com/europe>

Our business is leading-edge software engineering skills transfer. Consider Clipcode as an extension to your company's advanced technology group - we are continuously exploring the very latest software technologies and providing you with timely in-depth research on their use. Clipcode Training provides a wide-range of innovative training courses covering advanced Windows, Internet and Object technologies. These are available on-site throughout North America & Europe for six or more attendees. These may be presented "as is" or customised, combined and extended to suit your specific requirements.

Key QA TR QA Training Ltd

Cecily Hill Castle, Cirencester, Gloucestershire, GL7 2EF

Email: responsecentre@qatraining.com

Web: <http://www.qatraining.com> Tel no 01285 883388 Fax no 01285 883399

QA Training is widely recognised as the premier IT Training company in the UK and the largest provider of technical training to IT professionals. From over 70 classrooms at 7 dedicated training centres around the UK we offer over 150 programming and support courses. We are major business partners and accredited trainers of Compaq, Lotus, Microsoft, Novell, Oracle and Powersoft amongst other key industry players. More than that, we actually provide internal training to companies like Microsoft on their own products in advance of release. This makes us the first to understand and provide training and consultancy on the latest technologies to our customers.

Key OBJE The Object People Limited

Epsilon House, Chilworth Science Park, Southampton, SO16 7NS

Tel: 01703 769996 Fax: 01703 766066 Email: ukinfo@objectpeople.com

Web: <http://www.objectpeople.com/uk/>

The Object People have a world-wide reputation in assisting clients adopt and make successful progress with object technology. Services include: general Java and Smalltalk Training|Consultancy|Migration. We also specialise in VisualAge and VisualWorks. In addition, we provide courses to cover Object-Oriented Analysis and Design techniques, as well as Object Technology Management Overviews.

Our consultants/trainers are highly skilled in a wide range of development environments. We therefore offer a tailor-made Migration Service to assist transition to Java or Smalltalk from other OO languages or between different Smalltalk systems.

Key VERH Verhoef Training

11 Kingsmead Square, Bath, BA12AB, United Kingdom

Tel 01225 339705 Fax 01225 339671 Web: <http://www.verhoef.com>

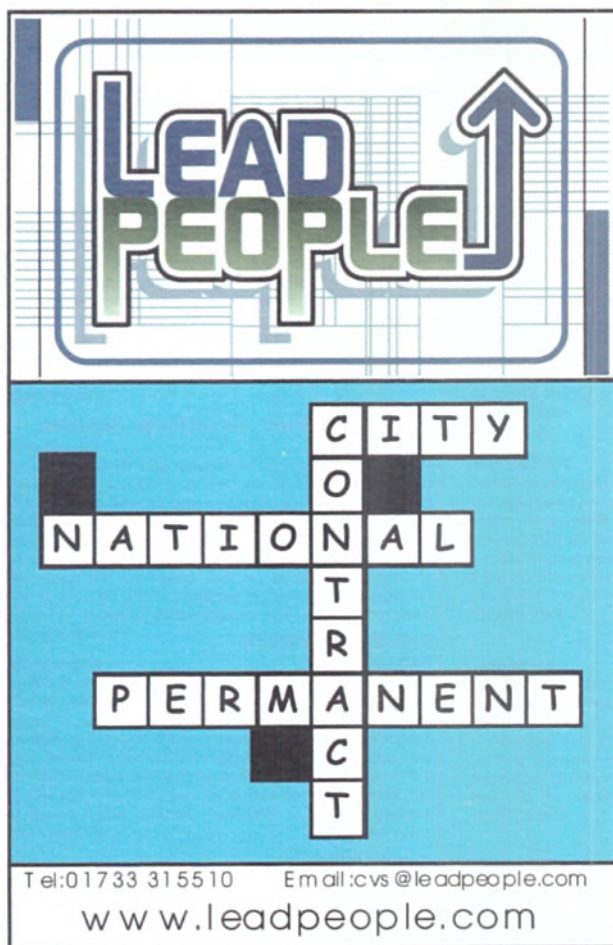
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EXE Software Training Guide, produced by EXE Magazine, Centaur Communications Ltd, St Giles House, 50 Poland Street, London W1V 4AX
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If you would like to include your Training Listings in our next guide, please call advertising on 0171 970 6547.

CAREERS & CONTRACTS

EXE brings you the cream of vacancies in the development and programming business.
For more information contact Sarah Horsley 0171 970 6545 Fax: 0171 970 6741 Email: sarahh@exe.co.uk



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Our expansion plans mean that we need the following technical staff:

- Development team leaders
- Experienced developers
- Experienced QA staff
- Support manager and staff

If you fit any of the above, and you have UNIX systems programming, WIN32 APIs or Novell NLM experience, then contact us now.

UK Technical Director: Ross Wakelin
+44 118 930 4224 email ukjobs@iss.net



Based in the Thames Valley, ISS Group Ltd. is a subsidiary of ISS Group Inc. and is tasked with producing the worlds leading host based security management tools.

Calling Serious Software Developers !

Compustaff specialise in recruiting software developers. Our clients range from multinationals through to small technologically innovative start ups. We are always looking for good developers. A selection of our latest vacancies is included below. For most positions a relocation package is on offer. If you consider yourself to be a truly competent developer then we would like to hear from you!

C	R&D Engineers, S/W Engineers and Support Programmers sought for award winning client. To £40k + 40% Bonus - Oxfordshire
C++	C++ developers sought for scientific software house. Gain exposure to a wide variety of other technologies. To £30k + benefits, M40 / A34
VB	Visual C++ / Inprise GUI developers. Various positions. To £40k + benefit, Midlands & South
VB	VB, Access, SQL Server 6.5, ODBC, NT4 To £35k + benefits, M40
VB	VB, SQL Server, Access. To £45k + banking benefits, City
VB	VB, SQL Server, Crystal Reports. To £30k, Hants
Delphi	Delphi on NT, VCL, GUI or Database experience. To £38k, M40
Java	Java Developers - Java, Java Beans, Graphical Modelling. To £34k, Oxfordshire, M40
Web	C++/C on NT plus VB, SQL, IIS, ASP, E Commerce To £35k, M4/M40
Web	Consultants - C++, NT, Unix, Perl, SGML/XML To £50k Midlands & M40

Telephone 01235 862737 Fax 862738 Email exe@compustaff.ltd.uk

In and Around West Yorkshire

We have clients currently seeking the following:

- Developer/Junior Consultant to develop application interfaces using Visual BASIC.....£25,000 to £30,000 + world wide travel
- C / C++ /UNIX Developer with SQL ability for Internet solutions & database work£18,000 to £25,000
- SQL/Visual BASIC Developers for database applications.....£18,000 to £23,000
- C / C++ Developers for industrial & complex commercial development.....£18,000 to £23,000
- IBM Assembler (BAL) Programmers (can include re-training of forgotten skills!).....to £28,000
- Junior Programmer with Visual BASIC or Visual C skills for telephony applications.....£neg + strong career development
- C / C++ /Assembly Language Developers for real time applications.....£28,000
- C++ /HTML Developers for Internet applications£28,000
- Software Development Project Leader for small Visual BASIC development team£26,000 + car

For your next career move around West Yorkshire telephone
Vincent Atherton on Leeds (0113) 250 4560 or write to:
AIREDALE RECRUITMENT
Realtex House, Micklefield Lane, Rawdon, Leeds LS19 6AX

Airedale Recruitment

SOUTH WEST

0117 988 0000 • e.mail: southwest@compfutures.co.uk

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UK'S
LEADING SUPPLIER
OF I.T. STAFF

C/C++/VC++

0117 988 0000 • Mark Lodge

THE BEST SOLUTION

BATH **TO £25,000**
This high quality systems consultancy specialises in the development of embedded and real-time systems at the forefront of technology. Success has meant that young dynamic Software Engineers are sought with at least 18 months experience of the following skills: C/C++, Visual C++, ADA, Java, OOA/OOD. You will be expected to have excellent client/customer facing skills and will be working with successful companies on exciting projects. Suitable candidates should want to rapidly broaden their development experience with new languages and varied application environments. In addition to rapid career development they are offering high salaries and bonuses. (Ref:ML/8416)

TAKE ON THE WORLD

BRISTOL **TO £34,000**
As a result of continued expansion, this leader in the supply of direct marketing software and bespoke solutions to global organisations is looking for Senior Analyst programmers to get involved in all aspects of their development life cycle. A minimum of 4 years C or 2 years C++ development on a Windows NT or Unix platform is essential with any knowledge of ODBC and COM/DCOM an advantage. Based in their central Bristol software R & D offices, the right candidates will enjoy a full complement of benefits and the opportunity to travel if desired. (Ref:WH/1851)

DEMAND TO BE HEARD

WORCESTERSHIRE **TO £48,000**
Our client has been awarded Best Business to Business e-commerce Solution to name but one of its prestigious accolades. Setting the standards in the speech recognition industry our client uses leading edge technology within a fast moving, dynamic environment. A vacancy for a Software Engineer/Senior Developer has been created for the right candidate with approximately 2 years MS Visual C++ with MFC within a Windows 32 bit environment. You will receive excellent training, exposure to the latest technology, occasional travel to the states, a salary second to none and good career prospects. This is an opportunity not to be missed. (Ref:WH/8197)

UNIX - TRAIN TO OO, C++

SOMERSET **TO £35,000 +RELOC +BENS**
Our client's huge success hinges on maintaining their position at the cutting edge of modern technology. Urgent vacancies exist within a number of specialist divisions involved in various stages of the project lifecycle. You must have at least one year's experience within a Unix and C development environment but also desirable is one or more of the following: Windows NT, OO, C++. Extensive training, however, is offered in each area. Benefits include more than satisfactory relocation expenses for both home-owners and non-home owners, along with an extensive benefits package. (Ref:ML/6677)

UNRIVALLED BENEFITS

BRISTOL **£20-44,000 +BENS**
Be a part of history and join one of the world's leading providers of advanced digital communications solutions. Whether you are a graduate with 12 month's experience or a well seasoned Software Engineer, this is an opportunity to use your Unix/C and or C++ skills within a state of the art technical environment. You will be involved primarily in developing real-time software for our clients next generation mobile systems. On offer is a fantastic benefits package which includes: pension scheme, private health insurance, flexible working hours and 25 day holiday. (Ref:ML/7510)

APPLY NOW!

DORSET **TO £33,000**
Our client is a rapidly expanding Telecoms solutions provider with an impressive client base throughout the UK. Phenomenal success has meant they are now looking to recruit for a number of new positions from Graduate Software Engineer through to Senior Software Engineer with the following skills: C/C++ or Visual C++ and Windows (V95/NT). You will work on a variety of exciting projects using the latest technologies. In return you can expect to receive a competitive salary, health and life insurance and 20 days holiday. (Ref:ML/8797)

WEB NOTES

0117 988 0000 • Peter Shawyer

JAVA/CORBA/E-COMMERCE CONSULTANTS

BATH/WILTSHIRE **£20-50,000**
This exciting, progressive software house urgently seek several developers for front-end and back-end Web/Intranet development projects. Whether you are a junior programmer or a project leader, if you have at least one year's experience in any of HTML, JavaScript, Java, ASP, Perl/CGI you can gain skills in the development tools you do not already know along with COM/DCOM & CORBA. Excellent scope for career progression, superb salaries, bonuses and flexible working arrangements make this the opportunity all aspiring Web developers cannot afford to miss. (Ref:PS/9497)

NOTABLY HOMELY

WILTSHIRE **TO £30,000**
Two CLP level developers are sought to specialise in Notes-based Intranet development projects for this Lotus business partner. If you have at least 1 year's Notes applications development experience, you can enhance those skills, gain exposure to Internet development technologies and earn a lucrative salary plus bonus; all of this plus the option to work in the comfort of your own home, spending just 2-3 days per month in the office, if you so wish. (Ref:PS/9200)

JAVAMOBILE

BRISTOL **£20-30,000**
This well-reputed provider of hi-tec solutions to the finance, telecoms and government sectors, urgently require Java developers at all levels. If you have a minimum of one year's Java programming experience, you can get involved in cutting-edge Internet/Intranet delivery projects, gain x-training to Corba and Oracle and earn an excellent package in a high-profile role with possibilities of UK and international travel. (Ref:PS/8581)

BOUNDLESS POSSIBILITIES

GLOUCESTERSHIRE **£28-35,000**
This extremely successful provider of Web-centric solutions to a variety of sectors urgently require several Web professionals. Whether you are a developer with knowledge of ATL, HTML, VB, Java, COM, C/C++ (any blend thereof) or an experienced web designer with a creative outlook and good general multimedia skills, you can become part of the South West's major IT success story. The scope for career progression, the marketability you will gain through both the training and prestige of working here, along with the irresistible package, make this an awesome opportunity. (Ref:PS/9588)

LOTUS NOTES - GAIN DOMINO

BRISTOL **TO £30,000**
This pioneering Notes Consultancy now need to recruit two Developers to join the burgeoning Lotus Notes Development team. Ideally you will have at least six months experience developing in Domino although X-training to Domino is available for those who can demonstrate a good understanding of Notes V4.x development. To find out more about this superb training opportunity and the fantastic package on offer, call today. (Ref:PS/9417)

REWARD YOURSELF

SOMERSET **TO £50,000 +CAR**
This dynamic software house, a leading provider of Intranet and Java applications, urgently require Java and Corba Developers at all levels, ideally with e-commerce, management and strategy experience. These opportunities encompass pioneering Web-centric development projects, accredited training in Java and Corba, irresistible remuneration packages, bonuses and car. (Ref:PS/8683)

S. WEST	C++, ASP, VB, DCOM DEVELOPERS	£18-36,000
BRISTOL	INTRANET A/P, C/C++, ASP GAIN JAVA	TO £35,000
BRISTOL	JAVA A/P, WEB/E-COMMERCE	TO £33,000
BATH	WEB DESIGNER, DIRECTOR, HTML	TO £20,000
BATH	JAVA CONSULTANTS, E-COMMERCE	TO £40,000
WILTS	JAVA/CORBA, OO DEVELOPERS	£20-35,000
WILTS	INTERNET CONSULTANTS, ALL LEVELS	£20-40,000
WORCS	OO/WEB DEVELOPERS - GAIN JAVA	TO £35,000
GLOS	WEB/INTERNET SYSTEMS DESIGNERS	TO £35,000
GLOS	NOTES/DOMINO DEVELOPERS	£25-30,000
WILTS	NOTES A/P's (CLP), WORK FROM HOME	TO £36,000
DORSET	NOTES DEVELOPERS & ADMIN	£15-32,000
DORSET	HTML, DIRECTOR, PHOTOSHOP	TO £21,000
BRISTOL	WEB/MULTIMEDIA DESIGNERS	£18-25,000

VB/SQL SVR

0117 988 0000 • Peter Bennett

PROGRAMMERS TO SENIOR A/P'S

WILTSHIRE **£22-35,000**
Specialising in Microsoft SQL Server database technologies our client has established itself as a leader in the development of enterprise wide software solutions. If you have 6 months experience in Visual Basic v4/5/6, SQL Server 6.5/7 then apply now to work within this relaxed but dynamic environment. This unique opportunity will cross train you to the latest Microsoft technologies as and when required encouraging you towards MCS D status. Apply now and receive a structured career, high salary and full benefits. (Ref:DV/9885)

DOCUMENT MGMT, WORKFLOW, IMAGING

BATH **£21-38,000**
Our client is one of the largest and most prestigious consultancy firms in the world. 5 Senior Consultants/Consultants are now urgently required with experience in any of the following: Workflow Implementation, Document Management, Imaging, Data Capture, Systems Integration. You will be involved in the full project lifecycle, utilising and building on your expertise. The successful candidate will receive an excellent salary, training as and when required and a generous benefits package. (Ref:DV/9783)

SHARE THE WEALTH

BRISTOL **£18-38,000**
Our client employs 2000 staff worldwide providing software and services to the securities industry. Within this dynamic environment Developers through to Senior Analyst/Programmers are now urgently required to develop their software through its full project life cycle. You will have a minimum 6 months experience in Visual Basic v4/5/6 and SQL Server 6.5/7. As well as an excellent salary you will be working within a flexible, leading edge hands-on environment. (Ref:DV/9883)

SLICK VACANCY

WILTSHIRE **TO £30,000 +BENS**
Our client is a specialist lubricants and chemicals manufacturer with operations in over 50 countries worldwide. Vacancies exist within there IS department for 4 A/P's with at least 12 months experience of 1 of the following: Visual Basic (v5/4), Access 97 and SQL Server 6.5/7.0. You will be responsible for the development of cross-business applications for deployment throughout the world. On offer are excellent salaries, full benefits package and an opportunity to receive technical skills training into other leading edge technologies. (Ref:DV/9348)

WHAT A JOB!

NORTH GLOS **TO £31,000 +BENS**
This well established and highly successful software house urgently requires a graduate with at least 2 years experience designing, developing and testing a multi-user Visual basic 4/5 and SQL Server 6/6.5 application. Experience of the following would be advantageous although full training will be given: Rational Rose, Active X controls and components, COM/DCOM and SQL Server. If you are not already at MCS D status then full training to this is mandatory. Apply now and receive a healthy salary with full benefits and in/out house training. (Ref:VB/9413)

VB/ACTIVE X DEVELOPERS X5

WILTSHIRE **TO £30,000 +BENS**
Our client is one of the leading suppliers of IT solutions to the Emergency Services in the UK. Opportunities have been created to work on a leading edge technology project from inception through its full life cycle. The ideal candidates will have at least 12 months experience developing user interfaces for n-tier client-server systems using Visual Basic 4/5 and Active X. On offer are excellent salaries and an extensive benefits package. (Ref:VB/8864)

COMPUTER
FUTURES

SOUTH WEST

Tel: 0117 988 0000 (9am-7pm)
Fax: 0117 975 0195
eves/weekends Tel: 0468 166696
18-21 Queen Square, Bristol BS1 4NH
e.mail: southwest@compfutures.co.uk
website: http://www.compfutures.co.uk



COMPUTER
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CAREERS & CONTRACTS

EXE brings you the cream of vacancies in the development and programming business.
For more information contact Sarah Horsley 0171 970 6545 Fax: 0171 970 6741 Email: sarahh@exe.co.uk

REAL TIME

If you have good C, C++, Visual Basic or Firmware

from 1-10 years' experience in a technical computing environment and are degree qualified, we have permanent vacancies with client companies throughout the UK developing state of the art technology.

SALARIES TO £50K

For further details telephone or send CV to

John Ford Recruitment,

63 Wood Street, Barnet, Herts EN5 4BT

Telephone: 0181 447 1143 Fax: 0181 449 9248

E-mail: jford@atlas.co.uk

Web: <http://www.johnford.co.uk>



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Ninety four per cent of candidates using Connections, in response to a recent survey, have successfully been found a position which promised greater career prospects and, furthermore, higher salaries.

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Fax: 01189 893322

Email: mail@unixjobs.co.uk
Or visit www.connectionsgroup.co.uk

CONNECTIONS

THE SOFTWARE DEVELOPERS' MAGAZINE

EXE



Let EXE help you to promote your company

Take advantage of our Reprint Service for your own promotional purposes. We can print up articles which mention your company (as they appear in the magazine) as separate brochures and leaflets. We can also add your company information or an advert, depending on layout.

Please call Kate Adams on 0171 970 4000 for details and costs.

WINDOWS

VISUAL C++

3.1/NT/95

VISUAL BASIC

'C'/C++

DELPHI

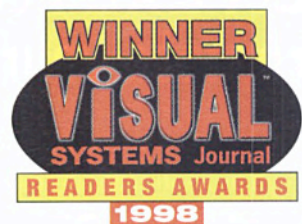
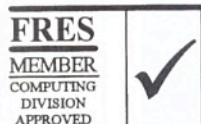
JAVA

APPLE

MULTIMEDIA

If you have development or support skills in any of the above and you are looking for a permanent or contract position, then we can help you find the right opportunity.

Logistix



Logistix Recruitment Limited, Lamb House, Church Street, Chiswick Mall,
London W4 2PD Fax: 0181 742 3061 E-Mail: logistix@atlas.co.uk
Website: www.atlas.co.uk/logistix

Telephone: 0181 742 3060

Visual C++ -Telecomms
London Up to £30,000

A small but well-established and successful software consultancy to the mobile Telecomms sector require developers with at least two years of commercial experience in Visual C++ MFC. You will be developing tools for mobile network optimisation and enhancement.

Ref:JA-101/E

C++ - JAVA - NT - UNIX
London £30,000 + Bens

This is a wide ranging role from designing solutions, and creating specifications to writing code. You must possess skills in C++, C, Java, HTML, NT or UNIX, and Coldfusion and be familiar with Internet and Web technologies. Working on projects at the forefront of the Web.

Ref:LP-102/E

Delphi Developers

London Up to £35,000

My client, a major insurance underwriter has an ongoing requirement for GOOD Delphi Developers. You must be an experienced client server developer with a minimum of 2 years of Delphi. Ideally as much version 3 as possible, plus exposure to Sybase or SQL server.

Ref:AR-103/E

MAD FOR IT - Visual Basic

Manchester Up to £32,000

Have you got at least 1 years Visual Basic programming experience in addition to Windows NT exposure. Do you fancy developing & designing GUI customer support interfaces, for international client base? Then this is the opportunity for you!!!!

Ref:CH-104/E

Visual C++ MFC

Cambridge Salary to £36,000

Experienced Visual C++ MFC developer with at least 3 years commercial experience in a development environment is required. Ideally you will have skills in graphical application and device driver development as well as knowledge of DirectX, ActiveX, COM and OpenGL.

Ref: PG-105/E

3DFX, VODOO & Glide

Watford £28,000 + Bens

Well known in the fast growing graphics market, this company produce the latest graphics systems including Voodoo II cards. We are looking for a software engineer with experience of graphics technology and device drivers. Good C++ or Visual C++ programming skills for 95/98/NT are essential.

Ref:MD-115/E

Oracle Development

Middlesex £30-50,000 + Ex Bens

One of the 12 most influential companies in IT. Cutting edge US software house now require Oracle developers with a minimum 2 years gained in commercial development of Oracle applications and similar RDBMS. Degree educated and Major Vendor experience preferred

Ref:MB-106/E

DIGITAL &/OR DSP

Hayes, Middx £40,000 p.a.

This multimedia company require a person with a very high technical aptitude. You will have at least 2 years Digital knowledge and DSP, including DSP boards (SHARC, MSDN). Other useful skills include CAD, Cadstar, Analogue, 'C' and the competence to be a senior engineer.

Ref:NB-107/E

JAVA - Expert

London (City) £40,000 upwards

JAVA developer required by this high level consultancy. You need to be degree educated and possess excellent JAVA experience (at least 3 years) along with JDK and J-Builder. With development projects on NT & UNIX, experience of both is required.

Ref: DL-108/E

C, C++, J++, Delphi, SQL (Software Engineers)

Fleet,Hants to £35,000

Experienced Software Engineers for a software house required with a broad mix of skills to include C/C++, J++, Delphi, SQL on Windows NT, Unix (SCO, Solaris, AIX or Linux preferred). Any Oracle or SQL Server would be advantageous. If you have all or some of the above and want experience on all!!!

Ref:JS-109/E

Visual C++ Prototyping

Cambridge to £30,000 + Bens

A unique opportunity has arisen with a Scientific Software House to work on a brand new development, producing Prototype Visual C++ applications for an Oracle v8 Database. You need to be a flexible Team Player with an interest in working in the very latest technologies.

Ref:ID-110/E

Visual C++/Visual Basic

Nr Tonbridge, Kent to £28,000

Visual C++/Visual Basic, OOD Software Engineers are required to develop diagnostic medical products based on DNA imaging. Good academic background required with a strong knowledge of either Visual Basic or Visual C++ with a strong orientation towards O/O Design.

Ref:RR-111/E

Delphi Team Leader

Weybridge, Surrey to £37,000 + Benefits

Delphi team leader required to work for a leading information company. You will lead a team of developers through the entire product lifecycle, as well as upgrading existing systems. You will have at least 2 years Delphi experience with 6 months held in a Senior Hands on Position.

Ref:NN-112/E

Visual Basic

Epsom, Surrey to £25,000 + Bens

Visual Basic developer required to work for a leading Software Development house. You will be working with some of the best Visual Basic developers in the country and you will be working on market leading software packages. You will have at least 6 months VB development experience.

Ref:GR-113/E

Visual C++/JAVA

Watford, Herts to £22,000

Visual C++/Java Developers required by UK's leading centre of expertise on building and construction. You will be a recent graduate with a degree in an IT related subject and have either academic or commercial experience of Visual C++ and Java.

Ref:JC-114/E

Ba

World class *training* for Delphi professionals

Learn from the best

All our lecturers are developers themselves and are experts in the topics they teach.

Hands-on training

All our courses are hands-on with a high practical content.

Personal attention

All our courses are limited to a maximum of six delegates.

Wide range of courses

Delphi fundamentals, database, Web development, client/server, MIDAS, object programming with COM, and Internet programming are all covered.

new Free telephone support *new*

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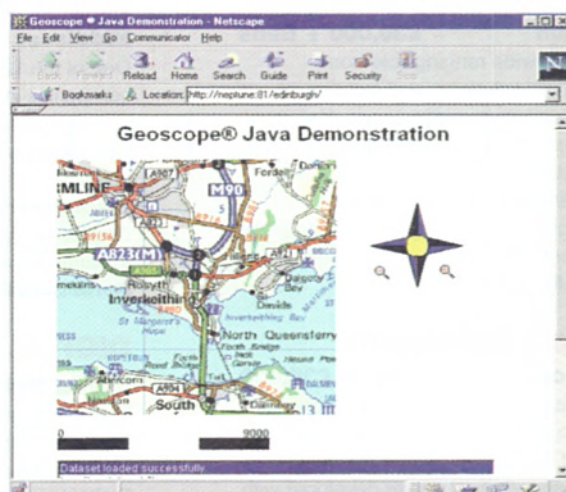
GeoScope® Java

Java Bean for Internet mapping

GeoScope® Java lets you create Internet and Intranet applications and applets with vector and raster colour maps. Platform-independent, versatile and robust, GeoScope will save you time and money in building applications with custom Internet mapping. For live demos, point at:

<http://www.webmapserver.com/>

WebMapServer CGI toolkit lets you create Internet colour raster mapping applications with pan, zoom & map query.



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MapServer Pro

Toolkits for mapping in Windows

MapServer Pro includes MapServer 4 and transparent overlays and double buffering of screen displays for real-time mapping such as vehicle tracking with satellite GPS.

MapServer 4 DLL, OCX & VCL let you build custom map applications in your preferred development environment and language for Windows95/98/NT. Includes import of vector and raster map data, pan, zoom, query of map objects and map extents, layer selection and turn on/off, spatial query, tiling and printing.

RouteFinda for shortest route analysis between two points in huge networks such as streets, railways or telecoms. High-level indexing gives fast results in lists or on map overlays.

*Toolkits for mapping in Windows sold
with royalty-free run-time licence.*

Graticule 2 Blenheim Court, Leeds, LS2 9AE, UK
Tel: +44 (0)113 234 4000 Fax: +44 (0)113 246 5071
<http://www.graticule.com> sales@graticule.com

The Bore Report

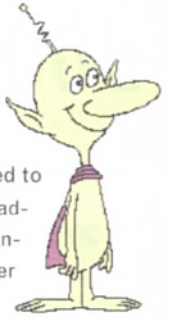
Greetings, readers! Investigative reporter Robert Bore here again, with the scoop on more low-down goings on in Codeland. I'll stop at nothing to bring you the stories you have a RIGHT to know about, especially if THEY don't want you to know about them. Right now, I'm hot on the trail of possible extraterrestrial interference in our Earthly programming matters.

Yes, readers, the hot tip is that *object-oriented programming*, otherwise known as OOP, OOPS, or BUGGER depending on where you come from, is actually the fruit of a decades-long super-secret NSA-sponsored CIA-run USAF-staffed black project to back-engineer the contents of an extraterrestrial operating system called *Wi'n'Do'os Eh'n't'EE* which even now masquerades as the rightful work of one of our biggest software companies. The scale of this Project is terrifying.

My source, an ex-CIA/NSA/USAF/GCHQ/GBH/FAQ/ASAP programmer who actually worked on the alien code, had this to say:

'You have to understand, in those days we thought code was supposed to come in one long chunk, from the top to the bottom. Someone – I think it was maybe Niklaus Wirth – had suggested the idea of *structures*, and we were having a hard time coping with it. Then we got hold of the code from

S4 and it had these weird things called *objects*. The code was written in a totally alien language, full of incomprehensible symbols and words. We later found out it was called "C++". Well, we didn't think the world was ready for that, so Brian and Dennis worked out how to dumb it down and called it "C". Then, when people had got used to that, we got Bjarne to pretend he'd invented C++, and gradually sneaked out more and more of it through the ISO standards committee – thanks to our man on the inside. I never knew his name... but his codename was "GlassMan".'



My contact went on to describe how he would be driven each day to a super-secret facility on the outskirts of Bognor Regis to work on the code. One day, he walked by a usually-closed door, now open, and caught a glimpse of what he believes was an *extraterrestrial biological entity*.

'It was hideous. It had these big round eyes – well, actually I think they were glasses – and a terrible haircut. It was running around the hangar, showing the project leaders how the operating system worked. Only I think it kept crashing. One of my managers, he shouldn't have told me but he did, apparently its name was *B'i'LG'aat's*. I think it escaped sometime in the 70s.'

Next month, I investigate the mysterious link between Common LISP and the Ancient Illuminated Seers of Bavaria – better known as *the Illuminati*. Until then remember, you're not paranoid if they really are out to get you.

Project Aura

Have you ever dreamed of sitting at one of those futuristic workstations on the bridge of the *USS Enterprise*? Or for that matter any other fictional space vessel to grace the small screen – especially the one with those really cool flat panel TVs in 2001: A Space Odyssey's *Discovery*, which can pick up BBC12? You have? Then welcome to the future, my friend.

offers complete electronic controllability, with lumbar, dorsal, tilt, and seat length adjustments. It includes electronically inflatable/deflatable cushions that ensure maximum contouring to prevent numbness caused by restricted blood circulation. And it permits multiple users to program their seating preferences into a single module.' Imagine – no more numb bum syndrome!



The overhead module provides customisable lighting and airflow systems, while the whole kit and caboodle rotates through 180° to change your line of sight and keep that pesky direct sunlight off your screen.

The system is especially designed with programmers in mind, and we think it's nearly perfect. Only the addition of a hi-fi system and Jolt dispensing nozzle is required to achieve a glare-free, non-numb, temperature regulated, airflow controlled, rotary coding nirvana.

Poetic Technologies – makers of Aura – if you happen to be reading... we want one. Make it so!



This is Aura (www.poetictech.com/aura/aura.html) and, unless we're very much mistaken, it's the workstation of tomorrow. And if it isn't, it should be. Imagine an office filled with row upon row of Auras – your office! You too can create the kind of chamber normally only seen in *Invasion of the Body-snatchers*, or its rather less inspiring remakes. Everything about Aura is futuristic. Take the seating, for example: 'Aura's seating system

Final freebie

Yes, it's true. This is the final Freebie of the Month. As much as we have enjoyed exposing the excesses of the software industry's gift culture, it has to stop somewhere. So we're getting out, before the joke wears thin (actually, the joke ran thin several months ago, but we just figured no one was reading this bit).

This month's tasteful gift is as sexy as it is yellow. And it's very yellow. The hard hat is the headgear of choice for construction workers and 70s pop stars alike, and now you can own your very own, decorated with merely a handful of tasteful Microsoft Site Server logos. Yes! We're giving away this yellow object of desire to the first reader who can answer this simple question:

Why are manhole covers circular?

The hat comes with EXE's guarantee of durability – during the time it's been in our office, practically everyone has been hit on the head with a girder while wearing it, and it hasn't affected any of us! We're still all as sane and *compos mentis* as we always have been. Wibble.

Answers on a postcard to **The Great EXE Yellow Hat Competition, EXE Magazine, St. Giles House, 50 Poland Street, LONDON W1V 4AX**, to reach us by 31st March 1999. The winner will be announced in a future issue.



Book of Yoc-am (contd)

Inprise has yet again turned in poor financial results, is laying off 20% of its workforce, and is once more restructuring.



Borland becomes Inprise (recap)

1. And it came to pass that the sons of Kahn, who had been known as the Borland-ites, announced that henceforth they were somewhat unconvincingly to be known as the Inprise-ites.
2. So the Elders of the tribe, called 'the usual suspects', were dragged forth to proclaim that Inprise was in safe hands and that its values had changeth not. And Zackur-Lockur burnt his Borland T-shirts in public, and Giant I wrote jolly articles for the web site, and Char Leecalvert went unto the newsgroups of the Internet, yea unto the very pits of dirt and filth of the earth.
3. And they cried out, saying: All is well! All is well!
4. But all was not well.
5. For it seemed that the tribe had departed far from the narrow path of wisdom, and instead wandered dangerously by night in the rain and spray on the Inter-State Highway of Folly, stumbling amongst the high speed traffic-burdened lanes, presenting a danger both unto itself and to others.
6. Moreover, to stretch the metaphor way beyond its limit, the sons of Kahn were not a bright yellow reflective high-visibility jacket.

Small prophet, quick return

1. Now at that time the sons of Kahn were led by a man named Del Yoc-am. And *this* Yoc-am had dreamed a dream that he would become as that Oracle bloke, who is much interviewed in the press and upon the television, and who is by all accounts loaded. And when Yoc-am awoke, he was well pleased with this dream.
2. Thus Yoc-am reasoned unto himself: All he doth is charge lots and lots of money for all his software. I shall go and do likewise, and then I too shall have my photograph in *Time* magazine, and be called forth to deliver opinions about the future of the Internet on the Letterman show.
3. So Yoc-am took himself a basket, and filled it to the brim with freshly harvested Delphi, and went down from the valley of the Scotts unto the market place.

4. And there chanced that way a small developer. And the small developer hailed Yoc-am saying: Greetings brother! How much for an upgrade to client/server?
5. And Yoc-am answered, saying: Twelve hundred shekels to you.
6. Then the developer replied, saying: No, no; just the upgrade please. I *already* have a copy of the previous version.
7. But Yoc-am answered, saying: I heard you correctly. It's twelve hundred shekels for the upgrade. The full version costs thirteen-fifty.
8. And the developer *cried out* involuntarily, saying: Blimey O'Riley!
9. Then the developer had a closer look at Yoc-am's basket, and he saw that the Delphi was infested with maggots and *crawling things*. And he spake unto Yoc-am, saying: I think I'll take a pass on this one, thanks all the same squire.
10. And in a while there chanced that way a corporate developer. And the corporate developer hailed Yoc-am saying: Greetings. Where can I find an agent for the tribe of Mic-rosoftees?
11. And Yoc-am answered, saying: Over there.
12. And the corporate developer thanked Yoc-am saying: Thanks.
13. And Yoc-am called out unto the corporate developer, saying: Just a minute. But the corporate developer was *deep* in conversation with the Mic-rosoftee, and heard him not.
14. Thus, after many more similar failures, Yoc-am went back up to the valley of the Scotts with a full basket.

He coming of borland.com

1. And the Nasdaq looked down upon the labours of Yoc-am, and it was mightily unimpressed.
2. And Yoc-am *in turn* looked upon the wrath of Nasdaq, and was sore afraid. And he spake boldly unto his shareholders, saying: I shall slay one in every five of the sons of Kahn, it is the aggressive and logical thing to do. Moreover I shall create a new division called borland.com which, having a lower case, shall be a *mighty* hit on the Internet. Oh, and it might be easier to sell that way.

3. Thus did Yoc-am do these things. He did slay one in every five of the sons of Kahn, and the valley of the Scotts ran red with their *blood*. And he did make a new division, and called it borland.com, and put in it most of what was left of Borland. And he did other stuff with the Visigenics bit of Inprise, which frankly is of *little* interest.
4. Moreover it came to pass that a great bemoaning went up among the borland.com-ites, who had been Inprise-ites, who had been Borland-ites. And when they began to get over the massacre, they cried out to one *another* saying: Who shall lead us in this our hour of great need? For surely the leadership of borland.com is a *can* of poisoned Kool-Aid with worms in it.
5. And there was heard a noise from the InterBase *cupboard*. And a little voice said: The door is stuck. Will somebody let me out?
6. And using his great and mighty strength, the Giant I unlocked the door using a key he happened to have.
7. And lo! They beheld a small bald man with a beard, blinking in the sunlight.
8. And the borland.com-ites, who had been Inprise-ites, who had been Borland-ites cried out with one voice saying: Our leader! Our leader!
9. In his dismay, the small man tried to run away, but the Giant I was standing on the tails of his coat, and he ran only in *little circles*.
10. Then Char Leecalvert burnt his Inprise T-shirts in public, and Zackur-Lockur wrote jolly articles for the web site, and Giant I went unto the newsgroups of the Internet, yea unto the very pits of dirt and filth of the earth.
11. And they cried out with one voice, saying: All is well! All is well!
12. But customers of the sons of Kahn remembered yet again the wisdom of the great English prophet M'andee-rice Davis. And *such* men began *costing* ports to Vi Su-Albabsic, just to be on the safe side. ■



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