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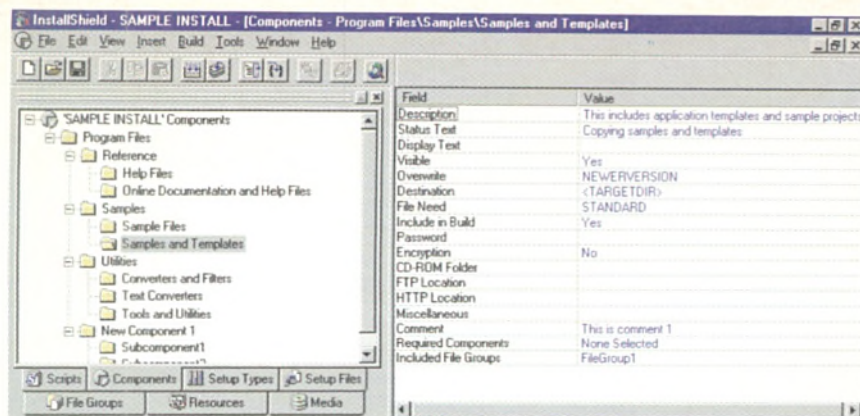
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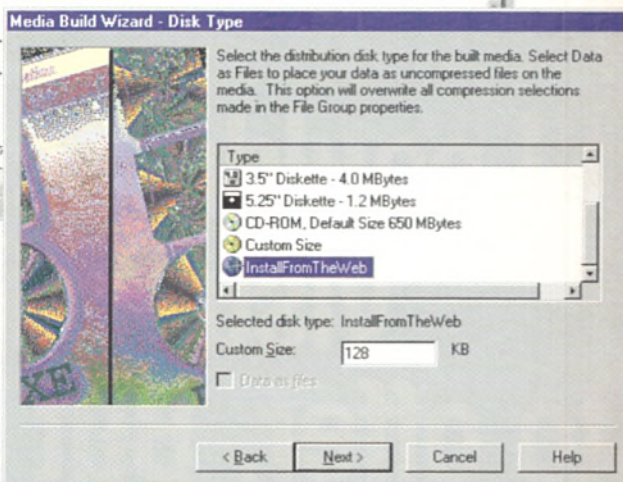


# FORWARD



Build started at March 6, 1997 10:58:06 AM.  
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Copying InstallShield engine files to Disk 1.  
Building system cabinet file 'sysl.cab'...  
Copying uncompressed setup files to Disk 1...  
Building user cabinet file 'userl.cab'...  
Building cabinet file 'data.cab'...  
Creating disk layout file 'layout.bin'...  
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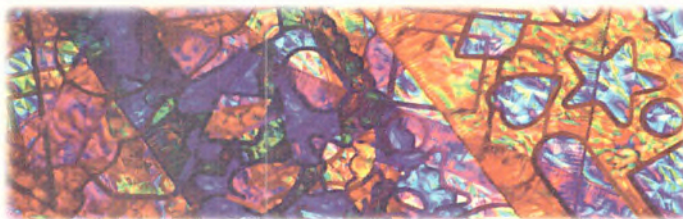
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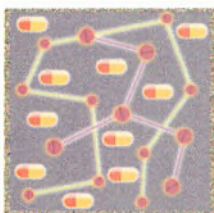
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### PVCS Professional

PVCS Professional is a complete enterprise software configuration management (SCM) solution that allows teams of any size to organise software assets, manage issues and standardise the software build process. It includes PVCS Version Manager, PVCS Tracker and PVCS Configuration Builder.

### BugCollector Pro 2.0

The latest version of Ken Nesbitt's bug tracking software now supports multiple, concurrent users on a network and uses the Microsoft Access database for all data storage, letting users create custom queries and reports using third-party tools such as Access, Visual Basic, etc.

### InstallShield 5.1 Professional

The latest version of InstallShield Professional includes a Visual Basic 5.0 Project Wizard, Automated Media Builder, Script Compiler, Visual Registry Editor, New Templates, Visual Shell Objects Editor and a host of other new features.

### True DBList Pro

True DBList Pro 5.0 is a powerful, customisable list and combo control for Visual Basic, that completely manages all database operations, thereby enabling the developer to focus on important application-specific tasks.

### WinDK 2.5

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### MKS Track Integrity

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# The value of free software



If you're involved in a small software company, as a developer, a guru, an MD or whatever, recent comments by Microsoft and announcements by Netscape must have made you seriously think as to what the future has to offer. Let me recall two events, which happened independently in January.

On January 9, Bloomberg interviewed Bob Herbold, Microsoft's chief operating officer. The interview focused on Microsoft's attitude towards the US Department of Justice and the fact that Microsoft doesn't have a plan for revising Windows 98 in case a federal judge orders the company to make changes.

Somewhere towards the end of the relatively short interview, when asked how small software companies could compete on products that Microsoft plans to fold into its operating system?, Herbold replied in an astonishingly frank manner that smaller rivals had three possible paths: they could fight a losing battle, they could produce a successful product and then sell to Microsoft or another large company, or they could not go into business to begin with because, hey, if you're a betting person you know which way it's going to go.

Later in the month, on January 22, Netscape announced that it would make freely available the source code of Netscape Communicator Standard Edition 5.0. This made a bigger impact. It has already received lots of comments which can be broadly classified in either: this is the best announcement ever made, or, Netscape really didn't have much of a choice and it's probably too

late to save the company. I'll explain later why I think the two events are important when viewed together.

The evolution of Windows shows that many software niches that once were viewed as clearly separate from the operating system eventually get integrated. So who is to say whether a product in development will fold into a Microsoft operating system or not, and when? If you can't answer that, then according to Herbold the only way you can have a successful software house is by hoping that you'll eventually be bought by Microsoft. There are better gambles in this world!

## When we speak of free software, we are referring to freedom, not to price.

One wouldn't have been surprised if most small software companies, after reading Herbold's reply, would consider themselves doomed. This is where the Netscape story comes in and lights the future in a completely different way: just give away your binaries and your source code.

This is not new thinking. The Free Software Foundation (FSF) did that many years ago, and GCC and Emacs are pretty successful. As Tim O'Reilly, President of O'Reilly and Associates, summed it up: freeware is the lifeblood of the Internet. To name just three other robust software projects for which the source code is freely available (and free): Apache, Linux, and Perl.

Giving away doesn't imply that you can't make money. One licence term that Netscape is contemplating as a possibility to adopt, the GNU General Public License, states: when we speak

of free software, we are referring to freedom, not to price. Our General Public Licenses are designed to make sure that you have the freedom to distribute copies of free software (and charge for this service if you wish), that you receive source code or can get it if you want it, that you can change the software or use pieces of it in new free programs; and that you know you can do these things.

Companies like Cygnus are successful by selling their experience: they specialise all the wealth of free code available to specific client needs. There is a real need for such commercialisation of free software. Even though free

software tends to evolve faster than its commercial counterpart, especially as far as bug fixes are concerned, many commercial businesses are still reluctant to acquire software which comes with no warranty at all. Software houses specialising in free software can offer customisation and warranties for a price. Another way to make money out of free software is on the documentation side as O'Reilly and Associates can prove.

One common advantage of free software development is that it benefits from very experienced developers from all over the world. As Tom Christiansen put it (on the *comp.infosystems.www.authoring.cgi* mailing list): A person will do for love in this case, the love of creation, the respect of one's peers what they will not do for money. And it benefits from its most experienced users when they want a new feature added,

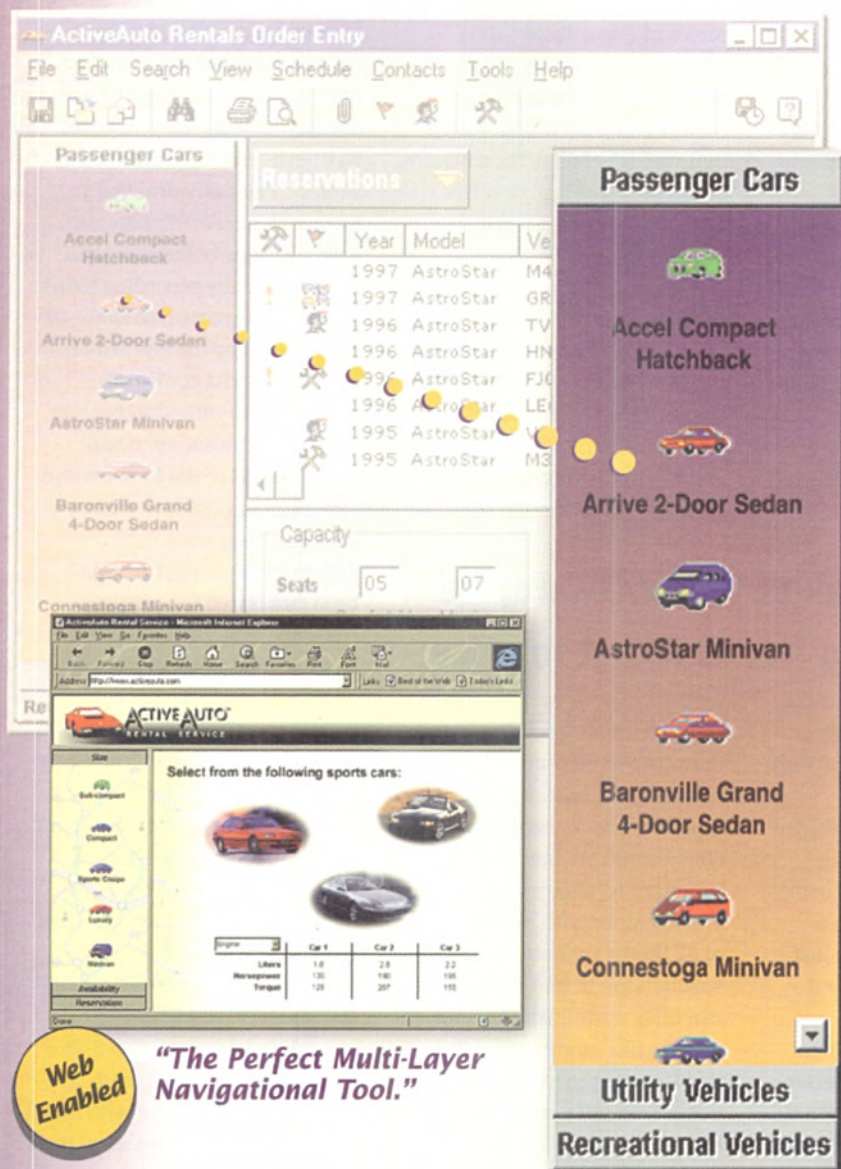
they just write it and offer it to everyone. That's not to say that there's only one model to follow to develop free software. Eric Raymond, maintainer of the famous Jargon file (aka the Hacker's Dictionary), who has been involved in free software development for ten years, has written a seminal paper on the subject: *The Cathedral and the Bazaar* (<http://earthspace.net/~esr/writings/cathedral-paper.html>). Basically according to his paper there are two methods, the one adopted by the FSF which imposes a strict control on releases the cathedral builder versus the release often and early method of the Linux world the bazaar. Both have been successful but work quite differently. Eric Raymond has been rumoured to consult for Netscape to advise on how to release Communicator's source code and how to maintain it.

However, free software is not the only alternative to traditional commercial software. The shareware market can also count quite a few successes, such as Quake and WinZip. This works by freely releasing binaries, and more rarely source code, and asking satisfied users to pay for the software only if they like it enough to continue using it. It relies on honesty so it tends to work only for software with large distribution, as honest users tend to be a minority.

Even though free software is not new, Netscape's move is the first change of status for a piece of software from commercial to free with full release of source code. Eric Raymond in an email to Tim O'Reilly commented: I'm ready to dance on rooftops, and [everybody] is officially invited to join me. It's happening, people! The Internet culture and the Unix/free software/open-development model is winning.  
*David Mery*



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# Communicator goes free

Netscape Communications is to make the source code for the next generation of its Netscape Communicator client software available for free licensing on the Internet. It plans to post the source code beginning with the first Communicator 5.0 developer release (expected in the first quarter of 1998, codenamed Mercury).

The strategy of Netscape is to harness the creative input of programmers on the Internet by incorporating their best enhancements into future versions of the software. The company will handle free source distribution with a licence which will allow code modification and redistribution and provide for free availability of source code versions, in the manner of the GNU Public License (GPL).

Netscape intends to create a special web site service where all interested parties can download the source code, post their enhancements, take part in newsgroup discussions, and obtain and share Communicator-related information. It will also continue to offer periodic certified and supported releases of its Communicator and Navigator products (incorporating the best fea-



tures developed by third parties).

In addition, the company is making its currently available Netscape Navigator and Communicator Standard Edition 4.0 immediately free for all users.

By making the code free Netscape hopes to encourage developers and system administrators to adopt its browser, knowing that they can tailor it to their particular needs. The company has noted the success of the Apache

software and Linux operating system, whose source code has long been in the public domain.

The move is seen as targeting Microsoft on several fronts. It makes official a common practice of obtaining the Netscape products for free, it makes Netscape appealing on price to computer makers and online services, and it gives software developers a new reason to side with Netscape.

[www.developer.netscape.com](http://www.developer.netscape.com)

Compaq has acquired Digital to become the third largest computer company in the world (after IBM and HP). Compaq says it is committed to investing in Digital's assets such as the 64-bit Alpha microprocessor, OpenVMS, Digital Unix, and Windows NT enterprise systems. [www.compaq.com](http://www.compaq.com)

CodeTEST, the software verification tool from Applied Microsystems, has device-specific processor probes for Intel and AMD 386EX and 486 processors, and Motorola's Power PC 603e/740 processors. It monitors embedded software behaviour and communicates with the user's workstation over LAN connections. [www.amc.com](http://www.amc.com)

True DBGrid Pro 5.0 VC++ from APEX Software is an upgrade to the DBGrid included in MSVC++ 4.2 and 5.0. The 32-bit ActiveX grid control is for use with the MSVC++ 5.0 MFC Class Wizard and enables developers to display and access data using the MFC DAO, ODBC, and RDO classes. [www.componentsource.com](http://www.componentsource.com)

Oracle Reports 3.0 is for low-cost, enterprise-scale report publishing to intranets and the Web (previously part of Developer/2000). Reports are called from a web browser, thin client, or ActiveX control but the actual execution of a report occurs on the application server. [www.oracle.com](http://www.oracle.com)

Users of CA's Jasmine will be able to use Insyte TimeSeries class libraries. They provide functionality for creating and manipulating data which changes over time. [www.cai.com](http://www.cai.com)

## Modelling with cool shades

Interface-based design for business level components is the core principle supported by COOL:Spex. The modelling tool for component specification and architecture design, from Sterling Software, allows developers to identify and specify components by interfaces, for enterprise-scale component-based development (CBD). The idea is that by modelling the component specifications at the outset, developers can analyse and communicate what the component must do, while remaining flexible about how the specification will be implemented.

COOL:Spex has three diagrammers for component specification. The Type Diagrammer provides visual modelling support for recording the elements of interest in a domain. The Type Collaboration Diagrammer provides a way to model the dynamic behaviour, including actions between elements of a domain. The Interface Diagrammer is used to specify the overall behaviour of an interface, including pre and post conditions.

HTML is used for customisable reporting and the product ships with standard reports and report templates. A Model Manager allows viewing of multiple data sources including Sterling's COOL products and the Microsoft Repository (component specifications can be moved to and from the Microsoft Repository, opening the implementation to UML compliant technology).

[www.sterling.com](http://www.sterling.com)

## Follow the signs

DV-Centro is a development tool for building custom visual programming languages (VPLs) under Windows 95 and NT. By allowing Windows developers to extend MFC-based applications with diagrammatic or graphical language interfaces it enables user interaction through custom symbols, shapes, and objects. DV-Centro's graphic objects are linked to data structures and changes to the graphics are propagated to the rest of the application.

With DV-Centro 2.0 developers can convert a standalone DV-Centro application into an ActiveX component. It is integrated with the MSVC++ environment and features a suite of graphical tools that allow developers to create reusable components for graphical applications.

[www.dvcorp.com](http://www.dvcorp.com)



# Embedded development. Suite you, sir?

**MicroStrategy**, the relational OLAP vendor, has released **DSS Web 5.0** for data analysis via the web. There is an API for custom application development. Sample interface templates help to create applications using HTML, Java, or ActiveX.  
[www.strategy.com](http://www.strategy.com)

**HAHT Software** has announced the availability of the HAHTsite Enterprise Solution Module (ESM) for Seagate **Crystal Reports**. It allows integration of reports into HAHTsite web applications without writing further code.  
[www.haht.com](http://www.haht.com)

**SAVI** is an open interface which allows third party applications to integrate with the **Sophos** anti-virus protection system. Its multi-threading DLL provides performance benefits over invocations of command-line versions. It avoids the memory constraints of reserving memory when initialising, each time a file is **virus** checked.  
[www.sophos.com](http://www.sophos.com)

**Visual Quantify 4.0**, from **Rational Software**, extends the automatic performance profiling capabilities it has for Visual C++ and Visual Basic to Visual C++ applications in **Windows CE** Emulation Mode on the Windows NT platform.  
[www.rational.com](http://www.rational.com)

**Synon** has released **Obsydian 3.0**. The **model** based application development tool for NT now supports the automatic generation of **Java**-based server applications. IT systems are modelled from a business perspective and the application code is automatically generated.  
[www.synon.com](http://www.synon.com)

Diab Data is introducing a suite of tools to support the development of embedded applications. The set of tools, collectively known as the RTA Suite, consists of three visual runtime analysis tools for 32-bit applications: a Visual Interactive Profiler, a Runtime Error Checker, and an interactive Link Map Analyzer. More tools will be added to the suite over time.

The first element, the Visual Interactive Profiler (VIP), provides information about a program's runtime behaviour. It profiles an application to determine the most frequently used areas of code. Block count and timing information is provided. Coupling of the VIP with the Diab Data compiler suites allows them to make use of runtime profile data to invoke profile-driven optimisations.

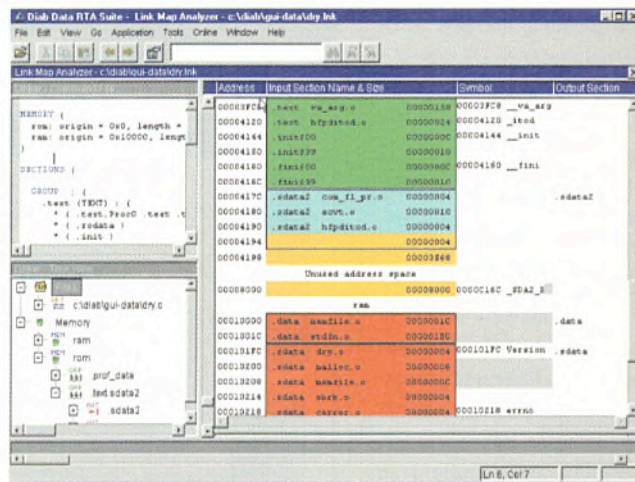
Hierarchical profile information is also provided by VIP. It examines function pair relationships at runtime to show the percentage of time that one function called, or was called by, another. For code coverage analysis, VIP verifies

## Searching SQL Server

**SPEED Ferret 3.5**, the find and replace utility, includes support for Microsoft SQL Server 6.5 as well as Access 97 and Visual Basic 5. The tool from Black Moshannon Systems searches all text properties of all objects in an application. Possible applications include global terminology changes, object renaming, date-related property searches and, more generally, project familiarisation.

With support for SQL Server 6.5 **SPEED Ferret 3.5** can search through tables, columns, stored procedures, views, rules, and all other objects in a SQL Server database. A table view of all occurrences allows users to assess the impact of proposed changes and minimises the risk of broken functionality due to overlooked occurrences.

[www.speedferret.com](http://www.speedferret.com)



whether a particular function block has been executed and colour codes the original text file depending on its execution status.

The second element in the suite is the Run-Time Error Checker (RTEC). It instruments a user's program and then analyses it at runtime to uncover memory leaks, stack overflows, dangling or out of bounds pointers, and other memory allocation errors that cannot be found through static program analysis.

The third product in the RTA Suite is the Link Map Analyzer (LMA). This gives multiple views of a developer's link map and allows interactive editing of memory setups for optimum memory use. The LMA provides three different views of a user's link map: a standard command file window, a graphical representation of the memory map, and a hierarchical file window.

[www.ddi.com](http://www.ddi.com)

## Netscape creates JVM gap

Following on from Netscape's announcement to make the source code for the next generation of its Communicator client software available for free licensing is the news that Netscape will no longer be supplying a Java Virtual Machine for use with its browser. Netscape will provide a programming interface, to be called **Open-Java API**, to allow operating system vendors such as Microsoft, Sun, or Apple to hook JVMs into Netscape's software.

The two announcements are probably related to the degree of Netscape's ability or desire to release source code for the JVM as part of the browser software. However, Netscape has had to port its JVM to over 15 different platforms which support its browser, and update each of these whenever Sun updated Java. The move is seen as part of a campaign to cut costs and return to profitability. Netscape has said it would lay off about 400 of its 3200 employees.

Netscape was the first company to license Java technology from Sun Microsystems and its browser's support played an important part in encouraging developers to write Java applets. However, people have criticised Netscape's implementation of Java and some do not see its loss as a direct threat to the future of Java. This has been further emphasised by some Netscape employees. Java is a fantastic language to program in. Now is the chance for Sun to set Java free and let it flourish, commented Ramanathan Guha (one of the chief architects of Meta Content Format), on DaveNet's Scripting News.

[www.home.netscape.com](http://home.netscape.com)



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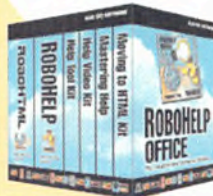
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## System Science News!

- **InstallShield 5.1 Pro** - new features include Automated Media Builder command-line program; enhanced SMS support; comprehensive printed Language Reference; templates for ODBC, DAO, and more! Call for upgrades.
- **TrueDBGrid Pro 5.0 VC++** - single ODCX for both VC++ and VB. Access Data using MFC DAO, RDO classes or custom data sources. TrueDBGrid 5.0 VC++ handles arrays of variant objects, multiple lines per record, colour control and more. Call for upgrades. Just £275
- **DemoShield 5.3** - this new version adds support for more multi-media file types, language localisation, CD Browser and new ActiveX and plug-in controls to play demos on the Internet. £275
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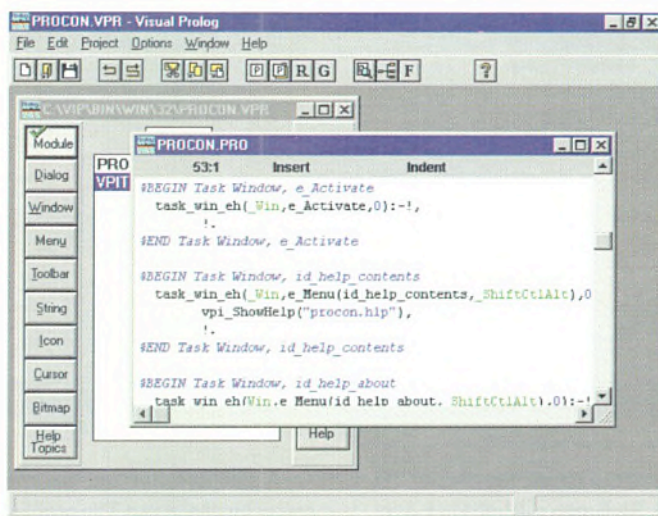
# The Internet gets logical

Visual Prolog version 5.0, from Prolog Development Center (PDC), contains compiler improvements, an enhanced development environment, Internet support, and a debugger (for the first time).

Changes to the compiler include the possibility to declare predicates as `procedure`, `failure`, `erroneous`, and `multi` in addition to `determ` and `nondeterm`. This enables the compiler to check for dangerous fail conditions in procedural code. Unused local predicates and problematic automatic type conversions can be detected. There are new predicates for runtime error handling and the compiler now supports a concept of Objects and Classes. A new linker means programs can be built without the use of a C compiler.

As well as increased speed of compilation and linking, enhancements to the development environment include support for project sharing and source code control with systems such as PVCS, MKS, and MS SourceSafe. Cursor positioning at the location of runtime errors has been incorporated.

Over fifty predicates have been added. They are concerned mainly



with aspects of a GUI, for example, changing fonts, customising menus, loading icons, and storing print preferences.

The Internet support of Visual Prolog 5.0 is to facilitate the development of intelligent web sites expert systems attached to homepages. They would be able to automate processes such as helping customers choose products. PDC anticipate applications for intelligent agents or data-mining, to help users navigate the volume of online information. As well as bindings to

Sockets (the API to the TCP/IP protocol), there is FTP and HTTP support. Example programs illustrate communication with Java applets, and CGI and ISAPI support.

The debugger is a standalone program for Win32 platforms; it is expected to be ported to OS/2 (but not to Win16 platforms).

Visual Prolog 5.0 is supplied in two versions: 1st Step and Professional. A full, time-locked, version of 1st Step (for 16-bit Windows) can be downloaded from the web.

[www.visual-prolog.com](http://www.visual-prolog.com)

**Visual Internet Toolkit 3.0**, from **Distinct**, is a set of reusable DLL and ActiveX components. Its features include: Finger, Firewall (Socks 5), FTP Client and Server, HTTP and HTTPS, MIME, TCP Server, **Telnet**, VT220, and Windows Sockets. It is bundled with the Distinct Network Monitor. [www.componentsource.com](http://www.componentsource.com)

**Sheridan Data Widgets 3.0**, the **ActiveX** component set for database applications, has improved data presentation functions: the ability to format and print reports directly from the **DataGrid**, export the DataGrid to HTML, export data to a delimited file, and to save and restore grid layouts. [www.contemporary.co.uk](http://www.contemporary.co.uk)

**Borland** has launched version 4 of its intelligent **middleware**, **Entera**. Along with new security features and integration with Borland's own AppCenter, the **Entera 4** Interface Generator has been built in Java to provide a unified GUI for all Entera's code generation tools. [www.borland.com](http://www.borland.com)

## XML is recommended

The World Wide Web Consortium (W3C) has released the XML 1.0 specification as a Recommendation. XML 1.0 is the W3C's first Recommendation for the Extensible Markup Language, which is a system for defining, validating, and sharing document formats on the Web. It is a subset of the existing international text processing standard SGML intended for use on the Web. (See EXE June 97 pp37-40.)

XML is primarily intended to meet the requirements of large-scale web content providers for industry-specific markup, and the processing of web documents by intelligent clients. It is fully internationalised for European and Asian languages, with all conforming processors required to support the Unicode character set. The language is designed for the quickest client-side processing consistent with its primary purpose as an electronic publishing and data interchange format.

Beyond its technical importance, XML represents a fundamental shift in the relationship between software producers and consumers. XML is an open, human-readable format that does for data what Java does for programs. Together XML and Java provide a platform and vendor-independent environment that liberates users from proprietary software and hardware architectures, said Sun's Jon Bosak, Chair of the W3C XML Working Group.

[www.w3c.org/XML](http://www.w3c.org/XML)

## Testing the millenium

Automating the testing of a system over 12 key date transitions is a feature of CYRANO's MilleniumTest. It enables companies to verify a Y2K fix and assess the level of risk in a system.

It operates solely through the application's UI, so it can validate programs and layered software without access to source code. By allowing the user to record a business process, identifying date sensitive input and output, the user can instruct MilleniumTest to age the recording to simulate the process across future dates. All date sensitive behaviour is compared with the original recording to check for correct, relative behaviour.

[www.cyrano.com](http://www.cyrano.com)

**Piercom 2000** Digital Version for **Cobol**, is Piercom's year 2000 readiness software. It is an integrated toolset for the automated assessment, analysis, and remediation of application code, tailored for **Digital** Unix and Open VMS environments. A release for Fortran is imminent. [www.piercom.ie](http://www.piercom.ie)

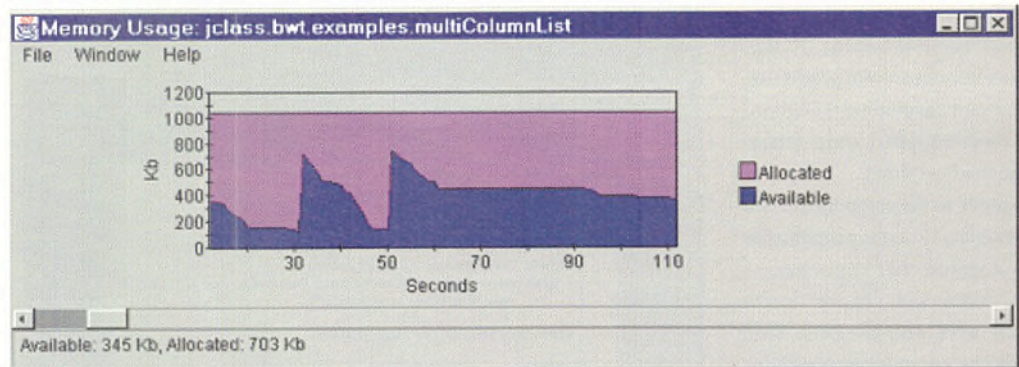
The Embedded Software Association (**ESOFTA**) has set up a **Y2K** area on its web site as well as providing a Y2K Internet Reflector. News items, meeting notices, and Questions & Answers will be carried. [www.esofta.com](http://www.esofta.com)



## Probe your Java code

Be was demonstrating the Intel version of **BeOS** at SD West. Looking practically identical to the PowerPC version, BeOS on Intel supports multiple processors out of the box. Be spokesmen claimed that the **Intel** version actually performs better at comparable CPU levels. BeOS on Intel is due to ship in late March.

[www.be.com](http://www.be.com)



Blue Sky's **RoboHelp** help authoring tool now supports three extra help formats: WebHelp, an **HTML**-based help system similar to Microsoft's HTML Help (already supported by RoboHelp), Windows CE Help, and Netscape's NetHelp 2.0. RoboHelp 5.5 will be available in March priced \$499.

[www.blue-sky.com](http://www.blue-sky.com)

**Sentinel LM** is a software-based protection tool designed to allow for the deployment of time-limited, feature-restricted, and **demo software**. Sentinel polices licence limits automatically, and remote activation allows additional licences to be added over an Internet connection.

[www.rainbow.com](http://www.rainbow.com)

Two releases from **DataViews** were announced at the show: as well as DV-Centro 2.0, DataViews 9.9 is a point release of the graphic and charting control package which also integrates into Developer Studio.

[www.dataviews.com](http://www.dataviews.com)

Newly-expanded **Rational Software** demonstrated **Rose 98**, an updated version of its flagship modelling tool. Rose 98 features support for multiple modelling languages including **UML** and improved round-trip engineering capabilities.

[www.rational.com](http://www.rational.com)

Announced on the first day of SD West, KL Group's JProbe is a Java code profiling tool designed to allow developers to analyse and eliminate bottlenecks in their code. Since performance is one of the traditional bugbears of Java, KL believes that developers will welcome such a tool with open arms.

At the heart of the system is a Java VM licensed from JavaSoft and specially adapted to allow measurements to be taken. The on-screen interface breaks Java programs down by class, method or

thread, and can list and browse memory blocks in use. The profiler will show the execution time of any portion of the code, right down to the individual line. The Call Graph shows which methods call which others both in your own code and in the Java libraries and the individual call times for each.

JProbe also spots unwanted memory references, the Java equivalent of a memory leak. This occurs when memory is referenced unexpectedly and the reference is never cleared, holding

up the garbage collection process. The Instance Summary displays the number and performance of all instances of a given object. JProbe will also profile calls to native OS methods made using JNI although not, at this stage, J/Direct.

JProbe runs only under NT 4.0 and only on Pentium-class PCs. At present it is available only in beta, but will be released, according to KL Group, in April. It will be priced at \$499.

[www.klg.com](http://www.klg.com)

## SD 98 hits a low

Exhibitors and visitors alike expressed disappointment at this year's Software Development West show, with attendance apparently down on previous years. Several exhibitors said they were less than impressed with the number of visitors on the first day.

The number of exhibitors was also down from last year. In 1997, SD West ran alongside the Java One conference and exhibition, which has this year moved up to spring. It was suggested that this change was responsible for the drop in attendance.

The SD West conference sessions were well-attended. For the annual Jolt Awards prizes went to NuMega for its Visual Basic DevPartner tools suite, Eiffel guru Bertrand Meyer for the 2nd edition of his Object Oriented Software Construction, and a Lifetime Achievement award to Microsoft for VB.

## SuperCede 1.0 superceded

Newly-formed Asymetrix spin-off SuperCede demonstrated version 2.0 of its eponymous product at SD West 98. The company's main selling point for this version is what it claims to be the first complete support for compiling Java source down to native Intel binary code. Although other packages claim to produce Intel binaries, some additional support in the form of libraries has always been required. SuperCede claims that version 2.0 will produce pure standalone programs from any valid JDK 1.1 Java source.

Other improvements in the product include the ability to include C++ code modules and class libraries into Java projects when targeting Intel processors, and a full set of database access functions. An ODBC data browser is included in the package as are drivers for the most common back end data sources. SuperCede 2.0 also fully supports JavaBeans, and again when targeting the Intel platform ActiveX controls.

The most revolutionary feature of the first version, Flash Compilation, has been retained and enhanced in the new version, and a library of useful JavaBeans is included. The Standard edition lacks the native code compilation abilities and has limited data access capabilities.

The Standard Edition will initially be available free over the Web, eventually retailing at around \$99. The Professional Edition, with all options included, will be priced at \$995. No UK pricing was available at the time of writing.

[www.supercede.com](http://www.supercede.com)



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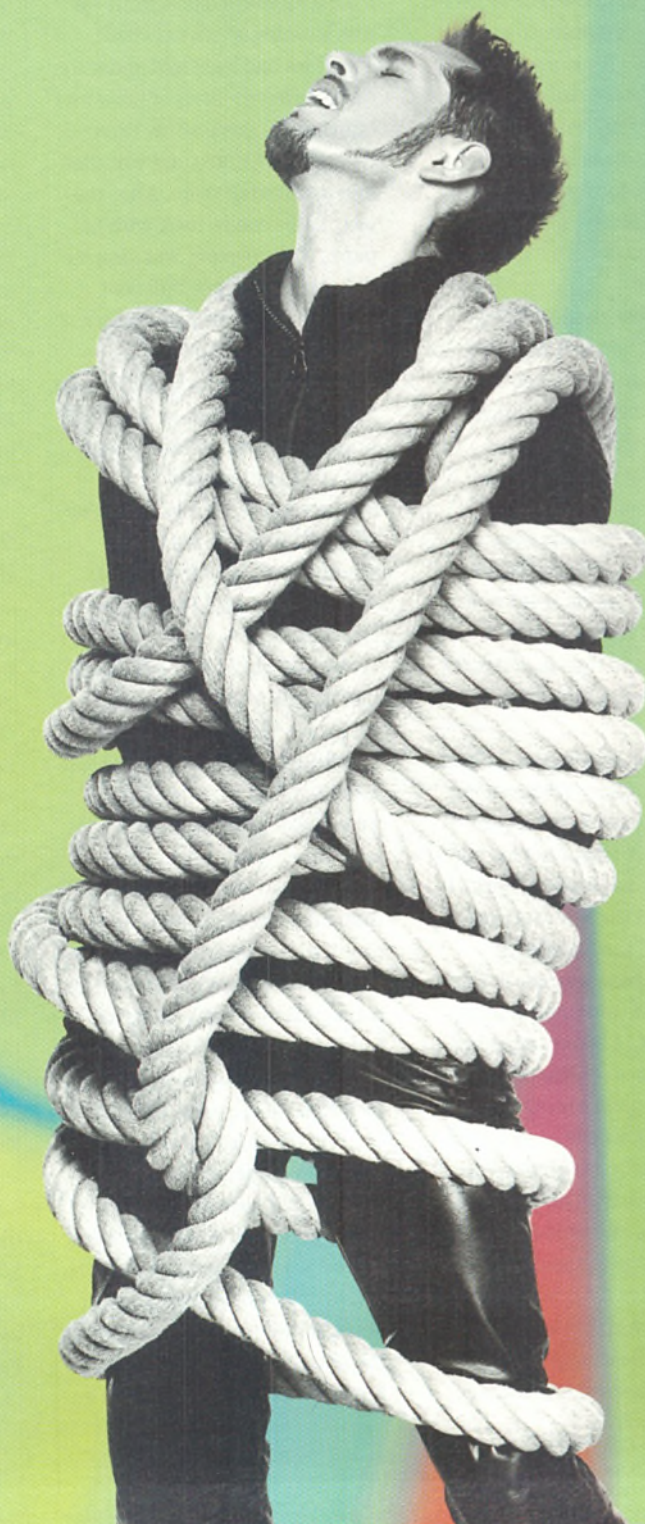
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# B+? Could do better

Jules finds himself back at school.

**Y**'ou're a computer expert, aren't you?' That's what people say after they've dropped their Gameboy. Or they've left their floppy containing their life's work beside the microwave. Or they're so sick of bank charges for nasty letters that they want to know how to hack the bank's computer to get all their money back out. They say it after all these things, and right before they say, 'So I wondered if you could just help me out – it's only a little job for someone of your talents after all!' Damn, I'm a sucker for flattery – it gets me every time!

This time, though, it was different. I had braced myself for the inevitable 'little' request, when the speaker continued 'So would you mind telling me whether my son's computer teacher is telling the truth?' What? 'Well, you see, none of what she says makes sense to him, and he wants to know if it's his fault'. I rather wanted to know too, and thus it was that I found myself with a tutee of my very own.

That day, they'd been talking about databases. 'What are the different kinds of databases?' I asked. Tutee consulted his notes: 'flat, relational, and network'. I looked, and there it was, copied straight off the blackboard. Every database was one of these three forms, and there were no others. 'OK,' I asked, 'what are the differences between them?' Tutee consulted his notes. He flicked back a page or two, then forward again. Finally, he closed the notebook with an air of completion, and proudly told me 'Dunno'. I tried to coax the answer out of him; 'What kind of records do you find in a flat database?' He thought for a while, realised that this was a

trick question, and said 'Everybody uses CDs now!' It was certainly clear that, if he'd never been told about records, he couldn't possibly have been told about the differences between the databases.

Here was another howler from a different day. A mini-test was looming about networks. The class had been told about the three different kinds of networks (apparently there's only three: tree, ring, and bus) and was then told to research them. After the test, Tutee comes back with his paper. The question was simple: 'What are the three different kinds of network? (See, there's still only three.) For each, explain how it works, and give an example.' Explain how it works? Good grief – people spend their lives trying to do that! Fortunately the teacher hadn't a clue, and was blinded by the science I had cued into Tutee. 'What did we get?' I asked him. He beamed, 'B+'.

I was furious. B+? Who does that bloody woman think she is, giving me (albeit vicariously) anything less than an A+++ with knobs on? 'Ah, well,' explained Tutee, 'you never told me anything about packetisation'. I looked at the question paper. It didn't ask about packetisation – didn't even mention protocols. It still asked about the (count them) three different kinds of network. I turned the question paper over; and there was still no mention of protocols on the other side. Even holding the paper up to the light didn't reveal what the three (there could only have been three) protocols might have been.

In a way, it's hard to blame the teachers for not knowing much about computers. After all, only the most dedicated humanitarian would teach in a

sixth form college for £6ph when they could use their MS Word/MS Office/MS Excel skills in industry for £25ph.

It's hard even to blame them for asking one question and marking quite another, when you see what the poor students have to cope with at exam time. In order to do the best possible job with my Tutee, I got hold of a syllabus for the exam he will take. At first glance this syllabus is surprisingly good – anyone who actually knows all this stuff will have a well-rounded overview of most of the field, and will certainly be in a position to select further training, no matter what use they will put their computers to. But, the exam questions don't reflect the syllabus at all, and the marking scheme is positively arbitrary.

Consider this question: 'Name three items, in addition to the data, that a packet should contain (3 marks)'. The model answers allow status bits (free or busy), reservation bits, and priority (I think they are claiming that all packets must have these), but specifically *exclude* framing bits, time stamps, or signatures. They demand CRC or checksum, but specifically *exclude* parity or hashing. Personally, apart from framing and data, the only thing I can think of which a packet absolutely must contain is a destination, so I'd have got zero for that one.

Secondly, try this one: 'Name three disadvantages of introducing a national identity smartcard system (but don't discuss the merits or demerits of identity cards)'. Do you have any idea how they expect the candidate to separate the issues? I'm sure I don't.

I'm not surprised that

teachers, when faced with this kind of stupid authority, fail to explain their subject clearly. How do you explain, without reference to lots of maths, what makes one kind of error correction better than another? How do you explain why leaving the side off a box, for example, makes a clear description of a file in context, and putting the side back on turns it into meaningless drivel? The fact is that they're looking for far more than a passing acquaintance. They're looking for students to demonstrate the kind of skill which can only be obtained from long familiarity with the subject. And they want those skills to have been learned in shops with the same arbitrary prejudices as the examiners.

It's not fair on the student. Even if he can learn to pass an exam (assuming, of course, that the teacher has any more idea than he does), what good is that when he has no chance to distinguish between the real science and culture of computers, and the fads of his examiners? What good does it do him when he goes on to further training and finds that the highly specific 'truths' he's learned turn out to be misleading (or worse)?

It's also unfair on the employers, who already complain that exam results bear no relation to the skills of the person. Filling a student's head with prejudices and half-truths can only make that situation worse, adding arrogance to his officially sanctioned ignorance. ■

*Jules' exam-taking days are behind him, a fact which makes him very happy. If you're not so lucky, call him on 01707 662698, or email him on cix as [jules@cix.co.uk](mailto:jules@cix.co.uk).*









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## Lookalikes

Dear Sir,  
While perusing the booklet accompanying a compact disc of music by the popular 1970s electronic music group the Electric Light Orchestra, I was struck by the remarkable similarity of Mr. Jeffrey Lynne, its inspiration and leading light, to our own programming superstar and

Gloop [very good anti-mist visor product Ed] inventor Mr. Jules May. Are they by any chance related? I think we should be told.

Michael Mounteney  
[mounty@cix.co.uk](mailto:mounty@cix.co.uk)

Both of them like electronic things that make noises. The more noise, the better! Ed



Jules May



Jeff Lynne

## Interweaving languages

Dear Sir,  
Peter Collinson's clever exploitation of comments to switch between JavaScript and HTML (*EXE* January 1998, page 39) reminds me of a trick I got up to a few years ago. Readers may be amused by the enclosed program listing for adding two numbers together. So far so boring, but the clever bit was that you could use the Fortran, Pascal, or pre-ANSI C compiler on it and it didn't mind which!

It was not fully portable, because for one thing it relied on Fortran tolerating all sorts in columns 2 to 6 and 73 to 80 (shaded on my listing), but it worked under VAX VMS with no compiler errors. If you want to follow the plot but don't know all three languages, let me explain that Fortran treats as a comment the whole of any line whose first column has C; C comments take the form `/*comment*/`; and Pascal comments can take either of

two forms: `{comment}` or (for those with primitive keyboards) `(*comment*)`. A printable character in column 6 introduces a Fortran continuation line.

Seriously, what we may have here is a technique looking for an application. The technique is valid for programs and data, and allows either the same or different meanings in different languages. The basic requirement is that the

languages comment formats allow all but one language at a time to be commented out. Perhaps the main problem is readability: such code is a little difficult to present and comment! *W.R. Lynch*  
*Ipswich, IP5*

```

(*z);/*
C This language-independent program can be compiled, linked and run under VAX
C VMS using the C or Fortran or Pascal compilers with identical results.
C The first line is seen by C as the declaration of an integer pointer followed
C by a comment opener; by Fortran as line sequencing information; and by Pascal
C as a comment opener followed by the beginning of a comment string.
C
C Author W R Lynch, 11.9.1986. *)

PROGRAM LIP
C) (input, output); var i, j: integer; {
C*/ main () { int i, j; /*
C*/ puts ("Give me two integers please:"); /*
C) begin writeln {
    TYPE *,
    ('Give me two integers please:'
    ACCEPT *, I, J
C*/ scanf ("%d %d", &i, &j); /*
C) readln (i, j); writeln (i:13, ' + ', j:12 {
    TYPE *, ' ', I, ' + ', J,
    ' = ', (i + j):12); {
C*/ printf ("%13d + %12d = %12d\n", i, j, i + j); /* }
END. {*/

```



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# Bjarne Again

With ISO standardisation imminent and a third edition of its defining book recently published, we invited Bjarne Stroustrup to make some 'state of C++' remarks. Things went swimmingly until interviewer Will Watts mentioned the J word...

**C**ongratulations on a new edition of *The C++ Programming Language*. What are its main themes? Did it really need to be 900 pages long? Thanks. Main themes? The value of abstraction. The possibility of writing code that is both elegant and efficient. The validity and effectiveness of several very different programming styles.

The book has four main parts:

Part I describes how traditional styles of programming can be done in C++. People are assumed to understand the basic concepts here (eg from C or Pascal), but I also introduce namespaces and exceptions. Note that I do not suppose previous knowledge of C, just some programming experience.

Part II explains object-oriented programming and generic programming in the context of C++. This is where I present classes, class hierarchies, templates, serious use of exceptions, etc.

Part III explains the structure of the standard library and an introduction to its use. Here we find strings, vectors, lists, maps, I/O, algorithms, etc.

Part IV goes into some details about the role of a programming language in design and presents some key programming techniques from a design perspective.

In addition, there are three introductory chapters giving an overview of the book, some background on C++, a tour of the C++ language features, and a tour of the standard library facilities. You can download these three chapters from my homepages to get an idea of the book: <http://www.research.att.com/~bs/3rd.html>.

Technicalities, such as the grammar, compatibility issues, obscurities of conversions, and name lookup details are banished to appendices.

And yes, *The C++ Programming Language* does have to be this big. I am pretty sure that after working with it more people will wish it was longer than would wish it shorter. It is curious that everyone seems to want books shorter, but they also want every individual topic presented in greater detail. I have seen complete books on parts of the standard library that didn't provide the detail that my Part III does – yet I get more requests for more information and examples than I get complaints about the size of those chapters.

My aim is for *The C++ Programming Language* to be complete in the sense that it gives a serious programmer all that is needed to understand the language, the programming techniques it supports, and its standard library to successfully complete a major project. What I do not cover is the deepest language lawyer-ish technicalities (though some programmers will find more of those than they really want to know about) and vendor specific libraries.



Carl Flint

**I**n this edition, you seem to be more ready to hand out advice, if still very unwilling to proscribe...

That is true. I give somewhat firmer advice than I used to, and yes, I'm still most reluctant to proscribe techniques or language features outright. I cannot think of a single major feature in C++ that I do not know a good use for. I think many people are too prone to condemn facilities they don't personally see the need for. I rate most condemnations of individual C++ language features for being 'unnecessary' and 'too complex' as part unwillingness to accept that others really do work differently for valid reasons, part fear of the unknown, part a fervent belief that the world really must be simpler and more uniform than it appears. Different people really do think differently and successfully design, implement, and maintain systems in radically different ways. If you don't feel comfortable with a C++ feature, don't use it, but don't try to ban others from using it where they see a genuine need.

But I did change a bit. When I wrote the first edition of *The C++ Programming Language* I had a positive dread of preaching. I had heard too much hype and seen the firmest advice given by people with very weak



backgrounds. Therefore, my approach was 'here it is, this is the definition, here are a few examples, have fun!' Unfortunately, this left the field open to everyone else to preach and condemn to their heart's content. As a result, opinions I disliked became doctrine and techniques and facilities I knew to be best in certain circumstances were condemned.

I concluded that my relatively mild and practical recommendations and warnings would do less harm than what would appear in their absence. Also, I guess I now have a broader base of experience from which to give advice. However, I still abhor the doctrinaire and semi-religious approaches to design and programming that I feel dominate too many debates.

It might be interesting to your readers to know that about 75% of the text is new relative to the second edition and the remaining 25% has been extensively modified. I think that someone who knows C++ only from my second edition – or one of the legion of books that copied its approaches – will get a big, and I hope, pleasant surprise when they read my third edition.

**A striking typographical and iconoclastic feature of the book is your use of a non-proportional font to print code. How did this come about?** I must admit that it took some thinking and a bit of experimentation. After all, we have about 50 years of tradition that says that code should be written in the ugliest, most teleprinter-like font available.

However, after working a bit on the presentation of my program fragments in the context of other text I came to the conclusion that using a constant-width font was about as ugly as ALL CAPITAL LETTERS and about as wasteful in horizontal space. By using a proportional-width font I can get the kind of look that readers have agreed to be preferable for about 500 years. I can also fit so much code onto a line that most illogical and distracting line-breaks are avoided.

I experimented a bit with the typesetting of the punctuation characters and decided to leave them in the traditional font and I also found it helpful to make identifiers slightly bold to get them to stand out slightly from the surrounding text and the comments. Basically, all of my code fragments are 'pretty printed'.

To avoid having all of this be an exercise in my own prejudices, I tried out several variants on unsuspecting readers. After I had exhausted the patience of my friends, I literally walked around the corridors of Murray Hill accosting innocent programmers and scientists for their opinions of the 'look' of my pages.

Now I find the usual style of program typography ugly and archaic and can't understand how people can bear reading text with code presented like that. Most people who mention the code typography to me like it; a few are apoplectic – to me they sound like old-style grumpy colonels fuming about the horrid habits of modern youth.

**A**nother aspect of the book, and I'm sure an old bugbear: I seem to detect a defensive note in your discussion of multiple inheritance. You continue to back full MI. But the current vogue, as evidenced by designs such as Java and COM+, is to favour single full inheritance plus multiple abstract inheritance. Surely this is a sensible and useful refinement of a dangerous mechanism?

Defensive? Or simply consistent and unwilling to dress my opinions up with hype? If anything I'm a bit more pro-MI than I was a few years ago. My experience with MI during that period has been quite positive. If I have to make a prediction, it would have to be that MI will increase in importance and esteem over the next years.

I consider MI less of a bugbear and more of a red herring. I see nothing particularly difficult, expensive, or unsafe about MI. Where MI is needed, circumlocution is quite horrid.

I think the discussion about MI has been confounded by language wars (demonising MI by proponents of languages that don't have it), overselling of MI by some proponents (sometimes as part of language wars), and poor teaching. Many people seem uncomfortable with a powerful and elegant feature that is not needed in every program. If you count, you'll find half-a-dozen uses of MI outside purely technical examples in my book.

In general – with both MI or SI – abstract classes can be used to simplify systems. In general, I find abstract classes underrated – possibly because of overselling of the value of deep inheritance trees. However, inheriting implementation is occasionally useful in MI exactly as it is in single inheritance, and for exactly the same reasons. The techniques that allows us to avoid MI are exactly the same as were used to avoid single inheritance by people who doubted its benefits – and I hear exactly the arguments against MI as I used to hear against single inheritance.

### Generic anxiety

**Y**ou touched on discomfort with new features. I was a little freaked out when I stumbled upon the Help page for the standard library template version of the old C macro *toupper()*. Please could you explain and justify the use of templates in 'straight functions' (as opposed to container classes) for the benefit of past-it programmers like myself? Hmm. A template definition will look odd to a C programmer, and to C++ programmers who haven't gotten used to templates. However, the aim of such templates is to make perfectly ordinary looking calls work right for a variety of argument types. Consider:

```
char c;           // good old char
Jchar jc;         // Japanese character
// ...
c = toupper(c);   // well-known toupper
jc = toupper(jc, Japanese_locale);
// do the Japanese equivalent to toupper
// to a Japanese character
jc = toupper(jc); // error: meaningless (unless you overload
// toupper yourself)
```

Could you think of a simpler interface that generalised to all languages and cultures of the world? Or even one that would handle signed chars and unsigned chars together with plain chars?

Anyway, for the 99.9% of the time where the average UK programmer deals with English text, the well-known *toupper(char)* is still there. Programmers who want to write code that is genuinely international must concern themselves with locales, and then the template *toupper()* comes in handy.

You could, of course, have chosen a more obvious example first. Consider complex numbers. People never agree on whether the best complex numbers are single or double precision or whatever, so naturally the standard library defines *complex* as a class template with the scalar type as the template parameter:

```
template<class Scalar> class complex {
    Scalar re, im;
    // ...
};
```

Having done that, we need to define the usual arithmetic operators and mathematical functions such as *+*, *-*, *sin()* and *abs()*. Because *complex* is a template, these operators must be template functions. For example:

```
template<class Scalar>
complex<Scalar> operator+
(const complex<Scalar>& a, const complex<Scalar>& b)
```



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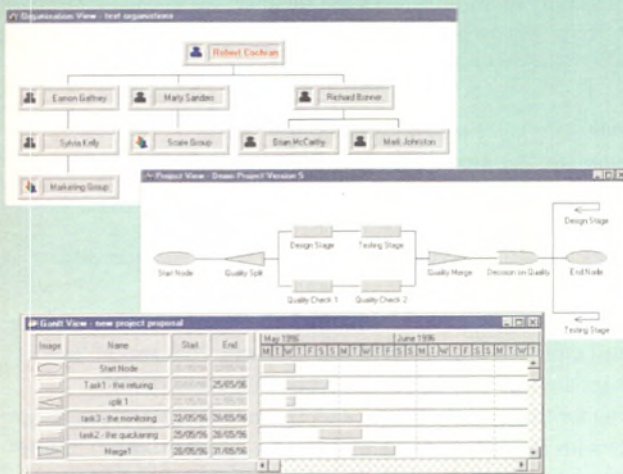
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```
{
    return complex<Scalar>(a.re+b.re, a.im+b.im);
}
```

Complicated? I think not. It is a bit more longwinded than writing complex for a single scalar type, such as *double*, but less work than writing complex add twice for *double* and *float*.

Importantly, if you defined complex separately for *float* and *double*, you are doomed to do it again for *Quad*, and for *int*, and... A function template simply defines a family of functions with the same semantics for a family of argument types. The alternative is to write a lot of functions (that is tedious and error-prone) or use macros (that don't obey C++'s scope and type rules and create havoc for tools, yuck!).

We are very used to overloading and the kind of 'templates' the compiler uses to handle the usual arithmetic operators for the usual arithmetic types. All I have done is to put those facilities in the hands of programmers.

**T**he standard library is very Computer Science-oriented – more so than the original C library – and old fashioned in its view of available OS facilities. Couldn't it have supported a few of the common things that there are now dozens of incompatible libraries for? Where is the Zip file archive access, the simple inter-process communication and OS services, ANSI SQL, interpretation of bitmap formats?

Like the C library, the C++ standard library is focused primarily on general computing and secondarily on a bit of simple I/O. It would have been nice to provide a standard library with all the features you mention, but far beyond what a relatively small group of part-time volunteers could create and create a consensus for – and there wasn't an existing library of sufficient generality and non-commercial nature that we could have accepted.

So, yes, more standard facilities would be beneficial – provided that they were good enough, but the committee had to focus on essentials and generality within its ability and time frame. Given these constraints, I think the committee did marvellously and the existence of 'dozens of incompatible libraries' for many of the things provided simply shows the need for standardisation.

My main criteria were to provide facilities required for independently-developed libraries to communicate. Given a standard vector and list, you and I can each write a library, say for Zip file archive access and pattern matching, and a user of our libraries can use both without dropping to the lowest common denominator – having to deal directly with arrays, memory management, etc.

Furthermore, people worked hard on these basic facilities, proposed them to the committee, and created a consensus. This didn't happen for other plausible library facilities, say a concurrency-support library, date and time classes, or a pattern matching library.

In fact, the committee received at least as many comments to the effect that it should refrain from adding standard library facilities and stop inventing in the libraries arena as it received constructive suggestions for standard library improvements. A committee of volunteers who are busy with day jobs can provide only so much. And anyway, would you trust a library that had genuinely been invented by a committee, rather than a library polished by a committee but based on specific and well-thought-out proposals from individuals and groups – the way the standard C++ Library was done?

I'd love to see more standard library facilities. Now would be a good time to start designing and experimenting for revision of the

standard that will start five years from the official adoption of the ISO standard (this summer).

#### Of standardisation

**W**hat differences do you expect the ISO ticket to make to the use of C++?

Stability, and with that a much greater degree of portability! It will be a great pleasure to be able to rely on all the major facilities to work everywhere. This will, of course, take a couple of years. This year all the major vendors will get all of the major features right – I just received reports of the first compilers to handle every detail of the standard library exactly as specified – and then it will take a couple of years before most users have upgraded. Such an upgrade takes much longer than most people are willing to believe. I found a K&R C program recently that simply didn't work as an ANSI C program!

The other major issue is the standard library. Being able to use the standard library string type instead of C-style strings in most places and vector, list and other containers can make a huge difference to productivity and code quality. My hope is that the standard library will revolutionise the way C++ is taught and that it will become the basis of a variety of commercial libraries that exchange information using the library

facilities rather than the lowest level language features.

Maybe people will finally realise that C++ is not just a language for object-oriented programming. There are several powerful, elegant, and effective programming styles.

**I** believe the Standard breaks this code by changing the scope of the inner *i*:

```
int i;
// use i here
...
while (true)
{
    for (int i=0; i<max; i++) {
        ...
    }
    some_fn(i); // which i?
}
```

**Is this true? If so, what pressure was so strong that the ISO was forced to break the status quo?**

It is true. We made a change that introduced a nasty silent change of meaning to this example. I think it was the right thing to do.

The committee had to balance that relatively rare very nasty problem with the very frequent annoyance of

```
for (int i=0; i<max; i++) {
    // use i here
}

for (int i=0; i<max; i++) {
    // use i here
}
```

Under the old rule, the two *i*'s were declared in the same scope so an error occurred. Now it works the way the programmer intended. The



**My hope is that the standard library will revolutionise the way C++ is taught.**



most common problem with the new rule is caught by the compiler:

```
for (int i=0; i<max; i++) {
    // use i here
}
if (i<max) // oops i not in scope here.
and that is easily fixed.
```

These were the practical reasons. They were not sufficient to cause a change. There was, however, a language-technical reason that implied that the old rule would be hard to sustain. To avoid the separation of declaration and initialisation, declarations are now allowed in conditions. For example:

```
if (My_box* p = dynamic_cast<Window*>(pw)) {
    // use the My_box pointed to by p
}
```

Naturally, *p* isn't in scope after the if-statement. However, what is done in the condition of an if-statement can be done in the condition of a for-statement:

```
for (int i = 0; My_box* p = dynamic_cast<Window*>(w[i]);
     i++) {
    // use the My_box pointed to by p
}
```

It really would be odd to have *i* but not *p* in scope after the for-statement.

The decision about the scope of the for-initialiser was surprisingly hard, but I think the committee made the right decision. Ask anyone who hadn't been taught the old rule what the scope of the controlled variable is and they'll guess the new rule.

#### So, what about Java then?

**T**he inevitable Java questions: Java is frequently characterised as a 'pure' version of C++ with the dangerous bits removed. Here is the (respected) book *Java in a Nutshell*: 'Unlike C++, Java was designed to be object oriented from the ground-up' 'the Java designers removed a number of features available in C and C++. These features are mostly ones that led to poor programming practices or were rarely used ...' 'C++ supports (though not yet in a very standardised way) templates ... Java has no such facility. However ... every class in Java is a subclass of Object [so container classes such as stacks can be defined without need for templates - WJ]'. And so on for MI, operator overloading, clumsiness of the & syntax for references, pointers etc. Comments please.

That characterisation of C++ is 100% pure commercial propaganda. Like all good propaganda it mixes facts and misrepresentation in a way that makes sense to someone with only a superficial knowledge of the subject matter, while obscuring problems with the product being hyped.

C++ was never meant to be just object-oriented. Had it been, it could never have handled the tasks commonly done using C or achieved the efficiencies I needed. My book *The Design and Evolution of C++* presents the design criteria for C++; Java doesn't even begin to meet those. I suppose C++ doesn't meet the design criteria for Java, but then there are no official 'C++ evangelists' explaining why writing code in other languages is bad.

C++

- is a better C,
- supports data abstraction,
- supports object-oriented programming and
- supports generic programming.

Of those, Java supports only a limited range of OOP.



**Java is an interesting example of mass hysteria and a unique example of a large corporation throwing its marketing clout behind a programming language.**

Java doesn't simply remove features from C++; it is a fundamentally different language: its models of data, type, and inheritance differ from C++'s. Java proponents claim omitting C++ features to be a virtue. My experience is that users want those facilities – such as operator overloading and templates – and use them well.

Compared to C++, Java sacrifices efficiency, ability to deal with low-level facilities, and flexibility of programming for alternatives. To compensate, Java pushes complexity into applications (bad), into libraries (good, if done well), and into parts of the language without direct C++ counterparts. For example, Java doesn't provide overloading or the facilities to implement a decent string. Instead, Java provides a built-in string which overloads + in a way users cannot do for their own types. C++ offers programmers facilities to define efficient lower-level types with the operators their users expect, so the standard library string was provided without special pleading.

Java doesn't provide templates. Instead, it must rely on expensive and error-prone run-time type checking for containers such as vectors and lists – instead of the safer, faster, and terser static typing (used in the C++ standard library). I confidently predict that some form of templates will be added to Java – Java will be much better for that.

I find MI useful. Even Java provides a limited form of MI. Similarly, Java has pointers; much of what appears to be variables are pointers to objects allocated on the heap. This gives pointer semantics and allocation, deallocation, and indirection overheads. It would be more professional for Java proponents to focus on the advantages of implicit pointers and the dangers of pointer arithmetic while acknowledging that there are advantages to explicit pointers as well. However, a professional attitude makes poor hype.

The C syntax is ugly – if familiar. In particular, the declarator syntax is an experiment that failed. I am amazed that any language claimed to be 'designed from the ground up' and 'pure' would adopt that mess – let alone complain about minor details of another language with a similar syntax.

I don't think Java is interesting as a programming language. It is an interesting example of mass hysteria and a unique example of a large corporation throwing its marketing clout behind a programming language and marketing it primarily to non-programmers. In the US, you can find television ads warning people about programs not being '100% pure Java' and whole-page ads in the business sections of major newspapers.

Java is marketed as an alternative platform to Microsoft's Windows rather than as a programming language. However, the JVM is too restricted, Java-specific, too inherently inefficient and limited to be a good candidate for a general platform. In addition, it is controlled by a single commercial vendor. It is unfortunate – but probably commercially necessary for Sun – that the JVM is nowhere near a universal and language-neutral machine.





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**T**here must be some Java features you admire – maybe features you could not include because of the ‘as close to C as possible but no closer’ rule. Which ones? Which features, presented as advantageous by the Java crowd, do you consider to be restrictive?

With Java, I never had the ‘Wow, that’s neat!’ feeling that I have had with most other languages – such as Snobol, CLOS, Smalltalk, and ML – when I first encountered them. Maybe my acquaintance with Java is too shallow, but my impression is that Java cuts every corner so that the more elegant, effective, and efficient programming techniques are left painfully unsupported. Try writing something with the generality and efficiency of the STL in Java.

It seems that any feature not currently present in Java is deemed dangerous and its absence hailed as a sign of purity, simplicity, and safety. When later a feature is added – such as inner classes in Java 1.1 – it is then hailed as a great and important advance.

I’m no particular fan of header files, but the use of declarations separately from definitions is important for larger-scale programming. The absence of this distinction in Java is a weakness.

There is no feature left out of C++ for reasons of C compatibility. That constraint primarily ensured that I didn’t throw anything out or cleaned up the syntax. More strongly, there is no major feature of C++ that I could remove without making C++ less suitable for some reasonable style of programming.

**W**hile we are on the subject of your favourites: in a 1992 EXE interview, you commented that you had ‘no opinions on what OMG is doing, because I can’t figure out what it is’. We wondered how your view of ‘big objects’, and the various committees and powers that are standardising them, has developed over the interval.

At least they decided to focus on ‘big objects’. At the early meeting of the OMG too many people still thought that all objects could be best served by a single mechanism.

I don’t have a favourite among the current crop of contenders (Corba, COM...). I live in hope that something far more elegant and/or general will come along. These models all seem too large, too complicated, too hard to use, too hard to integrate with a programming language (or worse: completely integrated with a single language), too proprietary, or incur too much overhead to be ideal.

And no, I don’t have an alternative. It seems to me that there is something fundamental missing, but I have not been able to put my finger on it. I’m looking for something that allows synchronous and asynchronous calls to coexist smoothly, something that can be closely integrated into a variety of programming languages, and something where modules loaded into a single address space can communicate as efficiently as two classes compiled together. To deliver all we

## Life of Bjarne

Bjarne Stroustrup (pronounced ‘Be-ar-neh Strov-strup’) was born in Aarhus, Denmark in 1950. He spent his early years there, and graduated in Computer Science from the city’s university. He went to Cambridge to obtain his Ph.D., and it was while he was doing this that his attention was drawn toward the design of computer languages; to obtain usable performance he was obliged to rewrite his doctoral programming project from elegant-but-slow object-oriented Simula language to ugly-but-fast BCPL.

When he took a job at Bell’s famous Murray Hill labs in New Jersey, he made use of this experience, developing an object-oriented variant of C called ‘C with Classes’. With its familiar syntax, ease of porting and excellent provenance, C++ (as the language was renamed) enjoyed an exponential growth in popularity during the 1980s, and has now supplanted its predecessor as the *lingua franca* of the industry. Stroustrup has continued to work for AT&T Labs (which moved to Florham Park after the AT&T/Lucent break up) over the whole period, publishing books and papers on C++ – the first edition of *The C++ Programming Language* appeared in 1985 – working with his colleagues enriching and refining the language, and latterly toiling on the ISO standardisation committee.

As is to be expected, Stroustrup is a fierce defender of C++’s design; woe betide the person who essays a sloppy criticism of the language in a public forum – especially if the miscreant’s motives seem to be commercially inspired. Stroustrup’s choice of light reading matter, as advertised on his Web site <http://www.research.att.com/~bs/homepage.html>, is reassuringly eclectic; he enjoys the adventures of W Churchill, Odysseus, Snowball the Pig, and Philip Marlowe as well as programmer-mandatory Frodo and Arthur Dent. He is married with two children.

require of a component model, such a model must be complex, but does that complexity really need to be visible to a novice? To someone doing something fundamentally simple? I doubt it.

### Feature corner

**I** think you’ve always said that garbage collection was possible in C++, but I was mildly surprised to see a commercial Windows library offering it. Is this becoming a more common facility? Is there a possibility of there being a standard implementation?

Progress happens. I don’t think garbage collection is for every project – at least not yet – but you can get a reasonable garbage collector for most platforms (either free or commercially supported). If you have a project for which garbage collection is an obvious win, C++ is my favourite garbage collected language.



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I would have liked the standard to explicitly acknowledge that garbage collection is a valid implementation technique for C++, but a sizeable minority of the committee disagreed, so GC isn't mentioned. However, being simply an implementation technique, mentioning GC really isn't essential. Section C.9.1 of my third edition covers what I would have liked the standard to say explicitly – and a bit more – so I don't think there is any real danger that C++ GC implementations diverge from a language point of view.

#### Delphi bore strikes

**T**he main commercial C++ application frameworks for use with Windows have always been disappointing, and to this day remain hard-to-use and are of poor quality' say I – perhaps only a little wildly. Am I prejudiced by using specialist tools (VB, Delphi, PowerBuilder) – is C++ too general purpose to compete? I'm not an experienced Windows programmer, but it doesn't seem to me that C++ is too general-purpose to compete. On the contrary, when what you want to do is significant C++'s flexibility and efficiency really comes into play. I don't think it is easy to write programs for Windows – you need too much 'scaffolding' to get a nice user interface, and therefore you need tools to provide such scaffolding 'behind your back'.

Some of these tools are quite nice. For example, I found the Borland C++ Builder and its cousin Optima++ (whatever it is called these days) reasonably easy to learn and use. We will see many more improvements to the C++ development environments for Windows. As usual, the various vendors will copy each other and try to leapfrog by novel approaches and tools. I suspect that much good will come from that. I also hope that the vendors will leave room for Standard C++ – free of extensions – to be conveniently used for the main program logic. I find a lack of separation between the user-interface and the application a significant flaw for applications that are not mostly interfacing a user to a database.

This separation between vendor-specific tools and standard code will not be encouraged by vendors who will want to lock in users. It will happen only if users are firm in a demand for a large degree of vendor and platform independence.

**A**re these really good advertisements for C++ as a Windows tool? That Optima++/Power++ has not flourished is suggested by its name change. As for C++ Builder: it is built on top of a Pascal class library, contains language extensions ('properties') to make it more like Pascal,



**Much programming is about reuse. We reuse C and Fortran routines, why not a Delphi class hierarchy?**

uses a Pascal-built IDE... yet has compile/link cycle which is strikingly longer than Delphi. C++ is not a first class citizen here: it is used only to build the compiler itself. Borland's actions surely suggest that a specialised non-C++ alternative is better for actual Windows.

My answer wasn't meant to be an advertisement for anything and good software can be produced in most languages. Only a bigot would reject a tool because it wasn't implemented in his favourite programming language. Naturally, I assume that the Borland IDE would have been even

better had it been written in C++, but being written in Pascal on C++-like steroids doesn't make it bad. C++ is meant to be useful in mixed-language systems.

That said, I think they could and should have done without language extensions. Properties are essentially automatically-generated get and set member operations. For the standard classes these could have been written by hand – by suitable overloading, the

syntax could even have been the simple  $a = b$  with the meaning  $a.operator = (b.operator A())$ . If necessary, this style could have been supported by a tool without resorting to Delphi.

However, much programming is about reuse. We reuse C and Fortran routines, why not a Delphi class hierarchy? I suspect the decision was a simple economic one rather than a judgement about languages.

**T**he last question of EXE's 1989 interview with you was: what are you going to do next? (You answered, and subsequently executed, standardisation, a new edition of The C++ Programming Language, and adding templates and exceptions to the language.) Do you fancy a change from C++ yet?

I certainly fancy a change from language technicalities and standardisation. I want to write some code. Just about any kind of code will do! I plan to learn a few new languages, some new tools and environments, and maybe I'll write a couple of C++ libraries to get a feel for Standard C++ in contexts that are new to me. Also, I'm looking at some large internal projects at AT&T to get a good first-hand look at the changes that are sweeping software development and the telecommunications industry. After that, I hope to have a better notion of what problems are important. The common phenomenon of a solution looking for a problem isn't really my cup of tea. ■

*Many thanks to Bjarne Stroustrup for sparing the time for this interview. The C++ Programming Language Third Edition (ISBN: 0-201-88954-4) is available now.*

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# And who are you, then?

Many web sites need to maintain a user database and control access. Others need to personalise their services or provide user-specific information. None of this can be done without some reliable means of identifying users. But as Neil Hewitt found out, this can be easier said than done.



Kevin February

As anyone who has visited EXE's web site within the last eighteen months will know, we have been operating a compulsory registration policy. This means that we have had to come up with a way to identify our users and keep out unwanted guests. The first and most traditional means of user identification has always been challenge/response, where the user is presented with a dialog and invited to enter his or her username and password. As a security device this is fine; people are used to logging on to networks and workstations anyway, and despite the tendency of web users to choose rather easily-guessed username/password combinations – especially 'username' and 'password' – it is relatively difficult for anyone to impersonate anyone else.

Challenge/response does have its disadvantages, however. First and foremost, the necessity to log in to a site is at odds with the traditional 'click and go' freedom of the web, so much so that many people will simply not visit a site which requires it more than once. It's no surprise that the sites which make the most successful use of this method are those which charge for their services, especially adult content providers. Second, having yet another username and password combination to remember for a site which a user is unlikely to visit every single day is tedious and the details are quickly forgotten, leading to a barrage of plaintive emails asking for help or worse still, the same users registering over and over again, making your user data look like the stack from an infinite recursive loop. Third, it effectively locks out search engines and webcrawlers, blocking off your most effective form of advertising.

If your web site intends to store and retrieve user information, to use in personalising pages or to provide an end-user service like online ordering or stock querying, then basic challenge/response makes little sense. On the NT server platform, for example, authentication is enforced by setting the NTFS Access Control Lists (ACL) on

the directories you wish to keep secure; once the default permissions for the IUSR\_MACHINE guest account have been removed and anonymous access becomes impossible, the end-user must have a username and password which corresponds to a valid NT Server user account with the appropriate permissions to the files.

This can be an administrative nightmare and requires a great deal of programming to enable users to join your site without manual intervention being needed. And needless to say, writing a system-level program which interfaces with your web site is not the most sensible move from a security standpoint. Perhaps most importantly, it requires some fairly complex ISAPI filter programming to trap the username and password information entered by the user so that the values can be used in web pages, and then some form of state mechanism has to be set up so that the site can track each user individually.

## Beyond the basics

Having abandoned the idea of using the server's in-built authentication method, we then have to implement our user login procedure using server-side code of some kind, with the data input in HTML forms on the client side. I should mention at this point that some kind of Java solution is entirely possible but also unnecessarily complicated; what we wish to achieve can be done quite easily using server-side scripting. Webmasters on a Unix platform will doubtless wish to use Perl and CGI. As an NT developer, I plumped for server-side VB Script with the Active Server Pages (ASP) DLL, although I could just as easily have used JavaScript. For an introduction to ASP, I recommend you refer to Roy Tynan's article, *Scripting the Server* (EXE, August 1997), as I will be diving straight in.

The first requirement is to maintain a list of usernames and passwords together with any other details you may need. This could be



```

<%
' LOGIN.ASP
' A simple demo login script

' Check to see if we already have the username and password
if not isempty(request("username")) and not _
    isempty(request("password")) then

    ' First, create a new ADO database object
    set db = server.createobject("adodb.connection")
    db.open("YourDSN")

    ' YourDSN should be replaced by the name of a system DSN
    ' on the web server which logs on to the database you
    ' wish to use

    ' Now check the username against the database
    set dbrs = db.execute("SELECT * FROM Users WHERE _
        Username='" & request("username") & "'")

    ' If BOF & EOF are true, there's no record for username
    if dbrs.BOF and dbrs.EOF then _
        response.redirect("newuser.html")

    ' If we're here then there is a record for this username.
    ' Now check the password.

    if dbrs("password") <> request("password") then _
        response.redirect("error.html")

    ' The password checks out, so redirect to the home page
    ' after tidying up first

    dbrs.close
    db.close

    response.redirect("home.asp")
else

    ' No username / password, so display login boxes
    %>
    <html>
    <head>
    <title>Acme login page</title>
    </head>
    <body>

    <p><font size="6">Welcome to the Acme web site.</font></p>

    <p>Please enter your username and password in the boxes
    below.</p>

    <form method="POST" action="<%= request("SCRIPT_NAME") %>">

    <p>Username<br>
    <input type="text" name="username" size="20"></p>
    <p>Password<br>
    <input type="text" name="password" size="20"></p>
    <p><input type="submit" value="Enter"
        name="EnterDetails"></p>

    </form>

    </body>
    </html>

    <% end if %>

```

Listing 1 – A simple login script.

done in a flat file, but in order to reduce overhead and make the system scalable to large user lists, it makes more sense to store the data in some form of database. Which database this is makes little difference since all data access from ASP is done through ADO (ActiveX Data Objects) which uses the ODBC interface. In fact with NT you don't actually need a DBMS at all, because ADO will happily read from, write to, and query Microsoft Access-format .mdb files just like a normal ODBC data source.

First of all, we must create a database table to store the user information. In our simple example, this will contain only fields for username, password, firstname, lastname, email, registrationdate, and IPAddr. Each should be a text field of up to 50 characters for username, password, and names, 255 for email (some addresses can be quite long), 10 for registration date, and 15 for the IP address.

Listing 1 shows the ASP source for a simple login page. In this case, the action property of the form element points back to the same page using the SCRIPT\_NAME property from the servervariables collection of the request object. Self-referring forms like this are common in ASP; the lines of script at the top of the page check to see if the username and password variables have been passed to it, and if so run the authentication code. If not, the login boxes are displayed. Listing 2 is our 'new user' page – it captures the basic user details we require and writes them to the database.

Authentication is done by running a simple SQL query on the supplied username. If no such record exists then the recordset object dbrs will have both BOF and EOF conditions set to True and the user is automatically redirected to a page which could, for example, ask him to register. Then the supplied password is compared to the selected record. If the password is not correct the user is redirected to an appropriate error page. It is possible to include all the

error messages and account creation code into the same page as the login, but in general it's good policy not to put too much functionality in one page.

Remember that the flow of control in an ASP script is always top-down; because the response.redirect method is used it is essential to put the authorisation code at the top of the page, before any of the HTML content. This method sends an HTTP response header back to the browser containing the location of the new document. Once the HTTP page itself begins to stream, the browser will not accept any further HTTP headers, which means that response.redirect cannot be used in ASP code after the first HTML tags have been output. (Handy hint: if you get stuck in a situation where you need to redirect but must include some HTML code first, have your ASP script write out a short piece of client-side script in the format <SCRIPT> location.href=mypage.html </SCRIPT> which has the same effect but does require a script-compatible browser.)

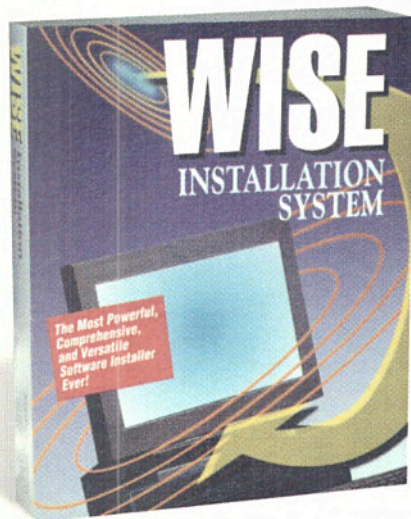
### Enter the cookie monster

Having logged the user in, we need to simulate some form of state so that other pages in the site have some way of identifying the user and responding accordingly. There are three common ways of doing this on NT: using the ASP session object, using cookies, or using the client IP address.

The ASP session object is created when a browser first requests a page from the server; it is maintained by placing a temporary cookie in the browser which is refreshed at each page request. This cookie expires in twenty minutes by default, which means that the session has an active lifetime of twenty minutes after the last page access. The session object will hold any parameters you care to assign to it, as in the following example:



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```

<%
' NEWUSER.ASP
' Gets user information and places it into the database

' Check if we have information in the request object
if not isempty request("username") then

    ' Check all required fields are filled in
    if isempty request("password") _
        or isempty request("passwordconfirm") _
        or isempty request("email") then _
        response.redirect("error.html")

    ' Check password matches passwordconfirm

    if request("password") <> request("passwordconfirm") then _
        response.redirect("error.html")

    ' Now open a connection to the database
    set db = server.createObject("adodb.connection")
    db.open("YourDSN")

    ' Create a new record and populate it

    sqlstring = "INSERT INTO Users _
        (username,password,email,firstname,lastname,regdate) "
    sqlstring = sqlstring & _
        "VALUES ('" & request("username") & "','" &
    sqlstring = sqlstring & request("password") & "','" &
    sqlstring = sqlstring & request("email") & "','" &
    sqlstring = sqlstring & request("firstname") & "','" &
    sqlstring = sqlstring & request("lastname") & "','" &
    sqlstring = sqlstring & date & "'"

    db.execute(sqlstring)

    ' Now send the user on to the home page

    db.close

    response.redirect("home.asp")

else

    %>
    <html>
    <head>
    <title>Acme user registration</title>
    </head>
    <body>

    <p><font size="6">Acme user registration form</font></p>

    <p>Please fill out the following fields:</p>

    <form method="POST" action="<%= request("SCRIPT_NAME") %">

        <p>Username<br>
        <input type="text" name="username" size="20"></p>
        <p>Password<br>
        <input type="text" name="password" size="20"></p>
        <p>Confirm password<br>
        <input type="text" name="passwordconfirm" size="20"></p>
        <p>Email address<br>
        <input type="text" name="email" size="20"></p>
        <p>First name<br>
        <input type="text" name="firstname" size="20"></p>
        <p>Surname<br>
        <input type="text" name="lastname" size="20"></p>
        <p><input type="submit" value="Submit"></p>

    </form>

    </body>
    </html>

    <% end if %>

```

Listing 2 A script to capture new user details.



```

<%
session("UserName")="wibble"
%>
<p align="left">The username for
this session is:
<%= session("UserName") %></p>

```

Because the server makes sure that no two session ID cookies are the same at any one time, the session object will always return the correct details for the browser which invoked it. However, the

session object has to be preloaded with the information you wish it to store, usually on the login page. Storing too much information in the session object can generate large bandwidth overheads, especially with multiple simultaneous users, so it is probably best to restrict your use of session to keeping a single piece of identifying information the username, for example and fetching anything else from the database as required.

A similar effect can be achieved by storing user data in a persistent cookie. Cookies have obtained a degree of notoriety of late, with many people regarding them as a security risk. Any server can scan any cookie held on your system, although it needs to know the name first. Should this ever be disclosed the security implications could be quite serious. The advantage of persistent cookies over the session object is that they stay with the browser after the session ends, so when a user next returns to the site it is possible to identify him directly from the cookie without needing to log in or provide any information.

Setting a cookie is simplicity itself. The response object can be used to return a cookie to the browser, and the request object can be used to read it back. The following code demonstrates this technique:

```

<%
response.cookies("DemoCookie")= _
    "This is a demonstration cookie"
if request.cookies("DemoCookie") <> "" then
    %>
    The cookie was set to:
    <%= request.cookies("DemoCookie") %><br>
    <%
    else
    %>
    The cookie could not be set. They are unsupported or
    disabled.<br>
    <%
    end if
    %>

```

Cookies can contain more than one piece of information. Such a cookie is known as a *cookie dictionary*. To store more than one piece of information in a cookie, use the key parameter in the following format:

```

response.cookies("DemoCookie")("cookie1")= _
    "This is demonstration cookie, key cookie1"
response.cookies("DemoCookie")("cookie2")= _
    "This is demonstration cookie, key cookie2"

```

Note that a cookie can store either a single value, or keyed values, but not both. Attempting to store a new key to a cookie with a single value assigned will erase the single value, and vice versa.

Many sites currently use cookies for this purpose, notably Microsoft's, which stores any information you might submit when downloading a file and pre-fills it in the next time you download. Microsoft also supplies a cookie-based user identification system in Site Server 2.0, called the Personalisation System. This combines cookie ID detection with a flat-file user property database and wraps



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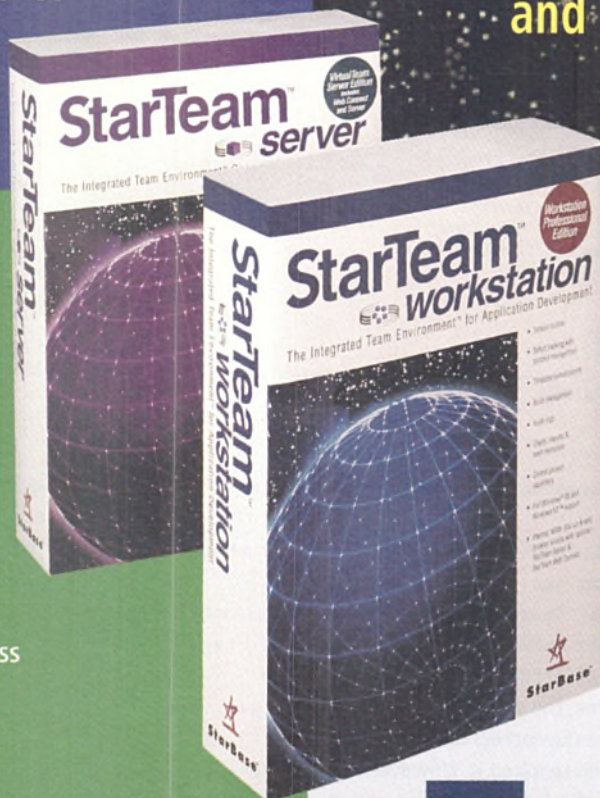
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```

<%
' REDIR.ASP
' A simple redirector page

set db=server.createobject("adodb.connection")
db.open "YourDSN"

' Open ADO connection to SQL Server

' If either username or password supplied alone,
' send to error page
if request("Password")="" and request("username")<>"" _
then response.redirect("error/nopassword.html")
if request("Username")="" and request("password")<>"" _
then response.redirect("error/nousername.html")

if request("Username")<>"" and request("Password")<>"" _
then
    ' Both username and password supplied in URL
    set dbrs=db.execute("SELECT * FROM Users WHERE _
        Username = '&request("Username")&'")
    ' Create a recordset on the chosen username -
    ' should be only 1 record
    if dbrs.EOF=False then
        ' dbrs.EOF would be True if no record had been found,
        ' so this is a valid username

        if dbrs("Password") = request("Password") then
            ' Password matches, user authenticated

            ' Get client IP address
            ipaddr=request.servervariables("REMOTE_ADDR")
            ' Put current IP address into user record for
            ' ID purposes
            db.execute("UPDATE Users _
                SET IPAddr = '&ipaddr&' _
                WHERE Username = '&request("Username")&'")

            authenticated=True

            ' If no password match display error message
            else response.redirect("error/badpassword.html")

            end if

            ' Username was invalid so redirect to newuser.asp
            else response.redirect("newuser.asp")

            end if
        end if

        ' If we're still here, there was no username or password
        ' supplied, or authentication is already done.
        ' If not authenticated, check SQL table for users with
        ' this IP address

        if not authenticated=True then

            set dbrs=db.execute("SELECT * FROM User _
                WHERE IPAddr = '&request.servervariables _
                ("REMOTE_ADDR")&'")
            if dbrs.EOF and dbrs.BOF then
                ' Empty recordset - user not found. Must be new.

                response.redirect("login.asp")
            end if

        end if

        ' If we're still here then the user has
        ' been found in the SQL database

        response.redirect(request("page"))

%>
<html>
<head>
<title>redirector</title>
</head>
<body bgcolor="#ffffff" bgcolor="#ffffff">
</body>
</html>

```

Listing 3 – A simple redirector script.

them in a set of server-side ActiveX controls which can be used from within ASP.

From a webmaster's point of view, cookies are an ideal authentication method. They make life easier for you, and don't require the user to jump through hoops just to access your content. Sadly they have one major flaw in that they are regarded with suspicion by many people and consequently some users simply turn them off, rendering your hard-crafted identification

system useless. Cookies are only a satisfactory solution where webmasters can be sure their potential audience has them enabled – for example

in an Intranet environment – or where they are happy to demand that users do so in order to access the site.

### IP, IP and away

The only other piece of information commonly available to a web server from every user is the client IP address. Although sometimes this may be the IP of a proxy server or firewall server, it is invariably unique for each browser during a session. IP addresses commonly change between sessions for many users, however, especially those who get their address via DHCP (Dynamic Host Configuration Protocol) or from a dial-up provider's IP pool, so a site should never store a user's IP address between sessions and expect to use that as an automatic identifier like a cookie.



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```

<%
' LOGIN.ASP

if not isempty(request("username")) and _
    not isempty(request("password")) then

    response.redirect("redir.asp?page=home.asp&username=" _
        & request("username") & "&password=" _
        & request("password"))

else

    ' No username / password, so display login boxes

%>
<html>
<head>
<title>Acme login page</title>
</head>
<body>

        <p><font size="6">Welcome to the Acme web site.</font></p>

        <p>Please enter your username and password in the boxes
        below.</p>

        <form method="POST" action="<%= request("SCRIPT_NAME") %">

            <p>Username<br>
            <input type="text" name="username" size="20"></p>
            <p>Password<br>
            <input type="text" name="password" size="20"></p>
            <p><input type="submit" value="Enter"
                name="EnterDetails"></p>

        </form>

    </body>
</html>

<% end if %>

```

Listing 4 – The modified login script.



In ASP you can retrieve the client IP address with the simple expression `request("REMOTE_ADDR")`. This is an object in the servervariables collection, like `SCRIPT_NAME`. This is the system of authentication used at EXE OnLine. As I mentioned above, because you can't expect the client IP address of a user to be the same between sessions, it's not possible to use the IP address

alone to authenticate; some other information, such as a username and password, must be supplied.

In the EXE OnLine system, once a user has authenticated with username and password, the current client IP address is written into the database – not being able to rely on the session object being available – where it can be queried by any page. After the user session has begun, comparing the current client IP address against this temporary table will always return the correct user account details for the client. This provides a quick and easy way for ASP pages which will customise themselves to detect the user, using the following code:

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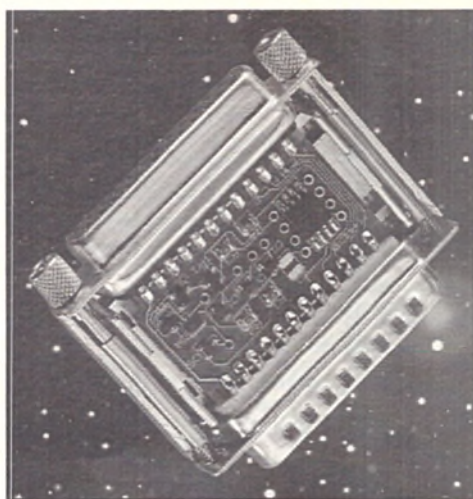
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## TECHNIQUES AND WHO ARE YOU, THEN?

```
<%
set dbrs = db.execute("SELECT * _
FROM Users WHERE _
IPAddr= _
'"&request("REMOTE_ADDR")&"'")
'the recordset dbrs can now be
'used to extract user details eg.
'dbrs("username") would return
'the username etc.
%>
```

The final piece in the puzzle is the capability to place name/value combinations in URLs. Originally developed to allow for the passing of variables to CGI scripts, ASP scripts are able to access any variables placed within the URL from the request object. This allows us to let the user authenticate without the need to manually log in, by placing the username and password into a bookmarked URL in the format:

<http://www.exe.co.uk/login.asp?username=wibble&password=wobble>

The login script from Listing 1 will already work in this way.

There is however a glaring security hole in this example; there is nothing at all to stop the user from bookmarking any of the other pages on your site and bypassing the login page completely. One way to stop this is to place checking code in each page which looks to see if the client IP address is in the temporary table and if not redirects to a login page, but this doesn't work in the case of plain HTML files which are not run through the ASP parser.

Our solution at EXE OnLine is to route all links through a single ASP script called `redir.asp` which performs a number of tasks including client authentication. This script also allows for webcrawlers and search engines to crawl our site by comparing incoming IP addresses against a known list of crawlers, and performs ad rotation duties. Centralising all this code means that a single change affects all pages immediately.

Listing 3 is a simplified version of `redir.asp` designed to work with an amended version of `login.asp` (Listing 4).

All internal URLs on a site which uses this method must be directed through `redir.asp`, for example a call to `aboutus.html` would be in the form `redir.asp?page=aboutus.html`. Note that there is no need to submit a username or password to `redir.asp` in normal operation as the session has already been established around the IP address during the first call.

New users should be sent a bookmark in the format:

<http://www.exe.co.uk/redir.asp?page=home.asp&username=wibble&password=wobble>

which allows them to return to the site, authenticating themselves as they go. Users who return to the base URL of your site should be redirected to log in manually – this can be achieved by making `login.asp` the default page for that site.

### The whole enchilada

The three example scripts, `login.asp`, `newuser.asp`, and `redir.asp` together form the basis of a working site registration and authentication system. Some way has to be found to send details of the username and password to the user, as well as the

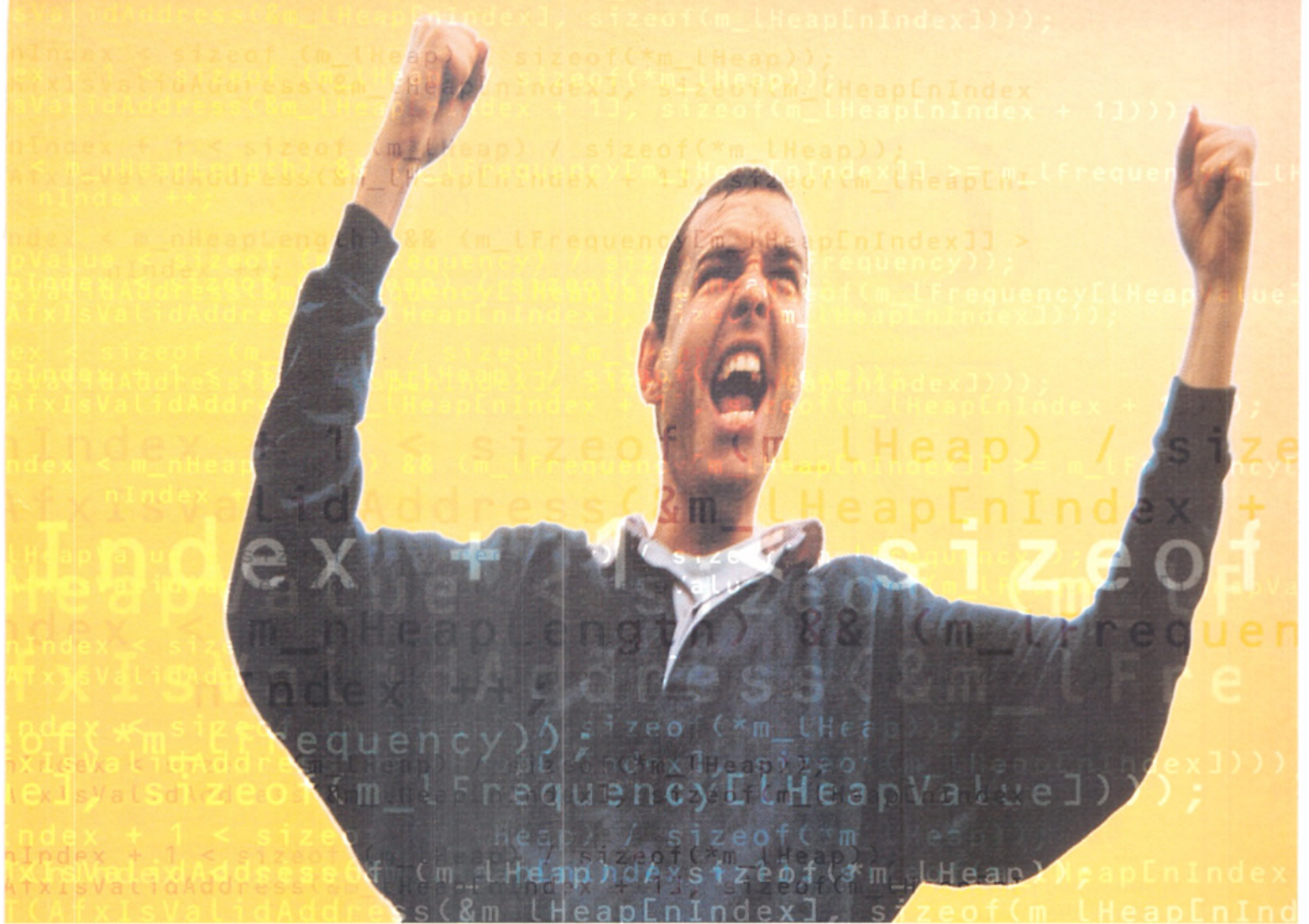
return bookmark. An easy way of doing this is by email; with IIS 3.0 it is necessary to buy a third-party ASP mail component which can send SMTP mail. There is one included with the Personalisation System, and the recently-released IIS 4.0 includes an internal SMTP mailer object.

There are a number of things missing from this very basic system. First and foremost, no context-checking or error reporting is performed. In actual use it would be essential to check that the user's choice of username was not already in use, that all information was supplied correctly, and that the database operations were successful. Second, no provision is made for IP session expiry – so for example if a user logging in via an ISP happened to be allocated the IP address previously used by someone else who visited the site previously, they would inherit the previous user's session and access to their personalised pages.

All these are quite easily corrected, which I leave as an exercise for the reader. For a demonstration of a fully-developed version of this registration system in action, browse over to EXEOnline at <http://www.exe.co.uk> and register yourself as a user.

I hope this has served as a useful introduction to some of the things which can be achieved relatively simply with Active Server Pages. In future articles in this irregular series I will look more extensively at some of the topics I only touched on here, including personalised content, dual-mode conferencing, and how to build a self-maintaining IE4-style Active Channel using ASP. Until then, happy scripting! ■





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# New life for your labels

Dave Jewell shows how to spruce up your Delphi programs with two easy-to-use label controls.

Is your application looking a bit tired and jaded? Isn't it time you gave it a new look for 1998? In this article, I describe a couple of simple to use label controls for inclusion in your Delphi applications. Having just finished reading Matt Pietrek's introduction to Windows NT 5.0 in a recent issue of *Microsoft System Journal*, it's apparent that a new raft of visual user interface gadgets are on the way. If you want to keep up with the Joneses (if not the Gateses!) then it's time you applied a lick of paint to your application...

One of the simplest ways of sprucing up your existing applications is by 'Internet-enabling' them. No, I'm not talking about adding Internet browsing capabilities to your new shareware egg-timer application. I'm simply saying that one or two URL hot-links can be quite effective if added (for example) to the About box of your program. You might want to give users the ability to connect directly to a specific area on your Web site in order to check for new product releases, bug-fixes, patches, and so forth.

By now most developers know that the easiest way to fire up a Web browser is to pass an URL to the `ShellExecute` API routine which, when programming with Delphi, is located in the `SHELLAPI` unit. Using the `OnClick` handler of a standard `TLabel` component, it's quite possible to set up an event handler which triggers off the necessary call to `ShellExecute`. However, to make this look nice, you've also got to have a non-standard font colour for the label, a non-standard cursor control (so that the user receives visual feedback that the label is 'hot'), and maybe a few other things besides.

## The LinkLabel control

Rather than reinventing the wheel each time you need one of these link label controls, the Delphi philosophy dictates that we write a reusable component to do the job. The result of my deliberations is shown in Listing 1. As you can see, this control is derived from the existing `TCustomLabel` class. It hides all the standard event-handling properties associated with the parent class, although if you wanted to expose these properties for any reason, you could easily do this by adding the relevant property statements to the published section of the class declaration.

What it brings to the party is a trio of new properties. First is `LinkColor`, the colour in which the text of the label is initially displayed. This defaults to blue. The next custom property is `VisitedColor`. I added this property for compatibility with Internet browsers

which change the colour of a link to indicate that a particular route has already been explored. When you've clicked on my link label control once, the colour changes to whatever you specify for `VisitedColor`. This defaults to red. In the event that you don't want the appearance of the link label to change once it has been clicked, you can just set `LinkColor` and `VisitedColor` to the same value. Finally, there's a read-only property called `Visited` which can be used to interrogate a particular link label to see if it has been clicked.

A couple of other points of interest. First, I've arranged things so that the `Transparent` property of the label defaults to `True`. Whenever I use a label control in a Delphi application, I almost always end up setting the label to be transparent so that background colour changes (if any) will show through. Having `Transparent` default to `False` is a pet hate of mine – you'll have to indulge me on this one! Second, it's convenient to be able to programmatically reset the control back to a 'non-visited' condition and I chose to do that by assigning to the `LinkColor` or `VisitedColor` property. If you prefer, you could make the `Visited` property read-write and directly set it back to `False`.

There's not a great deal to say about the code in Listing 1 because it's all very straightforward. You'll notice that in the class constructor I set an underlined font style, and I also set the cursor to Delphi's standard pointing hand cursor. As mentioned earlier, this provides visual feedback to the user. The most important part of the control is the `WMCClick` handler. This is the code that's responsible for calling `ShellExecute` in response to a mouse click.

As written, this code assumes that the control's caption string is a valid URL. It tries to open your default Web browser using that address and specifies the Windows desktop as the parent window. However, if you're feeling adventurous (or like adding bells-and-whistles!) you could easily modify the code so it looks like this:

```
ShellExecute (GetDesktopWindow, Nil, PChar(Caption),
             Nil, Nil, sw_ShowNormal);
```

With this simple change, the URL link label has suddenly turned into an Explorer launcher. Whatever you specify as the label caption will be interpreted as part of the Explorer's namespace and Windows will try to launch Explorer with the specified folder in view. For instance, set the caption to 'Desktop' and you'll obviously get the desktop. Set it to 'Desktop/In-Tray' (note the forward slash) and Explorer will give a view of your In-Tray folder, and so on.

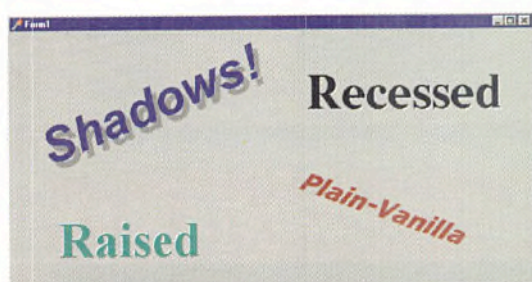
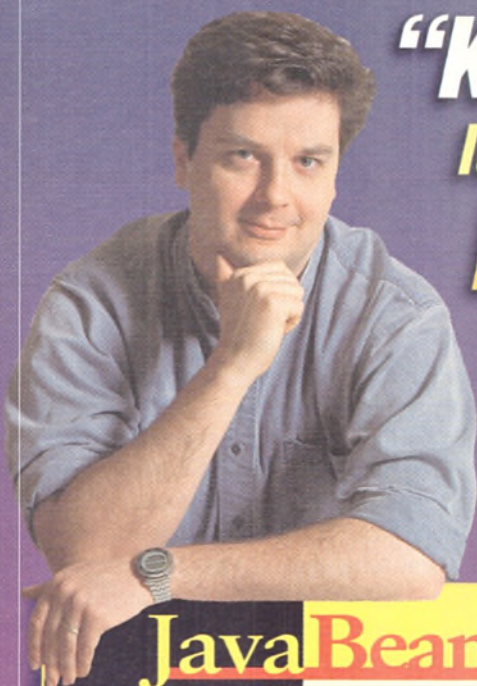


Figure 1 – The effects which you can get using the TXLabel control.



Figure 2 – The text effects with the standard Wingdings fonts.





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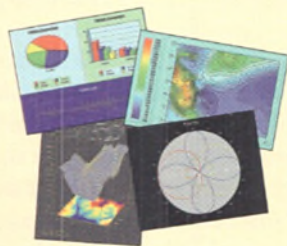
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### Adding a twist to your text

You can also give the label control a little more panache in the visual impact department. Listing 2 provides the complete source code to a control called `TXLabel`. This uses a number of ideas from other commercial control libraries which I've seen from time to time, such as the enhanced label in TurboPower's Orpheus library and the one in the Raize component library. There are quite a few things that `TXLabel` will do for you. (See Figure 1 for the effects this control can achieve.)

You can choose from one of four different text styles, as specified through the `TextStyle` property. In addition to the usual plain-vanilla look, you can give text a raised appearance or you can give it a sunken, three dimensional, embossed look. Finally, you can opt to have a shadow appear behind the text label. If you use the shadow style, then two other properties come into play. These are `ShadowColor`, whose meaning should be pretty obvious, and `ShadowOffset` which controls the horizontal and vertical displacement between the text and the shadow. These four properties are wrapped up into an enumerated type, `TXTextStyle`. By ensuring that the published property is of the same type, you will see each member of the enumerated type in Delphi's property inspector.

It should be emphasised that there isn't any support for prefixed characters. In other words, if you set the label caption to `&Hello`, then that's exactly what you'll see. No underlining of the initial `H` character will take place. The reason for this restriction is that `TXLabel` is designed primarily to produce decorative effects. In addition to the previously mentioned text style variations, you can display rotated text. This is done by setting the desired angle (in degrees) through the `Angle` property. By convention, an angle of zero represents no rotation, and angles increase counter-clockwise. Thus, 90 degrees is pointing straight up, 180 degrees is upside down (text going from right to left) and 270 degrees is pointing straight down. If you're a scientific bod, you may wish to add a `Radians` property so that the angle can be entered either in degrees or in radians. This would be trivial.

Note that it would certainly be possible to add support for prefixed characters at the cost of some complexity. Basically, you'd have to do a

special case for a zero-degree rotation and use something like the Windows API `DrawText` routine in order to get the special processing of the ampersand character when there's no rotation. Naturally, you still won't get the underscore when the text is rotated and you'll also find that large font sizes combined with special text styles will not give a nice effect. Until Microsoft comes up with a decent implementation of `DrawText` which works with rotated text and handles ampersand prefixes correctly, it's probably not worth the extra hassle in terms of code complexity.

While on the subject of `DrawText`, wouldn't it be terrific if there was a `dt_xxx` flag which didn't actually draw any text but instead calculated the size and position of the bounding rectangle? Before you fire off a letter to the editor, yes I know all about `dt_CalcRect`. The problem with `dt_CalcRect` is that it assumes no rotation. It will only give you a flat-on-its-back rectangle, irrespective of the degree of rotation in the font which you've selected into the device context. What's really needed, of course, is a routine which understands about rotated fonts and returns a region handle for the area which will correspond to the rotated text. That way, you could do some fancy hit-testing in response to a mouse-click and only trigger a mouse-down event if the mouse actually landed in this region. As the control stands at the moment, any mouse click in the client area of the control will be accepted. Note that the `AutoSize` property may not function entirely as you expect, especially when rotated text is being displayed, but I've got to leave a few things as an exercise for the reader.

In addition to the properties already mentioned, the `TXLabel` control provides optional hot tracking. This is enabled by turning on the `HotTrackEnabled` property. With hot tracking enabled, the colour of the label text will change to `HotTrackColor` every time that the mouse is in the control. The link label used a hand cursor to indicate that the control was interactive, but hot-tracking is another approach. Personally, I wouldn't recommend the use of a hand cursor in addition to hot-tracking, but it's really a matter of personal taste.

Another feature of the text label is the addition of `OnMouseEnter` and `OnMouseLeave` events, which are not supported by the standard

```
unit LinkLabel;
interface
uses
  Windows, Messages, SysUtils, Classes, Graphics,
  Controls, Forms, StdCtrls, ShellAPI;
type
  TLinkLabel = class(TCustomLabel)
  private
    fLinkColor: TColor;
    fVisitedColor: TColor;
    fVisited: Boolean;
    procedure SetLinkColor (AColor: TColor);
    procedure SetVisitedColor (AColor: TColor);
    procedure WMClick (var Msg: TWMLButtonDown);
      message wm_LButtonDown;
  protected
  public
    constructor Create (AOwner: TComponent); override;
  published
    property Enabled; property ShowHint; property AutoSize;
    property WordWrap; property Align; property Alignment;
    property Caption; property Font; property Color;
    property Visible; property Transparent default True;
    property LinkColor: TColor read fLinkColor
      write SetLinkColor default clBlue;
    property VisitedColor: TColor read fVisitedColor
      write SetVisitedColor default clRed;
    property Visited: Boolean read fVisited;
  end;

  procedure Register;
implementation

constructor TLinkLabel.Create (AOwner: TComponent);
begin
  Inherited Create (AOwner);
  fVisited := False;

  fLinkColor := clBlue;
  fVisitedColor := clRed;
  Font.Color := fLinkColor;
  Font.Style := [fsUnderline];
  Transparent := True;
  Cursor := crHandPoint;
end;

procedure TLinkLabel.WMClick (var Msg: TWMLButtonDown);
begin
  fVisited := True;
  Font.Color := fVisitedColor;
  Refresh;
  ShellExecute (GetDesktopWindow, 'open',
    PChar(Caption), Nil, Nil, sw_ShowNormal);
end;

procedure TLinkLabel.SetLinkColor (AColor: TColor);
begin
  fLinkColor := AColor;
  Font.Color := AColor;
  fVisited := False;
  Refresh;
end;

procedure TLinkLabel.SetVisitedColor (AColor: TColor);
begin
  fVisitedColor := AColor;
  Font.Color := fLinkColor;
  fVisited := False;
  Refresh;
end;

procedure Register;
begin
  RegisterComponents ('XFactor', [TLinkLabel]);
end;
```

Listing 1 LinkLabel, a control for adding URL hot-links to applications.



label. In order to support hot tracking, the code has to handle the VCL messages `cm_MouseEnter` and `cm_MouseLeave`. These messages are fielded by the routines `CMMouseEnter` and `CMMouseLeave`. Since pretty well all the code is there, it's a trivial job to add the necessary hooks for application supplied mouse enter/leave routines.

By now, you'll probably have realised that the `TXLabel` represents something of a superset of the link label. It can do pretty much everything that the simpler control can do, and a lot more besides. For example, if you wanted to be flashy (if not tasteful), you could use the `OnMouseEnter` and `OnMouseLeave` events to change the text style (or even the caption) while the mouse is over a hot label.

### No TrueType no comment

In case you've never rotated a Windows font before, here's an explanation of how it works. Basically, this feature will only work for TrueType fonts because, as I'm sure you appreciate, a TrueType font is a collection of drawing instructions for rendering each font character. Since the font contains the drawing instructions rather than an actual image

of the font, it's easy to rotate the shape of each character by rotating the co-ordinate system before executing the appropriate drawing instructions. In essence, TrueType fonts are to ordinary bitmapped fonts as Windows metafiles are to bitmaps. The analogy isn't exact because there's more inherent complexity in TrueType fonts. In addition to the basic drawing instructions, there's also hint information for improving readability at, for example, small point sizes.

The actual business of creating a rotated font is handled by the `CreateRotatedFont` routine—surprise, surprise! This uses the Windows API routine `CreateFontIndirect`, building a font specification in a `TLogFont` data structure, according to the requirements for the font, whether it should be bold, italic, underlined, or whatever. The only twist (pun strictly intentional) that's needed to produce a rotated font is to set the `lfEscapement` field. This controls the rotation of the font and is in units of one tenth of a degree. Thus, we need to multiply the `Angle` property by ten to get the correct value.

As mentioned above, rotation will only work with TrueType fonts. Therefore, the label control has to ensure that a TrueType font is being

```
unit XLabel;
interface
uses
  Windows, Messages, SysUtils, Classes, Graphics,
  Controls, Forms, Dialogs, StdCtrls;
type
  TXTextStyle = ( tsxNormal, tsxShadow, tsxRecessed, tsxRaised );
  TXLabel = class(TCustomLabel)
  private
    fAngle: Integer; fShadowColor: TColor; fHotTrackColor: TColor;
    fShadowOffset: Integer; fTextStyle: TXTextStyle;
    fHotTrackEnabled: Boolean; fHotTrackColorCache: TColor;
    fOnMouseEnter: TNotifyEvent; fOnMouseLeave: TNotifyEvent;
    procedure SetAngle (Value: Integer);
    procedure SetShadowColor (Value: TColor);
    procedure SetShadowOffset (Value: Integer);
    procedure SetHotTrackColor (Value: TColor);
    procedure SetTextStyle (Value: TXTextStyle);
    procedure SetHotTrackEnabled (Value: Boolean);
    procedure CheckTTFont (AFont: TFont; Zeroise: Boolean);
    procedure CMMouseEnter (var Message: TMessage);
    procedure CMMouseLeave (var Message: TMessage);
    procedure CMTextChanged (var Message: TMessage);
    procedure CMFontChanged (var Message: TMessage);
  protected
    procedure Loaded; override;
    procedure Paint; override;
    function CreateRotatedFont (Angle: Integer): HFont;
  public
    constructor Create (AOwner: TComponent); override;
  published
    property Caption; property Visible; property Enabled;
    property ParentFont; property ParentColor; property Align;
    property DragMode; property Font; property Color;
    property DragCursor; property PopupMenu; property ShowHint;
    property ParentShowHint; property OnMouseDown; property AutoSize;
    property Transparent default True; property OnMouseMove;
    property OnMouseUp; property OnDragDrop; property OnDragOver;
    property OnStartDrag; property OnEndDrag; property OnClick;
    property OnDblClick;
    property Angle: Integer read fAngle write SetAngle default 0;
    property HotTrackEnabled: Boolean read fHotTrackEnabled
      write SetHotTrackEnabled default False;
    property HotTrackColor: TColor read fHotTrackColor
      write SetHotTrackColor default clHighlight;
    property TextStyle: TXTextStyle read fTextStyle write SetTextStyle
      default tsxRecessed;
    property ShadowOffset: Integer
      read fShadowOffset write SetShadowOffset default 3;
    property ShadowColor: TColor read fShadowColor
      write SetShadowColor default clBtnShadow;
    property OnMouseEnter: TNotifyEvent
      read fOnMouseEnter write fOnMouseEnter;
    property OnMouseLeave: TNotifyEvent
      read fOnMouseLeave write fOnMouseLeave;
  end;

procedure Register;
implementation

constructor TXLabel.Create (AOwner: TComponent);
begin
  Inherited Create (AOwner);
  fHotTrackColor := clHighlight;
  fShadowColor := clBtnShadow;
  fTextStyle := tsxRecessed;
  fShadowOffset := 3;
  Transparent := True;
end;

function TXLabel.CreateRotatedFont (Angle: Integer): HFont;
var lf: TLogFont;
begin
  FillChar (lf, sizeof (lf), 0);
  with lf do begin
    lfHeight := Font.Height;
    lfEscapement := Angle * 10;
    if fsBold in Font.Style then lfWeight := fw_Bold
    else lfWeight := fw_Normal;
    lfItalic := Byte (fsItalic in Font.Style);
    lfUnderline := Byte (fsUnderline in Font.Style);
    lfStrikeOut := Byte (fsStrikeout in Font.Style);
    lfCharSet := Default_Charset;
    case Font.Pitch of
      fpVariable: lfPitchAndFamily := Variable_Pitch;
      fpFixed: lfPitchAndFamily := Fixed_Pitch;
    end;
    StrPCopy (lfFaceName, Font.Name);
    Result := CreateFontIndirect (lf);
  end;
end;

procedure TXLabel.CMFontChanged (var Message: TMessage);
begin
  Inherited; CheckTTFont (Font, True);
end;

procedure TXLabel.CMTextChanged (var Message: TMessage);
begin
  Inherited; Invalidate;
end;

procedure TXLabel.CMMouseEnter (var Message: TMessage);
begin
  Inherited;
  if fHotTrackEnabled then begin
    fHotTrackColorCache := Font.Color;
    Font.Color := fHotTrackColor;
  end;

  if Assigned (fOnMouseEnter) then fOnMouseEnter (Self);
end;

procedure TXLabel.CMMouseLeave (var Message: TMessage);
begin
  Inherited;
  if fHotTrackEnabled then Font.Color := fHotTrackColorCache;
  if Assigned (fOnMouseLeave) then fOnMouseLeave (Self);
end;

procedure TXLabel.SetHotTrackEnabled (Value: Boolean);
begin
  if Value <> fHotTrackEnabled then begin
    fHotTrackEnabled := Value;
    if Value = False then
      Font.Color := fHotTrackColorCache;
    Invalidate;
  end;
end;
```

Listing 2 TXLabel, a control for text styling (continued overleaf).





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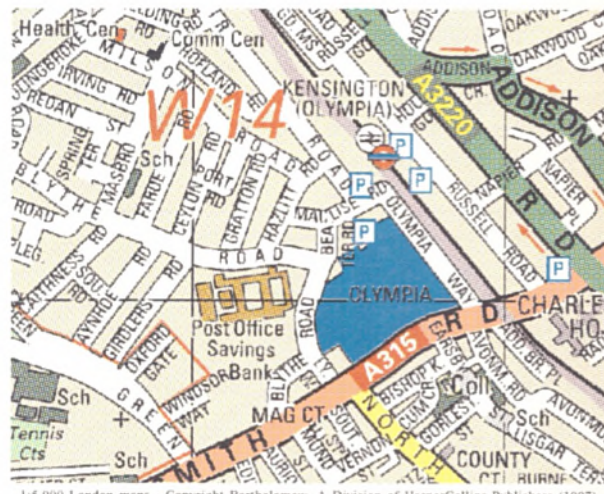
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used. This is handled by the `CheckTTFont` routine. If the `Zeroise` parameter is set, then the code will reset the rotation angle to zero if it detects that a non-TrueType font is being used. If `Zeroise` isn't set, then `CheckTTFont` forces use of a TrueType font, Arial being a good default choice.

The `CheckTTFont` routine is called from the `CMFontChanged` code whenever the label control is assigned a new font. Because the `Zeroise` parameter is set `True`, this has the effect of clearing the `Angle` property whenever a non-TrueType font is selected, the assumption being that if the programmer is setting the font, it's more important than rotation. Similarly, the `SetAngle` code calls `CheckTTFont` with the `Zeroise` parameter set `False`, which has the effect of loading the Arial font if a non-TrueType font is currently selected. Here, the assumption is that if the programmer is setting the angle, then 'rotatability' (to coin a phrase!) is more important than the currently selected font. Finally, `CheckTTFont` is also called from the `Loaded` procedure. This is a virtual method that's called to perform any needed initialisation before a control first appears on a form. Here again, the code ensures that a TrueType font is selected if a non-zero rotation angle is given.

## Other ideas...

Once you've written a little code to draw raised, recessed, or shadowed text, there are other things you can do besides creating fancy-looking labels. Figure 2 shows some of the eye-catching effects which result from applying this treatment to the various 'Wingdings' fonts. It would be quite easy to render these images into an off-screen bitmap and then use them as the basis for a nice looking toolbar. Better yet, because you're using a scalable TrueType font to produce the individual button images, you could give the user the option of scaling a toolbar to their own individual preferences while still ending up with a nice looking result. Even with the plethora of features embedded in Office 97, this is something that Word for Windows 97 can't do for you...

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```

procedure TXLabel.SetShadowColor (Value: TColor);
begin
  if Value <> fShadowColor then begin
    fShadowColor := Value;
    Invalidate;
  end;
end;

procedure TXLabel.SetHotTrackColor (Value: TColor);
begin
  if Value <> fHotTrackColor then begin
    fHotTrackColor := Value;
    Invalidate;
  end;
end;

procedure TXLabel.SetShadowOffset (Value: Integer);
begin
  if Value <> fShadowOffset then begin
    fShadowOffset := Value;
    Invalidate;
  end;
end;

procedure TXLabel.CheckTTFont (AFont: TFont; Zeroise: Boolean);
var
  tm: TTextMetric;
begin
  Canvas.Font := AFont;
  if (not (csLoading in ComponentState))
    and (fAngle <> 0) then begin
    { We need to rotate. See if it's a TrueType font }
    GetTextMetrics (Canvas.Handle, tm);
    if (tm.tmPitchAndFamily and tmpf_TrueType) <>
      tmpf_TrueType then
    { It's not a TrueType font - zero angle or use Arial }
    if Zeroise then fAngle := 0
    else Font.Name := 'Arial';
  end;
end;

procedure TXLabel.SetAngle (Value: Integer);
begin
  if Value <> fAngle then begin
    CheckTTFont (Font, False);
    fAngle := Value mod 360;
    if fAngle < 0 then fAngle := 360 + Value;
    if fAngle <> 0 then AutoSize := False;
    Invalidate;
  end;
end;

procedure TXLabel.SetTextStyle (Value: TXTextStyle);
begin
  if Value <> fTextStyle then begin
    fTextStyle := Value;
    Invalidate;
  end;
end;

procedure TXLabel.Loaded;
begin
  Inherited; if fAngle <> 0 then CheckTTFont (Font, False);
end;

procedure TXLabel.Paint;
var
  DrawPoint: TPoint;
  qHeight, fRads: Extended;

  procedure PaintText (Offset: Integer);
  var
    r: TRect;
  begin
    r := ClientRect;
    OffsetRect (r, Offset, Offset);
    with Canvas do begin
      case fTextStyle of
        tsxShadow:      Font.Color := fShadowColor;
        tsxRaised:
          if Offset = 1 then Font.Color := clBtnShadow
          else Font.Color := clBtnHighlight;
        tsxRecessed:
          if Offset = -1 then Font.Color := clBtnShadow
          else Font.Color := clBtnHighlight;
      end;

      TextRect (r, DrawPoint.x + Offset,
                DrawPoint.y + Offset, Caption);
    end;
  end;

begin
  with Canvas do begin
    if not Transparent then begin
      Brush.Color := Color;
      Brush.Style := bsSolid;
      FillRect (ClientRect);
    end;

    Brush.Style := bsClear;
    DrawPoint := Point (Width div 2, Height div 2);
    Font := Self.Font;
    fRads := (Angle * pi / 180.0) + (pi / 2.0);
    qHeight := TextHeight ('Y') * 0.25;
    SetTextAlign (Handle, ta_BaseLine or ta_Center);
    Dec (DrawPoint.x, Round (Cos (fRads) * qHeight));
    Inc (DrawPoint.y, Round (Sin (fRads) * qHeight));

    Font.Handle := CreateRotatedFont (fAngle);
    case fTextStyle of
      tsxShadow: PaintText (fShadowOffset);

      tsxRaised, tsxRecessed:
        begin
          PaintText (1);
          PaintText (-1);
        end;
    end;

    Font.Color := Self.Font.Color;
    if not Enabled then Font.Color := clGrayText;
    TextRect (ClientRect, DrawPoint.x,
              DrawPoint.y, Caption);
  end;
end;

procedure Register;
begin
  RegisterComponents ('XFactor', [TXLabel]); end;
end.
```

Listing 2 - TXLabel, a control for text styling (continued).

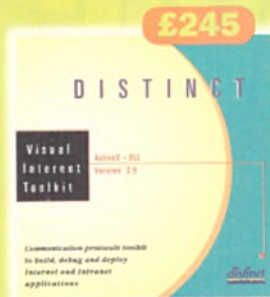




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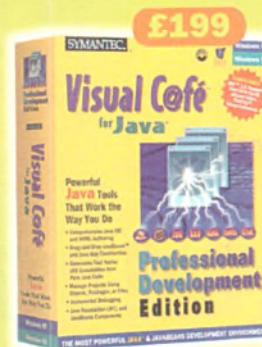
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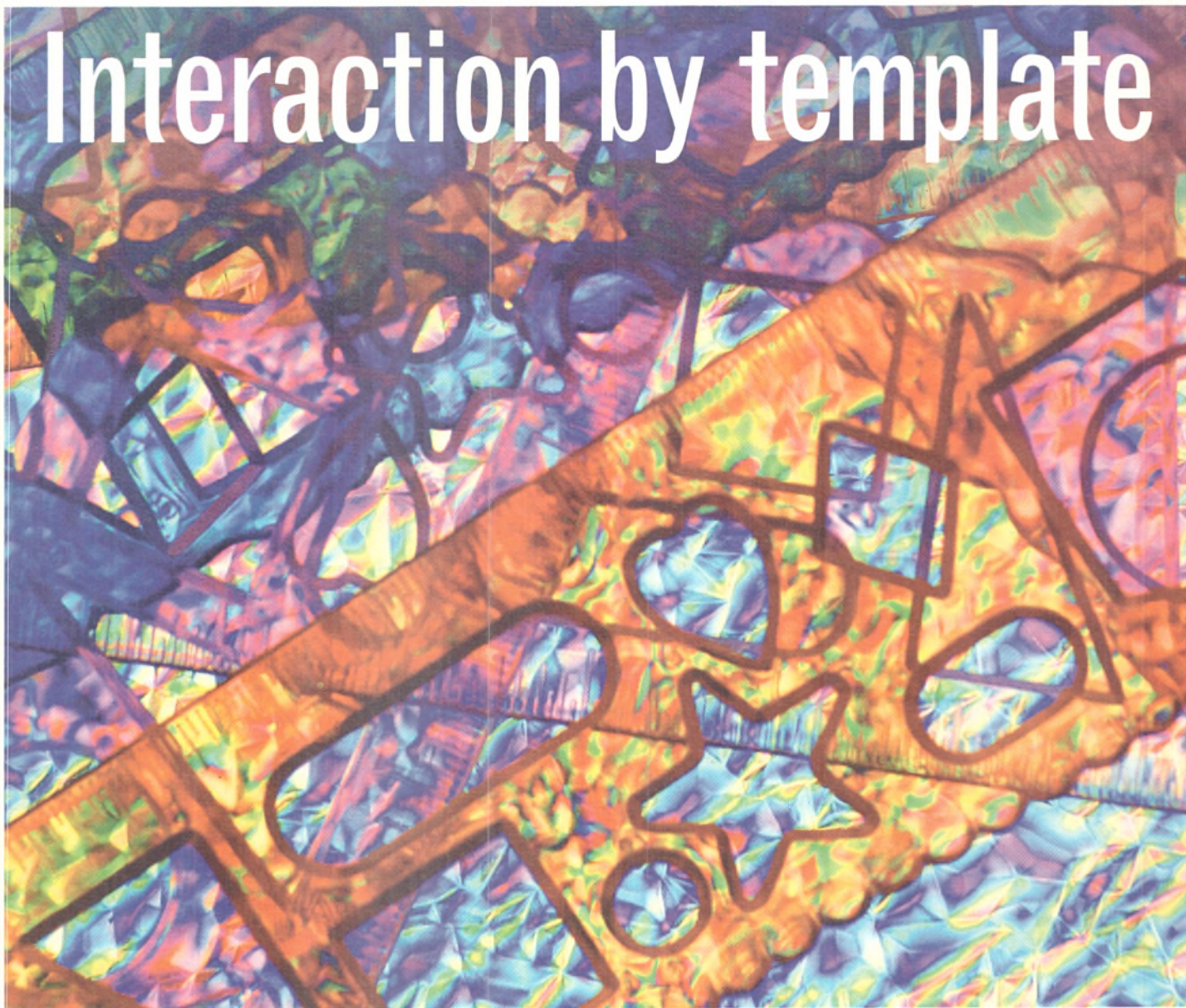
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# Interaction by template



**Peter Collinson looks at how the generation of interactive web sites can be made much easier using a simple Perl macro processor.**

In my guise as webmaster, web page creator, and web CGI programmer for various sites, I'm seeing increasing demands for real interactivity on the web. On all my web sites I'm finding the need for many separate applications which boil down to a common sequence of operations: data input, data storage, data processing, and finally, some result. I suppose that I am seeing the extension of the general computing model to the web. Rather than the user simply looking at information, the user is being asked to provide data so that someone else can process it.

Usually the user supplies information via a form. This form, perhaps an order for some product, may contain credit card information, or a simple request for information, or contain data which will find its way back onto the web. On some sites, the data from the form is fed back directly online. I don't feel too happy about allowing random users to have direct access to my web pages because there is too much opportunity for misuse. I prefer to place a moderator in the way of the data flow to check that the information from the user is appropriate.

All of these applications mean that the data from the user is stored somehow for processing later. About a year ago, we would have dealt with this data storage by using email. The data was taken from the web CGI script and sent by email to someone for processing. These days, I am beginning to set up administrative web pages designed to process the submitted data which has been stored in a file on the server machine.

The reasons for choosing the web as the primary GUI and processing tool are easy to list. First, it's a platform independent method of delivering information. I don't have to worry about the machine or system which the person processing the data is running, they will have access to a browser and that's all I need. Second, it's a familiar interface. The person accessing the data runs a browser which slots into their familiar working environment and accesses information in the same way that they do when surfing the net. Third, it's location independent, as long as the person reading the data knows the user-name/password pair, I don't care where they are in the world.



Finally, getting the person who processes the data to return to the same machine which acquired the sensitive information can aid data security. People are correctly worried about sending their credit card information over the net and are much happier if you supply a secure server using SSL (Secure Sockets Layer) to protect the packets. However, what happens then? I'll bet that many businesses store credit card information in plain text on their machine. If that machine is on the Internet then there is always the possibility that a hacker can come in and take that information. Actually, this has happened at least once – but not to me, yet.

If I were storing the sensitive information in a file, then I'd like to use a public key encryption method, like PGP (Pretty Good Privacy), to protect it. I want to ensure that the key which is needed to decrypt the data is not stored on the machine, so that a hacker cannot easily decrypt the file. I could send the encrypted information by email to the vendor for processing, but this involves some training and worry about whether I can get the vendor to operate the decryption mechanism correctly.

It seems easier to encrypt the data with a public key and get the vendor to come in over the web to access the information using the secure server. They will type in their private PGP password and be sent the information safely. There are risks when the information is sitting on their machine, but these are probably no greater than the risk of having a faxed or written order around in the office. The data has left the user encrypted and will appear on the vendor's system having been encrypted for the duration of its passage. This seems the best that can be done.

Therefore, I am beginning to build sites which have a public face with some pages and forms, and a private administrative face, allowing the owner of the site to interact with the data from the user. I'd done a couple of these applications before I understood that I was solving the same problem repeatedly. It can often take a long time for this particular penny to drop. Sometimes, the realisation never strikes, because you can solve the same problem in many different ways. Each solution dominates the work so that you are unable to step back and realise that there is a common problem which you are attempting to solve each time. This is particularly true of the web, where each site has a different look and feel, and each set of pages which you create is different from the last.

Actually, I don't feel that I have arrived at a complete set of tools which can help to solve these problems. It's an ongoing development. I have perhaps taken a different route from many people and I am finding that the tools which I have created make the generation of interactive sites much easier.

### The nature of the beast

Luckily, some far-sighted person decided that we would all need a standard interface to get information from web servers into their information handling support programs. CGI programs can be written in any language but Perl is probably the first language of choice for most web programmers.

The underlying reason for this is easy to understand. Perl is good at dealing with the data which the web server presents to its processing scripts. The data is all in the form of text strings, although they are encoded to ensure data integrity. Perl handles text strings very well. They are 'native' objects in the language and Perl supports a set of very powerful operations for them.

Another feature of the language which helps the CGI programmer is the associative array (or *hash*). Information from the web page is sent as *name=value* strings, and can be easily loaded into an associative array, the value being accessed using the *name* as the key.

Perl allows the programmer to deal simply with the system on which the program is running. The language supports easy access to files, databases, sockets, and the output of other programs. It has a good well-defined library mechanism, so it's simple for programmers to pick up code which they need and just use it in their application.

Actually, I would also argue that Perl is over-complex. It can be counter-intuitive, until you have the appropriate surgery to make your brain operate in the 'Perl way'. It is not too easy to learn and has too many 'hidden' aspects – it can be hard to read someone else's code and understand what is going on. However, the problems haven't stopped me using the language for web processing.

The script, which the web server calls when the user sends in the response from a form, has two tasks. First, it needs to decode the form and store (or process) the data. Second, it needs to send a page back to the user giving an indication of the action's result. Several Perl libraries are aimed at providing the programmer with tools that can be used to read and send data in the correct format. These libraries have coalesced into a single CGI module, which is part of the standard Perl release.

I've avoided these libraries. I will admit that part of the reason for ignoring them was the 'not invented here' syndrome. As I was learning Perl, I didn't want to be dependent on someone else's code which may or may not work properly, or for which I would have to dedicate a lot of time to understand. A larger and perhaps more cogent reason is that the libraries expect you to place much of the look and feel of the final page into the Perl code. I've decided from experience that I don't want to do that.

Many of my early CGI scripts were stuffed with print statements which turned a call like:

```
error("Please supply a phone number");
```

into a fully-fledged HTML page, starting with the correct MIME header which the HTTP protocol requires. However, embedding this information creates maintenance issues. To change the look and feel of the page, you have to change the script. No big deal, I hear you say. Well, changing the script can be a big problem. Once I have developed a program and deployed it, I find that I am always deeply queasy about making changes to it, however slight. You have to relearn how the program works and how it interacts with other programs. The possibility for unintentional accidental damage to the operational script is too great. Finally, you need to test the changed script, and on a live system this is not always easy.

Ideally, I don't want to change the script, I want to just alter the constant data which it uses to create the appropriate page. I want to place the data into a file, and use that file as a template to generate the final page, effectively splitting the action of decoding and sending a response from the format of the data which is sent. To change the format of the response I only need to edit a file whose contents will be sent to the browser and this feels safer than planning to hack the program. However, I'd like to set some of the contents of the file from the Perl script; I came to the conclusion that I needed a macro processor in Perl.

### Macros

I've used the `m4` macro processor for some years to generate web pages, but it does have problems. The program actually does too much and has several keywords which you need to eliminate. For example, `index` is a keyword used for string matching. I realised this when I found several of my web pages had embedded URLs of `href=" - 1.html"`, which started life in the source file as `index.html`.

I needed something which was much simpler and was preferably written in Perl so that I could place it in the script for efficiency. I did look around to find previous work, but found nothing. It turned out



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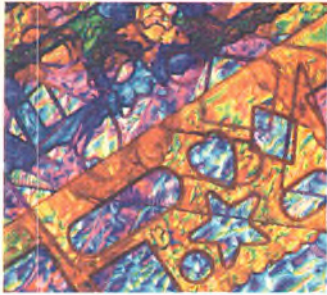
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## I want to place the data into a file, and use that file as a template to generate the final page.

normal HTML file, except that there's a line which says:

```
<p>The script processing routine reports  
that {{MESSAGE}}.
```

Actually, I choose to place the HTTP header in the file too, so that you cannot look at the template file directly with a browser. However, the file, to all intents and purposes, contains a normal HTML page.

The macro processing routine re-processes the text after the replacement is made. You can embed other macro definitions into the value of MESSAGE and have them be expanded before the page is output. This is a win when you have several layers of definitions.

I've found that there are two other macro features which assist in the creation of flexible pages. First, it's good to be able to create macro definitions in the template files. I've picked the ad hoc syntax of:

```
{{NAME, 'definition'}}
```

The use of single quotes here means that you can use regular expressions to pick up the definition even if it contains embedded macro specifications. The quotes are just used for matching and do not form part of the definition.

Second, it's useful to have some form of conditional expression:

```
{{NAME? 'defined': 'undefined'}}
```

If NAME is defined, then the first quoted string replaces the bracketed section. Otherwise, it is replaced by the second string. I suspect that I might like to have the ability to test the value of NAME but I have managed to do without that for the moment.

I've done nothing clever with newlines in the processing code. You can put newlines in the macro definitions and they will be mirrored in the output. A macro value in a definition or a conditional can also contain embedded newlines. If the line ends in }} then I lose the newline which follows. These rules are sometimes messy and you end up with extraneous newlines, but for HTML this is not a problem.

I've found this simple macro processor to be very useful and have used it for several real sets of interactive pages. None of the processing scripts have HTML embedded into them, instead they set up values in the associative array which is then applied to a template file. I've used a single template for error pages which can be shared across all the scripts in one suite. I've used templates to generate additional forms, where a form calls a script which checks the data and generates a new form, which in turn calls another script. The main win in

later that I was looking in the wrong place or was not using a correct keyword. There is at least one extant macro-processing library, but I'd cut this code by the time I found out about it.

I began by creating a Perl routine which is given a template file and an associative array. Whenever the routine finds {{NAME}} in the file (where NAME is user defined), it looks up NAME in the associative array and replaces the whole bracketed section by its value. If NAME is not defined, then the bracketed section is simply deleted.

My error routine becomes very simple. Its parameter is placed into an associative array using the name MESSAGE and the template file looks exactly like a

terms of getting things to work quickly is that the templates are just HTML pages and creating them is easy and quick. You can also use the macro processor to generate other data with variable information which can be taken from a template, for example, email messages.

The one downside of the scheme is that your processing script needs several additional files and spreads out over the file system. If you take care with filenames then things work out. I usually have a directory whose name matches the name of the CGI script so that it's easy to relate the script to its ancillary files.

### Storing the data

Once I had created the macro processing routines, generating interactive pages and the scripts which processed them became much easier. I began to think about data storage. Of course, storage always goes hand in hand with retrieval, and there are actually different requirements for that.

If we are storing product-ordering data, then we do want to present all the information to the person who is processing and dispatching the product. We may want to present an index of orders which are pending, or have been processed. We may want to allow an interface for the person who ordered the product to find out the status of the order. Has it been processed? Have the products been dispatched? If we have sensitive information which needs encryption, then it's a good idea only to encrypt that part of the data because we can satisfy most of the indexing requirements without having to know the private key.

I did think hard about using a relational database to store the information. If you have a single application that's rooted on one site then this is a strong contender. However, I was worried about moving this code onto several sites and wanted to generate my own storage system.

Since I was writing in Perl, taking information from the user into an associative array, it made sense to store a Perl associative array in such a way that it can be re-loaded by a subsequent script as if nothing had happened. My storage routine is given a filename, a section name, and an associative array. The section name is appended to the file, as text:

```
[SECTION]
```

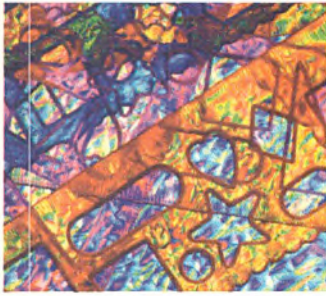
and this is followed by the contents of the array, with each character written as a hex number pair and each entry in the array separated by a '+' character. The reading routine searches the file for the section name and decodes the data which follows it. The same mechanism is used for PGP encrypted data except that the data in the section is regular text-armoured PGP data.

Putting the data from each form in a separate file is a win on Unix, which handles small files well. The name of the file needs to be unique, and I've used the time (yyyymmddhhmmss) or a 32 hex digit randomly generated number, it depends on the application.

Once the data is stored, we then have to worry about access. Here the web gives us a problem that is fairly hard to solve. Here's the scenario. We've taken a number of orders from several people and have a number of separate data files in the pending directory. A person logs into the admin pages and asks for some data for processing. We assemble a page and send it off. When they are done, they hit the submit button which tells the system that the data has been processed.

What happens when two or more people attempt to access the data at the same time? Well, we can lock the file so that if we are assembling a page then someone else will be given another one. However, once the page has been sent, we must unlock the file because there is no guarantee that the person will return saying that the file has been processed. We could mark the file as processed, but again there's quite a high chance that the user could be called away, or their machine will crash, and we will have no knowledge of their failure to process the data.





## What happens when two or more people attempt to access the data at the same time?

### Case studies

I have three sets of interactive pages on the web, which use these techniques. The first is on the System Administrator's Guild web site (<http://www.usenix.org/sage>) and was the 'Jobs Wanted' bulletin board. SAGE members who wish to participate can enter their information into a form which creates a file. At the time of submission, they are given a large random number (the name of the file) and there are a couple of pages which they can use to check on the submission or delete it.

I've come to no firm conclusion about how to solve this problem. I've tried to minimise its impact by using the Unix atomic rename system call to move the data file from the pending directory to the processed directory when the user is done. This means that if we cannot find the file when the user presses submit, then someone else has processed it and we can tell the user that (or not, as the case may be). Also, the script which reads the pending directory never presents a menu of files to be processed, it always gives the next file. Menus could hang around on screens or in web caches for some time, and could compound the problem.

A group of moderators is then notified about the new entry. Eventually, someone will get back to a password protected admin page to moderate the entry. If the entry is okay, it's moved to a directory where it will be incorporated into the live web page. If the entry is wrong, then the moderator must give a reason which is emailed to the submitter. There's a nice cut-off here, protecting the identity of the moderator. Finally, because people never remember to come back and say that they no longer need an advert, the data is timed out after 90 days (unless the submitter returns to refresh the data using the magic number which they have been given). We intend to spread this use to other 'bulletin' board applications on the SAGE and USENIX sites.

The second application is for Canterbury Pewter, a company located in Virginia in the USA but one which wanted to have their web pages on my server (<http://www.cantweb.co.uk/pewter>). Here we have an online ordering form, which stores encrypted credit card information using the methods outlined above. All the response forms which derive from failure to fill in the form correctly are generated using the macro processor. The person who runs this company has been given several private administrative pages which are used to access the encrypted pending orders, and to examine and delete processed orders.

Finally, I've created a highly dynamic site for a local radio station, CTFM (<http://www.ctfm.co.uk>). Staff in the station can come into the server over the web to generate news items for instant access, change the schedule showing what programme is on now, and set up their playlist using interactive web interfaces.

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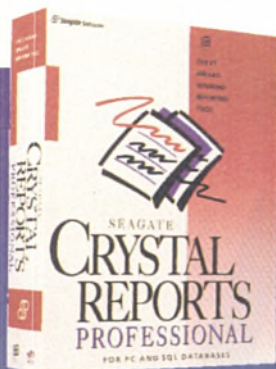
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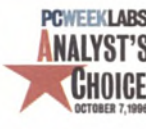
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# Disassembling the virtual machine



Tom Guinther looks at the JVM instruction set and presents a Java bytecode instruction decoder and disassembler.

If you sat down to design the virtual machine of tomorrow, it is doubtful that it would resemble what we today call the Java Virtual Machine. As virtual machines go, Java's has reached an unparalleled level of success and functionality. Success notwithstanding, the architecture of the Java Virtual Machine has enough defects and inherent limitations that not only would one hesitate to call it *forward-thinking*. One might actually ask: *what decade was this designed in?* Software, like everything else, must succumb to Darwinism, evolve or die. It remains to be seen how the relatively entrenched and immobile Java Virtual Machine will fare against the crushing march of software evolution.

## The Java disassembler

If you read last month's article discussing the overall Java Virtual Machine and specifically the Java class file format then you already know that I promised to extend last month's `ClassDump` sample to include a Java byte code disassembler. Fear not, for I have delivered unto thee a new version of `ClassDump` which will optionally disassemble Java byte code (the binary and source code can be found on EXE OnLine).

But before you begin jumping up and down with glee and excitement, you may need to reach deep down and forgive me for choosing a less straightforward design approach than you might expect. You see, although I wrote a byte code disassembler, the disassembler is built on top of a byte code *decoder*.

Lest you think I quibble with terminology let me explain what I feel the differences are. Typically, a disassembler converts something in a 'machine', or binary format to a human readable, or text format. In the process of performing this translation the disassembler may decode the binary format as a necessary intermediate step of the translation process. A decoder is responsible for interpreting the semantics of the binary format. For our decoder this means interpreting Java byte code instructions and any operands used by the instruction. Beyond this simple functionality, the decoder should provide higher-level semantic information which can be analysed and used by more sophisticated tools.

In essence, like a compiler, we are separating the back-end (decoder) from the front-end (disassembler) so that the decoder becomes a re-useable component.

For example, the decoder can be used as the back-end of the Java Virtual Machine byte code verification process, as a code analyser for a Java de-compiler or advanced debugger, not to mention as the engine of a Java disassembler. It is worth mentioning that using an instruction decoder to drive an interpreter loop would not be a good idea from a performance point of view. It is not that decoding is unnecessarily

slow, it's that you want *hyper-optimisation* for your interpreter loop. If performance isn't a consideration then by all means use a decode stage for your interpreter.

## The JVM instruction set

Last month I mentioned the invaluable guide *The Java Virtual Machine Specification*, which is published as part of the Java Series by Addison-Wesley. A majority of the information needed to write a Java Virtual Machine or a Java disassembler can be found in this book.

The virtual machine is a 'stack' machine. As Java code executes, the arguments, function results, and operation results move to and from the operand stack. In a static disassembly these operands are implied, but their value is irrelevant (which is a good thing since the operands don't actually exist). In a dynamic disassembly (such as a debugger would provide) the values of the operand stack can be incorporated into the disassembly to paint a better picture.

While most instructions explicitly or implicitly interact with the operand stack, some instructions have instruction operands which are embedded in the Java byte code stream. As an instruction is pulled from the byte code stream, any instruction operands are also extracted. A good example of this is the `goto` instruction, which is followed by a 16- or 32-bit offset.

The instruction set is not completely orthogonal, which means that some instructions only operate on a limited number of Java types. For example, you won't see many instructions which work with `byte`, `char`, or `short` operands. Instead these operand types will be converted to type `int`, usually implicitly, but instructions exist to do an explicit conversion.

Like any assembly language, the mnemonics for the Java opcodes may look a little strange at first but the naming convention is rather consistent. After a bit of browsing through disassemblies you should be able to get the gist quite well. Opcodes which have an implied type use a standard type prefix: (b)yte, (c)har, (s)hort, (i)nt, (l)ong, (f)loat, (d)ouble, and a for reference types. For example, `fdiv` is a floating-point divide, and `aload` loads an object reference from a local variable. For further discussion the term 'primary types' will refer to `int`, `long`, `float` and `double`.

There are few things more tedious than describing machine code instructions, but a brief overview is in order. For the Java Virtual Machine the major categories of instructions are: Load and Store, Arithmetic, Bitwise, Type Conversion, Operand Stack management, Comparison and Control Transfer, Call and Return, and Miscellaneous.

## Load and store

Load and Store instructions are used to move data between local variables, arrays, and the operand stack, as well as to push constants onto the operand stack. There are a lot of these instructions, primarily due to the large number of constant load and store instructions. Each primary type has five load and five store instructions from/to local variables. For example, `iload_0`, `iload_1`, `iload_2`, and `iload_3` put the





integer value from the specified local variable (the numeric part of the instruction mnemonic) onto the operand stack. If the integer you want to load is not one of the first four local variables then use the `iload` instruction which requires an 8- or 16-bit instruction operand to indicate the local variable index. The upshot is that for each store to local variables 0-3 you save one byte (yippee!) since the index is implied by the instruction. The trade-off is that

since Java opcodes are only one byte, you really crunch expandability of the instruction set. This is like gnawing off your arm to sharpen your teeth. All in all, 85 of the first 86 instructions are dedicated to load and store operations. The following example uses three different load/store instructions to divide a local variable (#0) by 2:

```
int Half(int value)
{
    value /= 2 ;
    return value ;
}

iload_0 // load "value" (local #0) to operand stack
iconst_2 // load constant value 2 to operand stack
idiv // perform integer divide
istore_0 // save the result into "value" (local #0)
```

#### Arithmetic and bitwise instructions

These basic instructions are relatively standard with one form of the instruction for each of the primary types: addition, subtraction, multiplication, division, and remainder (or modulo). The corresponding instructions are `iadd`, `isub`, `imul`, `idiv`, `irem`, `fadd`, `fsub`, `fmul`, `fdiv`, `frem`, `ladd`, `lsub`, `lmul`, `ldiv`, `lrem`, `dadd`, `dsub`, `dmul`, `ddiv`, and `drem`.

The bitwise operators, like the arithmetic operators, are pretty standard: Or, And, Exclusive Or, Negate, and three different types of shifts: left, right, and unsigned shift right. With the exception of Negate, bitwise instructions only operate on the primary integer types. That's a good thing because doing an exclusive-or on two floating-point numbers doesn't make much sense. The bitwise instructions are `ineg`, `ishl`, `ishr`, `iushr`, `ior`, `iand`, `ixor`, `lneg`, `lshl`, `lshr`, `lushr`, `lor`, `land`, `lxor`, and don't forget, `fneg` and `dneg`.

#### Type conversion

These instructions, as you might guess, convert between various supported types. The VM supports both *widening* conversions such as, `int` to `float` (`i2f`) or `int` to `long` (`i2l`), as well as *narrowing* conversions such as `int` to `byte` (`i2b`) or `double` to `int` (`d2i`). Type conversions are needed for explicit user type conversion, as well as to make up for the instruction set's lack of orthogonality.

#### Operand stack management

These include a special set of instructions which perform typeless operations on the operand stack. They are used to duplicate (`dup`, `dup2`, `dup_x1`, `dup2_x1`, `dup_x2`, `dup2_x2`), or remove (`pop`, `pop2`), or swap values on the operand stack. If you are familiar with stack based languages such as `forth` then you should feel comfortable with these instructions. The following example uses the `dup` instruction to create a second copy of a value for use in multiplication.

```
int iSquare(int value)
{
    return value*value ;
}
```

```
aload_0 // load the "value" (local #0)
dup // duplicate the top operand (value)
imul // perform integer multiply (value*value)
ireturn // return the result of value2
```

#### Comparison and control transfer

This group contains all the instructions related to making decisions (compare and branch instructions). This is the one area of the instruction set where non-orthogonality hurts because a majority of these instructions is devoted to integer comparisons. Comparisons of other types are possible of course, just less convenient. Integer instructions allow for `==`, `!=`, `<`, `>`, `<=`, or `>=` comparisons between two integers (`if_icmpeq`, `if_icmpne`, `if_icmplt`, `if_icmpgt`, `if_icmple`, `if_icmpglt`), or a more optimised form which compares an integer against zero (`ifeq`, `ifne`, `iflt`, `ifgt`, `ifle`, `ifge`). Remember that the VM is a stack machine so the values being compared are popped from the operand stack, and if the comparison is true then a branch to a new instruction is taken. In the case of `long`, `float` and `double` the instructions compare two values on the stack and *push* the result of the comparison onto the top of the stack. That result will be 1 (true), 0 (equality), or -1 (false).

For example, with two long values, `v1` and `v2`, the `lcmp` instruction will perform as follows:

```
if ( v1>v2) result = 1
else if (v1 < v2) result = -1
else result = 0 ;
```

This group of instructions also includes the complex instructions, `tableswitch` and `lookupswitch`, which are used to implement the languages switch/case functionality. And not to be forgotten are the traditional, unconditional control transfers, `goto`, `goto_w`, `jsr`, `jsr_w`, and `ret`.

#### The gory implementation details

I used last month's `ClassDump` as a source code base with a few minor modifications to the core files. Primarily I added files that assist in the decoding and disassembly of the VM instruction set. First and most basic is class `JavaBinaryStream`, which is a 'stream' style wrapper I use to wrap around the code bytes of the method being decoded. It provides basic extraction operators to grab instructions and instruction operands from the stream. Remember that multi-byte items in the instruction stream are in big-endian format and for Intel platforms they need to be coerced to get the appropriate value.

A rather large header file for all the definitions and types needed by the disassembler has been added, as well as a corresponding C++ file which is nothing but large tables and statically initialised arrays. This implementation file is required because the decoder is 'table-driven': there is one function for decoding any and all instructions. It performs its work by looking up information about the instruction in the provided tables. With this information it is able to succinctly and flexibly decode instructions.

Due to space limitations I have spruced up the comments in the code. Use them as a guide as you work your way through the disassembler and decoding engine. As always, if you have questions or comments send email to [tomg@vireo.com](mailto:tomg@vireo.com). ■

Tom Guinther is working for Vireo, a company developing device-driver tools. He can be reached via e-mail at [tomg@vireo.com](mailto:tomg@vireo.com). The code for this article is available on EXE Online and directly via ftp at [ftp://ftp.exe.co.uk/pub/exestuff/9803\\_Java](ftp://ftp.exe.co.uk/pub/exestuff/9803_Java).

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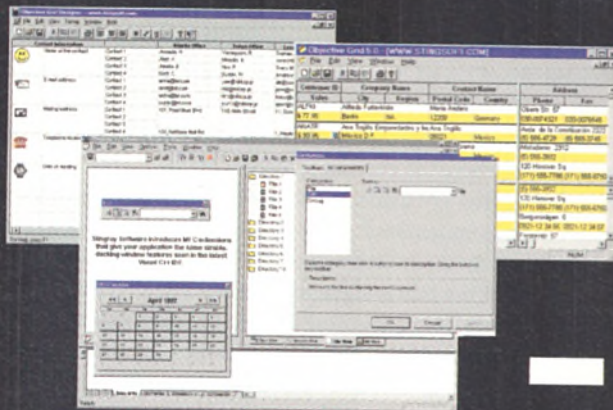
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# Values and side effects

Francis Glassborow shows that C and C++ programmers need to know when evaluation and side effects happen.

The letter from Richard Howells, in the January issue, serves to highlight how difficult it can be to identify problems in code. Of course, as many of you spotted, he made a mistake because he only read the first paragraph of sub-clause 6.3 of the C89 Standard (that sub-clause spans 17 pages). There are very few people in the world completely familiar with the C Standard (I guess there are none who are familiar with all parts of the C++ Final Draft International Standard). Even when you know that something is guaranteed by ISO/IEC 9899:1990 it can be hard to find the exact place providing the guarantee. As an example, does the following statement contain undefined behaviour?

```
if(i++) i++;
```

Which sub-clause of the C89 Standard supports your belief?

Let me try to clarify the general problem before answering the question. (Yes, I needed help with my answer.)

## Sequence points

C source code is broken up into statements and declarations (plus pre-processor directives). This is how most programmers view their code. Unfortunately, this way of dividing the code is largely irrelevant to understanding the working of your code. The vital concept is that of a sequence point. A sequence point is a kind of island of stability where you can be certain about what has been done.

There are two key elements to any piece of source code: declarations and statements. Declarations introduce identifiers so that they can be used subsequently. They provide the compiler with information it needs to convert statements to executable code. Statements specify an action to be performed.

There is a subclass of declarations called definitions. The writers of C89 were a little loose in their definition of definition by stating that A declaration that also causes storage to be reserved for an object or function named by an identifier is a definition. That does not explain how we should classify:

```
struct X;
enum Colour {red, blue, green};
```

In neither case is storage reserved. It is conventional to say that the above are declarations of `X`, `red`, `blue`, and `green` and a definition of `Colour`. I am unaware of anything in the text of C89 to support this usage.

Let me leave the subject of declarations and focus on statements because that is where the current problems lie.

Most statements are made up of expressions (the exceptions are the various jump statements: `goto <label>`, `continue`, `break`, and `return`). Expressions are themselves made up of expressions, recursively. The end of the line is something called a primary expression. At the other end we have something called a full expression. This may be a statement, but some types of statement include several full expressions. A full expression is any expression which is not itself part of a larger expression. A couple of examples will help.

The controlling expression in an `if`-statement is a full expression which is followed by a statement that is itself composed of one or more statements. The key is to realise that the largest unit of code which gen-

erates a value or action is a full expression (though some jump statements do not include an expres-

sion). Every full expression is terminated with a sequence point. In a moment I will turn to the significance of sequence points, but first we must be able to recognise them.

In addition to the sequence point which terminates a full expression there is a sequence point between the left and right operands of `&&` (logical and), `||` (logical or), and the comma operator. There is a sequence point after the first operand of the conditional operator (`?:`). There is another at the end of the evaluation of the arguments for a function call but before the call is made. We need to take care with commas because the same symbol is used to separate lists of arguments, where it is just punctuation, and as a sequence operator. For example:

```
fn(3, 5);
/* Call fn passing it the values 3 and 5 as 1st and */
/* 2nd arguments with a sequence point after the '5'. */
array[3, 5];
/* Evaluate the list '3, 5' with a sequence point */
/* after the '3'. Access that element of the 'array'. */
```

Of course, any sane compiler warns you about that second statement. Both because it does nothing (it just reads and discards the value in `array[5]` in C, or calculates the address of `array[5]` in C++) and as a warning for evaluating a list to obtain the index for an array. Please ensure you understand how to locate the sequence points in your code. Unless you can, you are vulnerable to all kinds of errors. Many of these will be subtle, hard to locate, and dependent on the compiler you use and the compile-time switches you select. Curiously, and contrary to common opinion, there is no sequence point at a semicolon. None of the following contain sequence points:

```
continue;
goto end;
break;
return;
```

However, `return 5;` includes a sequence point because, in this context, `5` is a full expression.

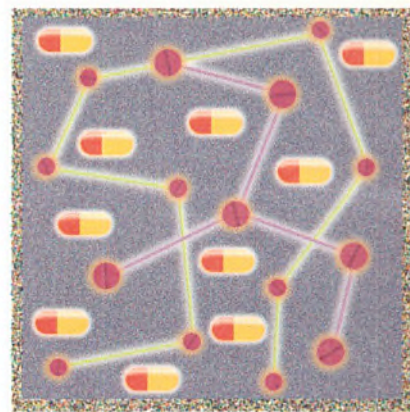
## Between sequence points

Once you can break your code up with sequence points you are in a position to understand exactly what is allowed to happen between them. What may you require of a correctly implemented compiler, and what may the writer of such a compiler require of you?

Generally, the code between sequence points either computes a value or generates side effects. Most code does both. Novices are frequently confused by this because we are often more interested in the side effects than in the value. For example, we usually ignore the value (the number of characters transmitted) of:

```
printf("Hello World");
```

because we are interested in the side effect the output on `stdout`.





The problems start because many programmers do not realise that they need to ask when evaluation and side effects happen. The answer may not be what they expect. The rule for values is simple: Not later than when it is used. Here *used* means required for some further computation. If the compiler can deduce that the value is never used it need not generate code to do the evaluation (though the side effects will still have to occur). The precedence and associativity rules for operators are provided so that the compiler can determine in which order it needs to evaluate use of operators. For example:

```
x = y = -1;
```

The right to left associativity rules for assignment cause the compiler to parse this statement as:

```
x = (y = -1);
```

The values required are the addresses (lvalues) of *x* and *y* and the value of (*y* = -1). The value of the full expression is not used and need not be computed. Note that we do not need the lvalue of *y* in order to calculate the value of (*y* = -1), though we need to know the type of *y*.

I guess many readers will read that last paragraph several times, trying to work out when the value gets stored in *x* and *y*. It does not say. That has nothing to do with the process of evaluation. The storage (which is what we are actually interested in) is a side effect of the evaluation. The rules for side effects are much simpler. They can happen anytime between the prior and the next sequence point and in any order. Worse still, execution of the side effects can overlap. Evaluations cannot. WG14 ruled in response to a defect report that while sub-expressions can be evaluated in any order, commensurate with the precedence and associativity rules, they must be evaluated sequentially.

The only guarantees given are that no side effect can occur prior to the previous sequence point and they must be complete before the next sequence point.

Once you understand this (and the rules have been written to allow compilers the maximum freedom to optimise code) you will understand why writing to the same storage more than once between sequence points will result in undefined behaviour – the actions may overlap.

Going back to *x = y = -1*; I do not need to know which storage gets modified first; both have been modified by the end of the full expression because of the sequence point.

The above may seem very complicated but actually it reduces to two simple rules. First, between sequence points, (sub) expressions can be evaluated in any order which provides values when needed for the evaluation of operators in a sequence determined by the precedence and associativity rules. Second, all side effects since the prior sequence point will be complete at the next one. And you need a clear understanding of the six places which introduce sequence points (and parentheses are not one of them).

If you want something hard, try this one:

```
int i = 2, j = 3, k;
k = ((i = 3) ? 4 : 5) + ((j = 5) ? j++ : i++);
```

If you cannot work it out, do not worry – just don't write code like that.

#### That question

Is there undefined behaviour in *if(i++) i++*? Well, there may be but not because of the two increment operators – each case of *i++* is a full expression. However, if *i* has not been initialised then you have read uninitialised storage, which gives undefined behaviour.

#### Last month's problem

The problem of finding the highest common factor (HCF) frequently occurs in integer mathematics. There is an ancient algorithm for

finding the HCF which is attributed to Euclid. What is wrong with the following implementation?

```
int findHCF(int first, int second) {
    int temp;
    while(first != second) {
        if(first < second) temp = first, first = second,
                           second = temp;
        first -= second;
    }
    return first;
}
```

In Euclid's time negative numbers had yet to be invented, and zero was not considered a number. In this context it is a fast and efficient algorithm. For those using an abacus it was a particularly efficient one as it could be rephrased as an instruction to repeatedly reduce the larger number by the smaller until the two were equal.

The algorithm breaks down if either number is zero or negative. If we wish to include negative numbers, we need to write something like:

```
unsigned int findHCF(int first, int second) {
    int temp;
    first = abs (first);
    second = abs (second);
    if (!first) return second;
    if (!second) return first;
    while(first != second) {
        if(first < second) temp = first, first = second,
                           second = temp;
        first -= second;
    }
    return first;
}
```

It is surprising how often programmers forget to check that an algorithm works correctly over the range of values to which they are applying it.

#### This month's problem

The following problem is the result of an incorrect answer given in Pete Becker's Q&A column in the January issue of the generally excellent *C & C++ Users Journal*. I guess the error got past the highly experienced editor because of Pete's deserved reputation for expertise. It just goes to show that you should not trust anyone.

What does the following code do?

```
#include <stdio.h>
int main(void) {
    int i;
    puts ("An integer please: ");
    scanf ("%d", &i);
    i ^= 4 ? i &= 7 : i |= 4;
    printf ("%d\n", i);
    return 0;
}
```

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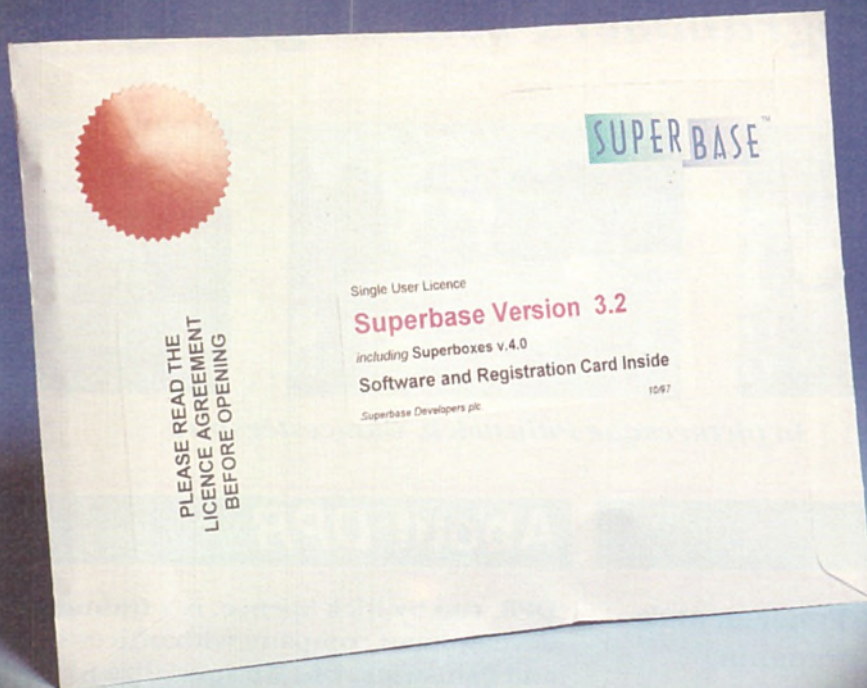


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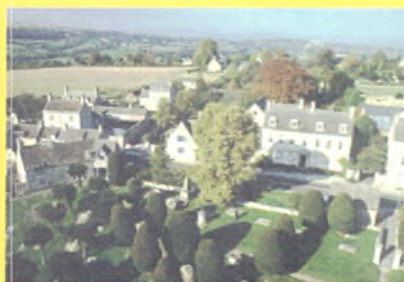
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## A bundle of JavaBeans books reviewed by Gavin Smyth

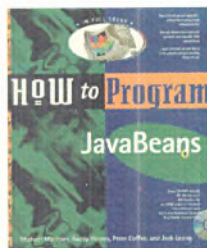
You have done a bit of Java programming, but what about these 'Bean' things which let you build reusable components instead of just low-level classes? Here are three books which each claim to tell you all you need to know about JavaBeans. Before I start, I would like to point out the existence of a JavaBean tutorial that's on the Java home site (<http://www.javasoft.com>) where you will find the Bean Development Kit (BDK) and other tools. This online tutorial is really too brief and the BDK documentation possibly too concise, so these books do fill an important gap.

The three books cover just about all that you need to tackle Bean production, deployment, and use, though their approaches and level of sophistication differ. Before looking at the differences, the similarities are as follows. They all discuss general component architectures to some extent, comparing JavaBeans with things like ActiveX. They all describe basic Bean attributes – properties, methods, and events – explaining design patterns and the use of Bean-Info structures and customisers for more sophisticated control. (In JavaBean-speak, *design patterns* really means naming conventions, not the general notion of applying recognised patterns in software design.) Bean persistence and serialisation, JAR files, and the ActiveX bridge all get a mention too. The first two books have accompanying CDs containing the Java Development Kit (JDK), the BDK, and a few other bits and pieces. The BDK includes a beta of the ActiveX bridge (a tool for wrapping a JavaBean into an ActiveX object so that it may be embedded in Windows applications such as Visual Basic or Microsoft Office). Both books suggest checking the Sun Java site for the latest software, and in fact current versions of the software make the CDs mostly out of date.



*Special Edition Using JavaBeans* covers much more than the list above. Ms White et al have really written a book for some-

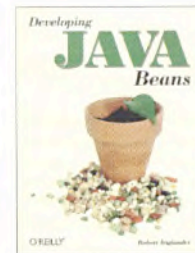
one who got interested in Java when it first appeared, and understands Java 1.0.2 quite well, but who has not kept up with later developments. (Quite a lot of space is devoted to changes to the JDK from versions 1.0.2 to 1.1.) The authors describe a Java JAR API called `tog.moa` and a GUI JAR application, but I did not think that these chapters were particularly enlightening or useful. In the discussion of component architectures the book contains material on the ActiveX bridge as well as Taligent Software's Migration Assistant, a tool more or less operating in the opposite direction – creating Java frameworks from ActiveX objects. The section on serialisation is particularly good and covers database access. Additional material includes a mention of LiveConnect, Java development tools, RMI, and Corba, as well as a bit of speculation on the future of Java in enterprise applications. This is a very comprehensive list, but a lot of the material is cursory and not really relevant to Beans (such as the changes to the JDK). Unfortunately, the book suffers from a lot of repetition. About a sixth of it is an almost useless appendix which lists the JDK 1.1 API.



My first reaction to *How to Program JavaBeans* was one of dismay at the 'in full color' declaration on the front cover; the book uses syntax colour coded listings throughout,

and all the screen dumps are in colour. I think the full colour nature of the book adds very little, except perhaps to the price. The introduction includes a tedious but glossy look at a number of Java development tools (mainly betas). This is followed, unexpectedly, by a very muddled explanation of the Java Reflection mechanism (the other two books introduce this much later on, when the reader has more of a chance of understanding what reflection is all about). As I read the book, I began to feel that it would

be more appealing to Dilbert's pointy-haired boss than to software developers. However, perseverance pays off because the second half of the book is much better. The examples of Beans, gradually increasing in complexity, are very clearly explained, and the section on remote access methods (RMI and Corba) is quite good. The associated CD also includes the text of *How to Program Java* so the whole package might well be useful to someone beginning to investigate Java and JavaBeans.



The third book, *Developing Java Beans*, is much thinner than the others (and much less expensive), but is much more tightly focused on the subject of JavaBeans.

Robert Englander wastes little space on non-Bean issues and concentrates on a detailed examination of producing and using JavaBeans, discussing advanced concepts to a much greater depth than the other two books. The writing style is very clear and readable, with short segments of sample code scattered throughout. There is a more substantial example: a temperature control simulator. This is taken from design concepts, through code production, to deployment, including use within Visual Basic via the ActiveX bridge.

In summary, the glossy *How to Program JavaBeans* is aimed at an altogether less sophisticated audience than the other two but is still, I feel, not particularly good value for money. *Developing Java Beans* is the most advanced and I could not find any real deficiencies in the book at all. *Special Edition Using JavaBeans* has a good coverage of background material and is suited to someone with limited exposure to Java 1.1.

### Verdicts:

*Using JavaBeans*: recommended.

*How to Program JavaBeans*: average.

*Developing Java Beans*: highly recommended.

Title: *Special Edition Using JavaBeans*  
Author: Barbara White with J. Leong, B. LaForge, M. Foley, H. Seth, J. Rosenberger, and R. Monson-Haefel  
Publisher: QUE, 1997  
ISBN: 0-7897-1460-4  
Price: £46.95  
Pages: 630 pages

Title: *How to Program JavaBeans*  
Author: Michael Morrison, Randy Weems, Peter Coffee, and Jack Leong  
Publisher: Ziff-Davis Press, 1997  
ISBN: 1-56276-521-3  
Price: £37.50  
Pages: 350

Title: *Developing Java Beans*  
Author: Robert Englander  
Publisher: O'Reilly, 1997  
ISBN: 1-56592-289-1  
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Introduction to Client Server Computing	Monthly	4	1425	London	LTREE
Client/Server Systems: Analysis & Design	19/5/98	4	1425	London	LTREE
Microsoft Exchange 5 Server Admin: Hands-on	Monthly	4	1425	London	LTREE
Client/Server & Distributed Computing	Call 01285 655 888	3	1095	Call	QA TR
Architecture & Design of Enterprise Systems	Call 01285 655 889	4	1395	Call	QA TR
Building Enterprise Systems with Microsoft Technology	01285 655 890	3	1095	Call	QA TR
IT Infrastructure Implementation & Management	Call 01285 655 891	4	1395	Call	QA TR

## COMMS

Wide Area Networking & Telecommunications	Monthly	4	1425	London	LTREE
Wide Area Network Troubleshooting	14/5/98	4	1425	London	LTREE
Hands-on X.25	19/5/98	4	1425	London	LTREE
ISDN for Telecommunications	14/5/98	4	1425	London	LTREE
Implementing ISDN Data Networks	6/5/98	4	1425	London	LTREE
High Speed Wide Area Networks	5/5/98	4	1425	London	LTREE
Implementing Computer Telephony Integration	26/5/98	4	1425	London	LTREE

## DATABASE

System Architect 4.0 Data Modelling	Call	2	590	Leamington	POPK
System Architect 4.0 Data Modelling	Call	2	2000+	On Site	POPK
Microsoft Access	27/04/98	2	360	Reading	PTR
Microsoft Access	25/05/98	2	360	Reading	PTR
Microsoft Access	29/06/98	2	360	Reading	PTR
Relational Databases	12/5/98	4	1425	London	LTREE
Oracle Courses	Monthly	5	1675	London	LTREE
Microsoft SQL Server: Hands-On	Monthly	4	1425	London	LTREE
Hands-On Microsoft SQL Server System Administration	11/5/98	5	1675	London	LTREE
Object Oriented Databases	Monthly	4	1425	London	LTREE
Visual Basic 5 & ActiveX for Enterprise Applications	Monthly	5	1675	London	LTREE
Microsoft Access	Monthly	4	1425	London	LTREE
Database Analysis & Design	Call 01285 655 892	3	1045	Call	QA TR
Building a Data Warehouse	Call 01285 655 893	4	1395	Call	QA TR
Microsoft Access Development	Call 01285 655 895	3	875	Call	QA TR
Introduction to Microsoft Access	Call 01285 655 897	2	550	Call	QA TR
Programming with Microsoft Access Basic	Call 01285 655 898	2	595	Call	QA TR
SQL Language	Call 01285 655 900	2	630	Call	QA TR
Microsoft SQL Server & Transact-SQL Programming	Call 01285 655 901	3	945	Call	QA TR
Microsoft SQL Server 6.5 Administration	Call 01285 655 902	5	1475	Call	QA TR
Implementing a Database Design on Microsoft SQL Server 6.5	Call 01285 655 903	5	1475	Call	QA TR

## GENERAL

IDEF	Call	3	885	Leamington	POPK
IDEF	Call	3	3750+	On Site	POPK
System Architect Business Process Re-engineering	Call	1	1000+	On Site	POPK
System Architect Business Process Re-engineering	Call	2	2000+	On Site	POPK
System Architect Word Link Course	Call	1	295	Leamington	POPK
System Architect Word Link Course	Call	1	1000+	On Site	POPK
System Architect/Catalyst	Call	2	Call	Call	POPK
Identifying & Confirming User Requirements	Monthly	4	1425	London	LTREE
Implementing the Year 2000 Conversion	Monthly	4	1425	London	LTREE
Practical Software Testing Methods	Monthly	4	1425	London	LTREE

Course	Date	Days	Cost	Place	Company
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## GROUPWARE & OFFICE SYSTEMS

Lotus Notes/Domino R4.5 Application Development 2	Call 01285 655 905	4	1375	Call	QA TR
Lotus Notes/Domino R4.5 Application Development 3 & LotusScript	Call 01285 655 906	4	1375	Call	QA TR
Lotus Notes/Domino R4.5 Application Development 1	Call 01285 655 907	3	1045	Call	QA TR
Lotus Notes/Domino R4.5 System Administration 1	Call 01285 655 908	4	1375	Call	QA TR
Lotus Notes/Domino R4.5 System Administration 2	Call 01285 655 909	2	695	Call	QA TR
Introduction to LotusScript in Notes/Domino	Call 01285 655 910	3	1045	Call	QA TR
Microsoft Exchange Server Enterprise Support	Call 01285 655 911	5	1495	Call	QA TR
Supporting Microsoft Exchange 5.0 -Core Technologies	01285 655 912	5	1475	Call	QA TR
Groupware Development with Microsoft Office Technologies	Call 01285 655 913	5	1495	Call	QA TR
Domino Administration for Lotus Notes 4.6 & the Internet	Call 01285 655 914	2	695	Call	QA TR
Internet Development with Lotus Notes Domino 4.6	Call 01285 655 915	3	1045	Call	QA TR
VBA Programming with Microsoft Excel	Call 01285 655 917	4	1275	Call	QA TR

## GUI DEVELOPMENT

Application Development using Borland Delphi V3	Call 01285 655 918	5	POA	Call	QA TR
Advanced Programming with Visual Basic Enterprise Edition	Call 01285 655 920	4	1295	Call	QA TR
Building Object-Oriented Applications with PowerBuilder V5	Call 01285 655 921	3	1055	Call	QA TR
Fast Track to PowerBuilder V5	Call 01285 655 922	4	POA	Call	QA TR
Microsoft Visual Basic Primer	Call 01285 655 925	1	295	Call	QA TR
Application Development using Visual Basic	Call 01285 655 926	4	1275	Call	QA TR

## INTERNET

Microsoft Internet Information Server	Monthly	4	1425	London	LTREE
Introduction to Internet/Intranet for Business	Monthly	4	1425	London	LTREE
Developing a Web Site	Monthly	4	1425	London	LTREE
Intranet Technologies: Comprehensive Introduction	Monthly	4	1425	London	LTREE
Internet & System Security	Monthly	4	1425	London	LTREE
Deploying Internet & Intranet Firewalls	21/5/98	4	1425	London	LTREE
Java for C++ Programmers	Monthly	4	1425	London	LTREE
Intranet Technologies: Comprehensive Introduction	16/6/98	4	1425	Edinburgh	LTREE
Netscape Servers for Intranet Development	Monthly	4	1425	London	LTREE
Visual Cafe for Java Development	25/4/98	4	1425	London	LTREE
Practical Internet	01/04/98	1	225	Reading	PTR
Practical Internet	29/04/98	1	225	Reading	PTR
Practical Internet	24/06/98	1	225	Reading	PTR
HTML Web Authoring	02/04/98	2	450	Reading	PTR
HTML Web Authoring	30/04/98	2	450	Reading	PTR
HTML Web Authoring	28/05/98	2	450	Reading	PTR
HTML Web Authoring	25/06/98	2	450	Reading	PTR
Programming with JavaScript	Call 01285 655 928	2	625	Call	QA TR
Creating & Configuring a Web Server using Microsoft Tools	Call 01285 655 929	3	995	Call	QA TR
Internetworking with Microsoft TCP/IP on Win NT 4	Call 01285 655 930	5	1375	Call	QA TR
Internet Fundamentals	Call 01285 655 931	3	995	Call	QA TR
Intranet Design & Migration	Call 01285 655 932	3	1045	Call	QA TR
Internet & Intranet Security	Call 01285 655 933	3	1045	Call	QA TR
Building an Effective Web Site	Call 01285 655 934	3	1045	Call	QA TR
Netscape SuiteSpot Server v3	Call 01285 655 935	5	1495	Call	QA TR
Internetworking with TCP/IP	Call 01285 655 937	4	1245	Call	QA TR
Programming with Visual Basic Script	Call 01285 655 938	2	665	Call	QA TR



Course	Date	Days	Cost	Place	Company
<b>LANGUAGES</b>					
Advanced C	Call 01285 655 939	4	1275	Call	QA TR
Advanced C++ Development Techniques	Call 01285 655 940	4	1275	Call	QA TR
C++ for non-C Programmers	Call 01285 655 941	5	1345	Call	QA TR
C++ for C Programmers	Call 01285 655 942	4	1195	Call	QA TR
C++ Primer	Call 01285 655 943	2	630	Call	QA TR
C Primer	Call 01285 655 944	2	595	Call	QA TR
C Programming	Call 01285 655 945	4	1230	Call	QA TR
Advanced Java Development	Call 01285 655 946	5	1495	Call	QA TR
Developing JavaBeans	Call 01285 655 947	5	1495	Call	QA TR
Java for non-C Programmers	Call 01285 655 948	5	1295	Call	QA TR
Java Primer	Call 01285 655 949	2	630	Call	QA TR
Java for C/C++ Programmers	Call 01285 655 950	4	1245	Call	QA TR
Object Oriented Programming with Java	20/04/98	4	1295	London	VALT
Object Oriented Programming with Java	18/05/98	4	1295	London	VALT
Object Oriented Programming with Java	15/06/98	4	1295	London	VALT
Object Oriented Programming with Java	08/06/98	4	1295	Manchester	VALT
Developing JavaBeans	01/04/98	3	1195	London	VALT
Developing JavaBeans	27/04/98	3	1195	London	VALT
Developing JavaBeans	01/06/98	3	1195	London	VALT
Developing JavaBeans	29/06/98	3	1195	London	VALT
Developing Java Clients	02/04/98	2	795	London	VALT
Developing Java Clients	30/04/98	2	795	London	VALT
Developing Java Clients	04/06/98	2	795	London	VALT
Developing Java Servers	20/04/98	4	1295	London	VALT
Developing Java Servers	26/05/98	4	1295	London	VALT
Advanced Programming with Java	11/05/98	4	1295	London	VALT
Advanced Programming with Java	08/06/98	4	1295	London	VALT

## MANAGEMENT

Management Skills for IT Professionals	Monthly	4	1425	London	LTREE
Influence Skills	Monthly	4	1425	London	LTREE
Effective Communication Skills	26/1/98	3	1125	London	LTREE
Teambuilding Skills	Monthly	3	1125	London	LTREE
Finance for Non-Financial Managers	14/4/98	4	1425	London	LTREE
Business Process Re-engineering	Monthly	4	1425	London	LTREE
IDEF	Call	3	885	Leamington	POPK
IDEF	Call	3	3750+	On Site	POPK
OO Management Overview	Call	1	1250+	On Site	POPK
System Architect Business Process Re-engineering	Call	1	1000+	On Site	POPK
System Architect Business Process Re-engineering	Call	2	2000+	On Site	POPK
System Architect/Catalyst	Call	2	Call	Call	POPK

## NETWARE

NetWare Service & Support	12/5/98	4	1425	London	LTREE
NetWare 3 Support & Administration	Call 01285 655 956	4	1345	Call	QA TR
IntranetWare Support & Administration using Win NT	01285 655 957	5	1475	Call	QA TR
IntranetWare: NetWare 4.x Administration	Call 01285 655 958	5	1595	Call	QA TR
IntranetWare: NetWare 4.x Advanced Administration	Call 01285 655 959	3	1095	Call	QA TR

## NETWORKING

Hands-on LAN Troubleshooting	Monthly	4	1425	London	LTREE
Fast LAN Technologies	6/5/98	4	1425	London	LTREE
Fast LAN Technologies	14/5/98	4	1425	Edinburgh	LTREE
Introduction to Internetworking	Monthly	4	1425	London	LTREE
IP Routing with OSPF & BGP	26/5/98	4	1425	London	LTREE
Cisco Routers	Monthly	4	1425	London	LTREE
Hands-On Introduction to TCP/IP	Monthly	4	1425	London	LTREE
Configuring Cisco Routers: Advanced Hands-on Workshop	19/5/98	4	1425	London	LTREE
Introduction to Datacomm & Networks	Bi-weekly	4	1425	London	LTREE
Local Area Networks	Monthly	4	1425	London	LTREE
Hand-on PC Networking	Monthly	4	1425	London	LTREE
Hands-On PC Networking	21/4/98	4	1425	Edinburgh	LTREE
Data Network Design & Optimisation	5/5/98	4	1425	London	LTREE
SNMP: From Workgroup to Enterprise Network	14/5/98	4	1425	London	LTREE
Computer Network Architectures & Protocols	19/5/98	4	1425	London	LTREE
Basics of Data Communications	21/04/98	1	245	Reading	PTR
Basics of Data Communications	13/05/98	1	245	Reading	PTR

Course	Date	Days	Cost	Place	Company
Basics of Data Communications	12/06/98	1	245	Reading	PTR
Introduction to Data Communications & Networking	07/04/98	3	675	Reading	PTR
Introduction to Data Communications & Networking	20/05/98	3	675	Reading	PTR
Introduction to Data Communications & Networking	17/06/98	3	675	Reading	PTR
TCP/IP Overview	20/04/98	1	245	Reading	PTR
TCP/IP Overview	14/05/98	1	245	Reading	PTR
Practical TCP/IP	22/04/98	2	490	Reading	PTR
Practical TCP/IP	11/05/98	2	490	Reading	PTR
Practical TCP/IP	08/06/98	2	490	Reading	PTR
Implementing TCP/IP	24/04/98	1	245	Reading	PTR
Implementing TCP/IP	15/05/98	1	245	Reading	PTR
Implementing TCP/IP	10/06/98	1	245	Reading	PTR
Understanding Frame Relay	07/04/98	1	265	Reading	PTR
Understanding Frame Relay	05/05/98	1	265	Reading	PTR
Understanding Frame Relay	02/06/98	1	265	Reading	PTR
Introduction to ISDN	08/04/98	1	265	Reading	PTR
Introduction to ISDN	06/05/98	1	265	Reading	PTR
Introduction to ISDN	03/06/98	1	265	Reading	PTR
ISDN Technology & Applications	07/05/98	2	530	Reading	PTR
PC Networking	27/04/98	2	490	Reading	PTR
PC Networking	18/05/98	2	490	Reading	PTR
PC Networking	29/06/98	2	490	Reading	PTR
Supporting Modems	06/04/98	1	225	Reading	PTR
Supporting Modems	01/06/98	1	225	Reading	PTR
Understanding ATM	Call 01285 655 951	2	730	Call	QA TR
Introduction to Data Communications	Call 01285 655 952	2	730	Call	QA TR
Enterprise-wide Communications & Networking	Call 01285 655 953	4	1345	Call	QA TR
Local Area Network Implementation & Management	Call 01285 655 954	4	1345	Call	QA TR
Network Primer	Call 01285 655 955	1	295	Call	QA TR

## OBJECT ORIENTED TECHNOLOGY

Object Technology Introduction	Monthly	4	1425	London	LTREE
Object-Oriented Analysis & Design	20/4/98	5	1675	London	LTREE
Advanced IBM Smalltalk	23/2/98	5	1375	Southampton	OBJE
Advanced IBM Smalltalk	11/5/98	5	1375	Southampton	OBJE
Building Distributed Applications using VisualAge for Smalltalk	2/3/98	3	895	Southampton	OBJE
OO Management Overview	Call	1	1250+	On Site	POPK
UML Basics	Call	3	885	Leamington	POPK
UML Basics	Call	3	3750+	On Site	POPK
System Architect Object Oriented Course	Regularly	2	590	Leamington	POPK
System Architect Object Oriented Course	Regularly	2	2000+	On Site	POPK
System Architect Object Oriented Course	To Suit	3	885	Leamington	POPK
System Architect Object Oriented Course	To Suit	3	3000+	On Site	POPK
Manager's Approach to Objects	05/05/98	1	395	London	VALT
Manager's Approach to Objects	01/06/98	1	395	London	VALT
Use cases	06/05/98	2	795	London	VALT
Use cases	02/06/98	2	795	London	VALT
Analysis with UML	14/04/98	4	1295	London	VALT
Analysis with UML	11/05/98	4	1295	London	VALT
Analysis with UML	08/06/98	4	1295	London	VALT
Analysis with UML	29/06/98	4	1295	Manchester	VALT
A Technical Introduction to CORBA	27/04/98	1	395	London	VALT
A Technical Introduction to CORBA	18/05/98	1	395	London	VALT
A Technical Introduction to CORBA	15/06/98	1	395	London	VALT
A Technical Introduction to CORBA	11/05/98	1	395	Manchester	VALT
A Technical Introduction to CORBA	20/04/98	1	395	Edinburgh	VALT
CORBA Enterprise Architectures	28/04/98	3	1295	London	VALT
CORBA Enterprise Architectures	19/05/98	3	1295	London	VALT
CORBA Enterprise Architectures	16/06/98	3	1295	London	VALT
CORBA Enterprise Architectures	12/05/98	3	1295	Manchester	VALT
CORBA Enterprise Architectures	21/04/98	3	1295	Edinburgh	VALT
A Technical Introduction to Java	14/04/98	1	395	London	VALT
A Technical Introduction to Java	11/05/98	1	395	London	VALT
A Technical Introduction to Java	08/06/98	1	395	London	VALT
A Technical Introduction to Java	22/06/98	1	395	Manchester	VALT
A Technical Introduction to Java	26/05/98	1	395	Edinburgh	VALT
Java Enterprise Architectures	15/04/98	3	1295	London	VALT
Java Enterprise Architectures	12/05/98	3	1295	London	VALT
Java Enterprise Architectures	09/06/98	3	1295	London	VALT



Course	Date	Days	Cost	Place	Company	Course	Date	Days	Cost	Place	Company
Java Enterprise Architectures	23/06/98	3	1295	Manchester	VALT	Building Applications with Microsoft Transaction Server	Call 01285 655 977 5	1595	Call	QA TR	
Java Enterprise Architectures	27/05/98	3	1295	Edinburgh	VALT	Fasttrack Windows NT 5 for Developers	Call 01285 655 978	2	650	Call	QA TR
Constructing Web Applications using VisualAge for Smalltalk	19/3/98	2	650	Southampton	OBJE	Windows OLE Programming with the MFC Library	Call 01285 655 979	5	POA	Call	QA TR
Introduction to VisualAge	23/2/98	5	1375	London	OBJE	Developing OLE/ActiveX Controls with the MFC Library	Call 01285 655 980	5	1495	Call	QA TR
Introduction to VisualAge	30/3/98	5	1375	Southampton	OBJE	Windows OLE System Programming	Call 01285 655 981	5	1595	Call	QA TR
Introduction to VisualAge	11/5/98	5	1375	Southampton	OBJE	VisiBroker for Java	20/04/98	4	1295	London	VALT
Building Applications using VisualAge for Smalltalk	9/3/98	5	1375	Southampton	OBJE	VisiBroker for Java	18/05/98	4	1295	London	VALT
Building Applications using VisualAge for Smalltalk	18/5/98	5	1375	Southampton	OBJE	VisiBroker for Java	15/06/98	4	1295	London	VALT
Team Programming using VisualAge for Smalltalk	8/4/98	2	650	Southampton	OBJE	VisiBroker for Java	05/05/98	4	1295	Manchester	VALT
Programming in IBM Smalltalk	20/4/98	5	1375	Southampton	OBJE	Advanced VisiBroker for Java	27/04/98	3	995	London	VALT
Using Lotus Notes with VisualAge for Smalltalk	16/4/98	2	650	Southampton	OBJE	VisiBroker for C++	14/04/98	4	1295	London	VALT
MVS Smalltalk: Transaction Managed Objects	27/4/98	5	1450	London	OBJE	VisiBroker for C++	22/06/98	4	1295	London	VALT
VisualAge for Smalltalk Programmers	2/3/98	5	1375	Southampton	OBJE	Orbix for C++	11/05/98	4	1295	London	VALT
Programming in VisualWorks	16/2/98	4	1025	Southampton	OBJE						
Programming in VisualWorks	23/3/98	4	1025	Southampton	OBJE						
Programming in VisualWorks	5/5/98	4	1025	Southampton	OBJE						
OO Programming with VisualAge for Java	16/2/98	5	1250	Southampton	OBJE						
OO Programming with VisualAge for Java	23/3/98	5	1250	Southampton	OBJE						
Building Applets & Applications with VisualAge for Java	9/3/98	5	1250	Southampton	OBJE						
Building Applets & Applications with VisualAge for Java	30/3/98	5	1250	Southampton	OBJE						
Object-Oriented Analysis & Design using the Booch Method	Call 01285 655 960	4	1245	Call	QA TR						
Object-Oriented Analysis & Design using Rumbaugh's OMT	Call 01285 655 961	5	1475	Call	QA TR						
Developing CORBA Applications	Call 01285 655 962	3	POA	Call	QA TR						
Object-Oriented Design for C++ Development	Call 01285 655 963	5	1475	Call	QA TR						
Overview of Distributed Objects	Call 01285 655 964	1	295	Call	QA TR						
Object-Oriented Primer	Call 01285 655 965	1	295	Call	QA TR						
Object-Oriented Software Development	Call 01285 655 966	3	995	Call	QA TR						
Object-Oriented Analysis & Design using the Unified Modelling Language	Call 01285 655 967	5	1475	Call	QA TR						

## PC SUPPORT

PC Configuration & Troubleshooting	Bi-weekly	4	1425	London	LTREE
Advanced PC Configuration Troubleshooting & Data Recovery	5/5/98	4	1425	Edinburgh	LTREE
PC Configuration & Troubleshooting	9/6/98	4	1425	Edinburgh	LTREE
Troubleshooting & Data Recovery	Monthly	4	1425	London	LTREE
Advanced PC Support	Call 01285 655 968	4	1245	Call	QA TR
PC Fundamentals	Call 01285 655 969	3	845	Call	QA TR
PC Support	Call 01285 655 970	4	1175	Call	QA TR

## PROGRAMMING

Visual Basic 5 for Business Solutions	Bi-weekly	4	1425	London	LTREE
Windows CE Programming	5/5/98	4	1425	London	LTREE
Visual InterDev for Enterprise Applications	9/6/98	4	1425	London	LTREE
Win32 Systems & Network Programming	14/4/98	4	1425	London	LTREE
Programming ActiveX with MCF	Monthly	4	1425	London	LTREE
Visual C++: Windows Programming with MFC	5/5/98	5	1675	London	LTREE
Java Programming: Hands-On	Monthly	4	1425	London	LTREE
Java for Enterprise Systems	12/5/98	4	1425	London	LTREE
Visual J++	Monthly	4	1425	London	LTREE
Introduction to Programming: Hands-on Workshop	Monthly	4	1425	London	LTREE
C Programming	Monthly	4	1425	London	LTREE
Introduction to C++ for Non-C Programmers	Monthly	4	1425	London	LTREE
KornShell Programming	5/5/98	4	1425	London	LTREE
System Architect BASIC Workshop	Call	1	295	Leamington	POPK
System Architect BASIC Workshop	Call	1	1000+	On Site	POPK
Programming in C	14/04/98	4	840	Reading	PTR
Programming in C	05/05/98	4	840	Reading	PTR
Programming in C	02/06/98	4	840	Reading	PTR
Programming in JAVA	06/05/98	3	720	Reading	PTR
Programming in JAVA	29/06/98	3	720	Reading	PTR
Developing Windows NT Server Applications	Call 01285 655 971	5	1595	Call	QA TR
Mastering Web Site Development using Visual InterDev	01285 655 972	5	1445	Call	QA TR
Win32 Programming Essentials	Call 01285 655 973	5	1495	Call	QA TR
Developing ActiveX Controls & Components	Call 01285 655 974	5	1495	Call	QA TR
Windows Programming in C	Call 01285 655 975	5	1495	Call	QA TR
Windows Programming with Visual C++ & the MFC Library	Call 01285 655 976	5	1475	Call	QA TR

## PROJECT MANAGEMENT

Software Project Planning & Management	21/4/98	4	1425	London	LTREE
Project Management: Skills for Success	Monthly	4	1425	London	LTREE
Software Project Planning & Management	9/6/98	4	1425	London	LTREE
DSDM Aware	Call 01285 655 982	1	295	Call	QA TR
Managing Modern Software Development Projects	Call 01285 655 983	3	1045	Call	QA TR
Microsoft Solutions Development Discipline: Deployment	Call 01285 655 984	3	945	Call	QA TR
Microsoft Solutions Development Discipline: Development	Call 01285 655 985	3	945	Call	QA TR
DSDM Practitioner	Call 01285 655 986	3	945	Call	QA TR
Object-Oriented Project Management	Call 01285 655 987	2	695	Call	QA TR
Project Management Skills	Call 01285 655 988	4	1245	Call	QA TR

## SYSTEMS ANALYSIS

Software Quality Assurance	6/4/98	4	1425	London	LTREE
Software Systems Analysis & Design	Monthly	4	1425	London	LTREE
Information Engineering	Call	3	885	Leamington	POPK
Information Engineering	Call	3	3750+	On Site	POPK
Structured Analysis & Design for Real Time Systems	Call	1	295	Leamington	POPK
Structured Analysis & Design for Real Time Systems	Call	3	885	Leamington	POPK
Structured Analysis & Design for Real Time Systems	Call	1	1250+	On Site	POPK
Structured Analysis & Design for Real Time Systems	Call	3	3750+	On Site	POPK
System Architect 4.0 Data Modelling	Call	2	590	Leamington	POPK
System Architect 4.0 Data Modelling	Call	2	2000+	On Site	POPK
System Architect 4.5 Data Modelling	Call	1	295	Leamington	POPK
System Architect 4.5 Data Modelling	Call	1	1000+	On Site	POPK
System Architect/Catalyst	Call	2	Call	Call	POPK
Systems Analysis & Design	Call	1	295	Leamington	POPK
Systems Analysis & Design	Call	3	885	Leamington	POPK
Systems Analysis & Design	Call	1	1250+	On Site	POPK
Systems Analysis & Design	Call	3	3750+	On Site	POPK
System Architect Structured A&D	Regularly	1	295	Leamington	POPK
System Architect Structured A&D	Regularly	1	1000+	On Site	POPK
System Architect 4.0 Data Modelling	To Suit	1	295	Leamington	POPK
System Architect 4.0 Data Modelling	To Suit	1	1000+	On Site	POPK
System Architect Structured A&D	To Suit	2	590	Leamington	POPK
System Architect Structured A&D	To Suit	2	2000+	On Site	POPK

## SYSTEMS MANAGEMENT

Hands-on Microsoft Exchange 5	Monthly	4	1425	London	LTREE
Windows Architecture	5/4/98	4	1425	London	LTREE
Building Office 97 Intranet Applications	Monthly 21/4/98	1425	London	LTREE	
System Architect Power User Course	To Suit	1	295	Leamington	POPK
System Architect Power User Course	To Suit	1	1000+	On Site	POPK

## UNIX

UNIX Introduction	Monthly	4	1425	London	LTREE
UNIX Tools & Utilities	14/4/98	4	1425	London	LTREE
UNIX Workstation administration	12/5/98	4	1425	London	LTREE
UNIX Server Administration	30/6/98	4	1425	Edinburgh	LTREE
X Window System Programming	9/6/98	4	1425	London	LTREE
UNIX Programming	19/5/98	4	1425	London	LTREE



Course	Date	Days	Cost	Place	Company
Perl Programming	Monthly	4	1425	London	LTREE
Unix Fundamentals	07/04/98	3	630	Reading	PTR
Unix Fundamentals	06/05/98	3	630	Reading	PTR
Unix Fundamentals	03/06/98	3	630	Reading	PTR
Shell Programming	21/04/98	2	420	Reading	PTR
Shell Programming	19/05/98	2	420	Reading	PTR
Shell Programming	16/05/98	2	420	Reading	PTR
Advanced Unix Tools & Shell Scripts	23/04/98	2	420	Reading	PTR
Advanced Unix Tools & Shell Scripts	21/05/98	2	420	Reading	PTR
Advanced Unix Tools & Shell Scripts	18/05/98	2	420	Reading	PTR
Unix System Administration	01/04/98	3	630	Reading	PTR
Unix System Administration	29/04/98	3	630	Reading	PTR
Unix System Administration	27/05/98	3	630	Reading	PTR
Unix System Administration	24/06/98	3	630	Reading	PTR
Unix Networking	06/04/98	3	420	Reading	PTR
Unix Networking	05/05/98	3	420	Reading	PTR
Unix Networking	01/06/98	3	420	Reading	PTR
UNIX Fundamentals	Call 01285 655 989	4	1195	Call	QA TR
UNIX Programming	Call 01285 655 990	5	1375	Call	QA TR
UNIX Systems Administration	Call 01285 655 991	4	1195	Call	QA TR
Mastering UNIX Shell Scripts	Call 01285 655 992	4	1195	Call	QA TR
Solaris Systems Administration	Call 01285 655 993	4	Call	Call	QA TR

## WINDOWS

Windows 95 Support & Networking	Monthly	5	1675	London	LTREE
Integrating Microsoft Office 97	28/5/98	4	1425	London	LTREE
Hands-On TCP/IP Internetworking on Windows NT	Monthly	4	1425	London	LTREE
Windows NT 5	Monthly	5	1675	London	LTREE

## WINDOWS NT SERVER

Administering Microsoft Windows NT 4.x	Call 01285 655 995	3	1035	Call	QA TR
Supporting Windows NT Server 4.x - Enterprise Technologies	Call 01285 655 996	5	1475	Call	QA TR
Supporting Windows NT 4.x - Core Technologies	Call 01285 655 997	5	1475	Call	QA TR
Supporting Microsoft Systems Management Server	Call 01285 655 998	5	1475	Call	QA TR
Supporting Microsoft SNA Server V4	Call 01285 655 999	5	1475	Call	QA TR
Windows NT 4.x Essentials	Call 01285 655 1001	4	1395	Call	QA TR
Windows NT 5 Essentials	Call 01285 655 1002	5	1595	Call	QA TR
Supporting Windows NT 4.x Servers	Call 01285 655 1004	4	1395	Call	QA TR
Implementing Windows NT 5 Active Directory	Call 01285 655 1005	3	1045	Call	QA TR
Windows NT 4 Workstation & Server: Hands-on	Bi-weekly	5	1675	London	LTREE
Windows NT 4 Workstation & Server: Hands-on	29/6/98	5	1675	Edinburgh	LTREE
Windows NT Optimisation & Troubleshooting	Monthly	5	1675	London	LTREE
UNIX & Windows NT Integration	21/4/98	4	1425	London	LTREE
Porting Applications from UNIX to Windows NT	19/5/98	4	1425	London	LTREE
Porting Applications from UNIX to Windows NT	2/6/98	4	1425	London	LTREE
Windows NT Support Fundamentals	15/04/98	3	690	Reading	PTR
Windows NT Support Fundamentals	13/05/98	3	690	Reading	PTR
Windows NT Support Fundamentals	10/06/98	3	690	Reading	PTR
Supporting Windows NT Server	27/04/98	5	1150	Reading	PTR
Supporting Windows NT Server	25/05/98	5	1150	Reading	PTR
Supporting Windows NT Server	22/06/98	5	1150	Reading	PTR
Citrix Winframe	06/04/98	1	230	Reading	PTR
Citrix Winframe	26/05/98	1	230	Reading	PTR
Citrix Winframe	22/06/98	1	230	Reading	PTR

## WINDOWS SUPPORT

Implementing Windows NT Security: Hands-on	Monthly	4	1425	London	LTREE
Windows 95/NT/3.11 Multiplatform Networking	21/4/98	4	1425	London	LTREE
NetWare to Windows NT Integration & Migration	26/5/98	4	1425	London	LTREE
Microsoft Systems Management Server	Monthly	4	1425	London	LTREE
Supporting Windows '95	27/04/98	2	460	Reading	PTR
Supporting Windows '95	18/05/98	2	460	Reading	PTR
Supporting Windows '95	08/06/98	2	460	Reading	PTR
Supporting Windows 95	Call 01285 655 1007	4	POA	Call	QA TR

## COMPANY DETAILS

### Key PTR PTR Associates Limited

41 London Road, Twyford, Berkshire RG10 9EJ  
Tel: 0118-934-4101 Fax: 0118-934-4105  
email: training@ptr.co.uk Web: http://www.ptr.co.uk

*PTR Associates specialises in offering quality hands-on generic technical training in two principal areas - Data Communications and Networking and Operating Systems. The modularity of course material and depth of subject knowledge enable tailored or custom-made single company courses to be offered, in addition to the schedule of public courses.*

### 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 LTREE Learning Tree

Mole Business Park, Leatherhead, Surrey KT22 7AD Contact: Jan Mott  
Tel: 0800 282353 Fax: 01372 364611  
email: uksales@learningtree.com Web: http://www.learningtree.com/uk

*Learning Tree International provides training for IT professionals. Established in 1974, the company presents an impartial view, focusing on practical application of knowledge.*

### Key QA TR QA Training Ltd

Cecily Hill Castle, Cirencester, Gloucestershire, GL7 2EF  
Tel: 01285 655888 Fax: 01285 643748  
Email: responsecentre@qatraining.com  
Web: http://www.qatraining.com

*QA Training is widely recognised as the premier IT training company in the UK and the largest provider of technical training to IT professionals. We offer over 150 programming and support courses and are major business partners and accredited trainers of Compaq, Hewlett-Packard, Lotus, Microsoft, Netscape, Novell, Oracle and Powersoft amongst others. 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 VALT Valtech Ltd

Corinthian House, St Giles Circus, 279 Tottenham Court Rd, London W1P 9AA  
Tel: +44 (0) 171 307 2300 Fax: +44 (0) 171 307 2301  
Web: http://www.valtech.com E-mail: training@valtech.com

*Valtech is an international training and consulting group offering a wide range of courses, to transfer the expertise to develop new multi-tier systems. Valtech has trained 5000 people throughout Europe in 1997, and is recognized as the European leader in Object Technology Transfer.*

### Key POPK Popkin Software & Systems

St Albans House, Portland Street, Leamington Spa, Warks CV32 5EZ  
Tel +44(0) 1926 450858 Fax +44(0) 1926 311833  
Web: http://www.popkin.com E-mail: sales@popkin.co.uk

*Popkin Software and Systems is the manufacturer and vendor of System Architect, the market leader in Analysis and Design Modelling tools. We also provide a comprehensive Consultancy and Training service covering the FULL analysis and design lifecycle including Business Process Modelling, Traditional and Object Oriented Methods, Data Modelling. We provide both public and on-site courses.*

*Popkin Software and Systems is the manufacturer and vendor of System Architect, the market leading suite of Analysis and Design Modelling tools.*

**EXE Software Training Guide, produced by EXE Magazine, Centaur Communications Ltd, St Giles House, 50 Poland Street, London W1V 4AX**  
Tel: 0171 970 4000 Fax: 0171 970 4895 e-mail: advertising@dotexe.demon.co.uk.  
If you would like to include your Training Listings in our next guide, please call advertising on 0171 970 4838.



## CAREERS & CONTRACTS

EXE brings you the cream of vacancies in the development and programming business.  
For more information contact Ben Boswell 0171 970 4838 Fax: 0171 970 4895 Email: [benb@dotexe.demon.co.uk](mailto:benb@dotexe.demon.co.uk)

# Broadcasting

### Software Engineers

#### Hampshire

Here is your chance to work for one of the largest broadcasting companies in the UK. A number of vacancies exist in product and systems development in fields such as multiplexing, modulation, digital terrestrial TV and receiver software. If you have experience in any of the following then we have the job for you.

MPEG2  
C/C++  
TCP/IP  
JAVA

Windows NT/95  
algorithm coding  
real time operating systems  
multimedia

Ref: PH00823

### C++ Programmers

#### Hertfordshire

Our client is looking for bright graduate engineers with a minimum of 1 year's experience to join their small but well established team developing teletext and subtitling software for major broadcasters. You will have a good degree and be a proficient C++ programmer. Knowledge of Visual C++, SQL Server, NT Server, Transact SQL, Visual basic and TCP/IP is highly desirable. Set in a quiet village location this is a chance to work in a fast moving exciting industry without the hustle and bustle of Central London.

Ref: PH00824

### Software Design Engineers

#### Hertfordshire

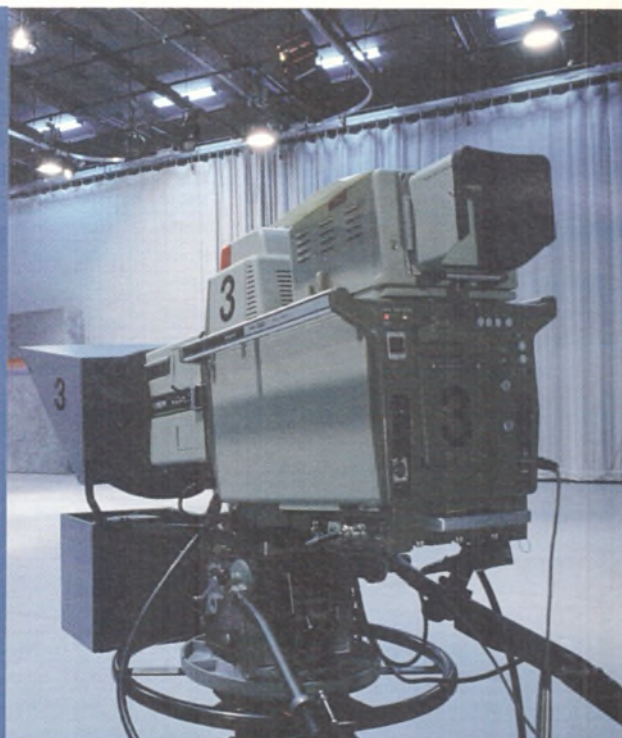
Young and dynamic this company has a string of technological firsts to its name developing innovative hardware and software products for the PC industry in 3D and media processing technology. They offer challenging and rewarding careers to people with enthusiasm, commitment and ability. They have a number of vacancies and are looking for graduate level candidates with experience in C/C++, Windows, 3D/Multimedia, Graphics, device drivers, DSP, Audio/Video, MPEG 1, MPEG 2, digital video and games. If you want to work on exciting projects using the latest tools and techniques then this is the place to do it!

Ref: PH00825



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For more information contact Pia Hartnell quoting Refs at

### ERS Technical

Ambassador House, 575-599 Maxted Road, Hemel Hempstead,  
Hertfordshire HP2 7DX  
telephone 01442 231691 facsimile 01442 215486  
email [pia\\_hartnell@ers.co.uk](mailto:pia_hartnell@ers.co.uk) web <http://www.ers.co.uk/ers>

## THE DEVELOPERS REGISTER

Readers of this magazine will remember our adverts run in early 1995 for the Developers Register. This was for dedicated Software Developers seeking a career path driven by technology rather than management.

This has proved to be very successful with many excellent registered engineers having started with new employers, advancing both their skills and careers. They successfully moved into New Technology gaining and enhancing skills to enable them to move into more technically challenging roles and applications or go into contracting. Importantly, more than a few of those early members have come back ready to move to even greater possibilities. This is a great time to be a Software Engineer.

The Opportunities Are Out There. Call James or Ron for details.

### High Quality Jobs for High Quality Software Engineers

We now put all our jobs on the Internet

URL: <http://www.ash-associates.com>

## JAVA

Salary to £45K + major Bens. Software Design House seeks 12+ Software Engineers with Java or excellent Real Time C++ experience to originate Java Tool development. These are brand New Projects starting now.

Call Ron Cook for details

Email: [ron@ash-associates.com](mailto:ron@ash-associates.com)

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Associates**

COMPUTER RECRUITMENT CONSULTANTS  
First Floor, 39 to 41 High Street  
Ringwood, Hants, BH24 1AD  
Email: [recruit@ash-associates.com](mailto:recruit@ash-associates.com)  
TEL: (01425) 475480 FAX: (01425) 480807

Telephone  
**01425 475480**

Fax  
**01425 480807**

Email:  
[recruit@ash-associates.com](mailto:recruit@ash-associates.com)

## Ready For A New Challenge?

Software Engineers to £35K

Manchester & Winchester

Are you a C++/C/VB software professional with  
in-depth skills in one or more of the following..?

- Microsoft Windows Operating Systems and MFC
- Internet Applications
- Data Communications/ Messaging/ Email
- Unix Systems Programming and X-Windows
- Palmtop Computing

Teleca is a growing software house building windows, internet and device-oriented applications, often working to very demanding deadlines. We need enthusiastic, hard-working software developers who want to succeed in a varied, technically demanding environment. In return we offer a friendly working environment, real opportunities to develop your personal and technical skills and sensible salaries.

If you have a good honours degree, a sociable disposition and a commitment to high professional standards, send your CV to:

**TELECA**

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Tel: 0161 448 2885 Fax: 0161 448 2886

E-mail: [jobs@teleca.com](mailto:jobs@teleca.com) <http://www.teleca.com>

Regional Offices in Winchester and Los Angeles



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EXE brings you the cream of vacancies in the development and programming business.  
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# CAN YOU SEE THE FUTURE?

**Developers with genuine vision - combine the excitement of a start-up with the benefits of a £multi-million group.**

**Visual Basic/ODBC/Active X/EDI**

## WINDSOR, BERKS £40,000 + CAR + BENS

There are some opportunities which are rare in the computer industry, this is one of them.

ediTRACK is an award winning supply chain management system. It has the potential to dramatically change the way that an organisation operates. Our current clients, some of which are household names, are already reporting significant benefits from using the system.

However, there is much more that ediTRACK can do. We believe that the underlying principles have a wider and more significant application to all business processes.

To this end, our parent company, the Allport Freight Group, have committed the funds necessary to develop the software into a fully "shrink wrapped" product. We want to explore the possibilities, technically and commercially, that ediTRACK introduces.

We are now looking to create a team of high calibre, creative, focused software developers. Each member of the team will be expected to have the technical depth to allow them to contribute to the development of the software, and also to have the presence to be able to communicate effectively with senior executives.

This is a start-up team, based in it's own office, with its own goals, its own presence and a point to make. However, we will have the backup of a £multi-million group, experienced in the formation and nurturing of new ventures.

Technical skills of particular interest include: VISUAL BASIC (4 OR 5), ODBC, ACTIVE X and ELECTRONIC DATA INTERCHANGE, but of equal significance will be your commercial understanding. We need your awareness of the "what for?" as well as of the "how to?"

Whilst business experience in Logistics and/or Freight Forwarding is desirable, candidates with a diverse applications background would also be welcome. Some international travel may be required. Ref:MG/EXE/717

If you want to be part of our future, contact our advising consultants: Claire Poole or Liz Agostini at Mercer Gray, Foxglove House, 166-169 Piccadilly, London, W1V 9DE. Tel: 0171 499 6600, evenings/weekends: 0181 241 8496. Fax: 0171 499 6696. E-mail: recruitment@mercergrey.co.uk Please quote the above reference number.



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Fax: 01296 336037

Email: jobs@soltech.co.uk

## SOFTWARE OPPORTUNITIES

The Tower House  
High Street  
Aylesbury  
Bucks HP20 1SQ



### SEND A CV OR CALL FOR INFO:

Interactive TV C/C++ multimedia, to £35k+ S. Coast, Surrey Camb

Internet & e-mail protocols, to £40k Suffolk

Image processing, interactive apps Cambridge

Visual C++/C++/Win32, SDK, MFC Manchester

Borland C++, GUI development Herts

Videoconferencing Bristol

1yr: Visual C++, MFC, SDK, 95/NT audio Cambridge

### MULTIMEDIA

Berks to £30k

Major player in Object Technology, Advanced Web Applications, and Multimedia technologies have several vacancies for Software Engineers with at least 2 years experience in some of the following: Delphi (or C++ prepared to learn Delphi), Visual Basic, GUIs, Java, SQL Server, Active X, Windows 95/NT, Object Technology, Visual C++, MFC, OWL, Windows 95/NT at systems level, network management, TCP/IP, embedded systems (set-top boxes, drivers), Internet technologies.

### C++/OO, COMMS

London, Berks, Wilts to £35k+bens

I have several top companies, all leaders in the telecomms & mobile comms industries, now seeking a number of degree (or HND) qualified software engineers with experience of C++ and OO techniques. Any experience in the comms industry would be an advantage but you can look forward to top salaries and excellent training in areas such as: GSM, Windows NT, UNIX, network planning etc. These companies also offer excellent benefits packages and career development.

### VIDEO / IMAGE

Kent £ Excellent

Shape the future of video & image control into the Millenium! My client works in the areas of video & multimedia and now seeks a bright engineer to join their video research team working on both short & long term projects focusing on emerging technologies in image processing to ensure they remain on the cutting edge. As a Principal Software Engineer you will be working on video streaming & image compression and aspects of embedded firmware incorporating RISC and DSP algorithms. You should have C and assembler, and some network experience (preferably in video).

### CONSULTANCY-VARIETY!

Cambridge to £35k

Exciting work in growth areas, variety, a friendly atmosphere, excellent training, and a good location are what you'll find if you start the New Year right by joining this software & systems consultancy. Some of the application areas include: mobile comms, digital video, Internet/WWW, set-top-boxes, advanced screen telephony, embedded software etc. Their clients list includes some of the best companies. If you get along well with colleagues, have a good degree and some of the following: C, C++, OOD, real-time embedded software, and hardware knowledge: then send a c.v. to be considered. Positions exist for Architects and Designers.

### SOFTWARE TEAM LEADER

Herts c. £40k+

Premier provider of interactive television and video on demand services. In preparation for national deployment of their service they have a number of vacancies in key technical positions. You will be leading a group of 6 developers working on a distributed software system written in C++ under UNIX. You should have a good academic background and around 10 years experience in a distributed software environment with proven team, leadership skills as well as: C or C++, UNIX, knowledge of TCP/IP.

### TELECOMMS/BROADCAST

Cambridge £20 to £35k

My client is involved in the design, manufacture & supply of test equipment for the telecomms & broadcast industry. They currently have requirements for Software Engineers to work on Windows software. Ideally you will have a good degree and around 3 years' experience as well as C++/MFC, OOD, Windows NT/95 application development, and preferably some experience of scientific/industrial applications. OLE, MPEG/DVB/digital video and Windows NT device driver experience a plus.

### GRAPHICS - TV

Hants £18 to 40k

Well known international consumer electronics company with an expanding UK design centre seeks engineers with drive and ability. In exchange for your skills & experience you can expect great career prospects, state-of-the-art work, and the prestige of working for this first class company. Vacancies exist from Graduate to Principal Engineer level in either longer term R&D projects or shorter term customer driven projects in areas such as 3D graphics & media animation, image processing, multi-media, comms, broadcast. You should have skills in SOME of: Visual C++, C++, MFC, OOA/OOD, Windows, GUIs, RDBMS, graphics, embedded systems.





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With a wealth of experience in Open Systems and IT recruitment, we are in a great position to assist in locating the right job for you. We are able to advise on future growth areas, the skills you should be acquiring and the direction you should be working towards.

So whatever your discipline within the technical arena - programmer, analyst, pre-sales consultant, support specialist, graduate, systems administrator or technical manager, telephone Connections on 01189 893222 or mail your CV to:

The Connections Group  
The Elms, 26 Broad Street,  
Wokingham, Berkshire RG40 1AB  
Fax: 01189 893322

Email: [mail@unixjobs.co.uk](mailto:mail@unixjobs.co.uk)

For further information on permanent and contract vacancies please visit <http://taps.com/connections>

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## The most stimulating OO jobs in the UK!

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- Object Oriented Developers (C++/Java)
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for internal roles within Ratio or to join one of our prestigious external clients.

Both permanent (£40,000+) and contract (c£1500/week) positions are available.

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*We know the object...*

## In and Around West Yorkshire

We have clients currently seeking the following:

Analyst Programmers with DELPHI or Visual BASIC or Access or FOXPRO to work with 4GL systems (4GL training given) .....£25,000

Programmers to work in Visual BASIC or DELPHI or 'C++' on multi media systems .....£20,000

Experienced Developers (10 developers needed) to retrain in UNIFACE 4GL and work on financial services and supply chain systems.....£15,000 to £25,000

Junior DELPHI programmers.....£15,000

COBOL & PROGRESS 4GL Junior Support Programmers .....£15,000

RPG400 Developers or retrain to RPG400 from RPGII/RPGIII .....£20,000

Microsoft NT Installers and NT Support (some vacancies with possibilities of international travel).....£18,000 to £20,000

**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,  
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Excellent salary  
(£30,000 - £40,000)

plus benefits

MFC 32 bit, ActiveX and COM

# C++ programmer

SQL Development is a fast growing international software development company with a commercial focus and prestigious clients. We develop to our own specification and constantly remain one step ahead of the market and our competition. We have been involved in the document management industry for the past seven years, servicing many of the world's biggest law firms, the US Government and numerous blue chip companies.

Creativity and excellence are the main qualifications for this position. You may be a recent graduate with hands-on technical experience or someone with years of expertise within the industry looking for a fresh challenge.

We are breaking the mould in software development, using innovation, imagination and vision. You will share in our success if you share our vision.

As a key member of a six-person team, you will be instrumental in specifying and writing our next product, which is destined to revolutionise the way documents are shared and transferred over the internet. You will be working in a 32 bit environment using the latest technology available, including ActiveX, NameSpace and COM, at our European base in London E1, close to Tower Hill tube station.

**SQL Development (Europe) Ltd**

Telephone 0171 481 8155



# Advanced Media Systems

## Vacancies for Delphi Developers

AMS are a small but growing software house specializing in system development for the Television Broadcasting Industry.

We are looking for bright IT professionals to join a young, dynamic team using leading edge technology in an innovative way.

It is essential that you have commercial Delphi experience and a good understanding of Relational Databases.

Any experience of the following would also be advantageous: NT, Oracle, Object-Oriented development.

You will be motivated by a genuine interest in computing, possess the willingness and aptitude to learn from us quickly and be able to communicate effectively with non-technical people.

If you can deliver results and are interested in joining us, please send your CV and covering letter to:

Sarah Janes  
Advanced Media Systems Ltd.  
Park House  
206-208 Latimer Road  
London  
W10 6QY





# Get a life!

In its ceaseless search of everything new, Ctrl-Break stumbled upon Keith Lynch's timeline (<http://www.clark.net/pub/kfl/timeline.html>), recording when Ken first spotted the appearance of new terms in emails and netnews. Here are some excerpts (reproduced with his permission):

1980 February	moderated mailing lists
1980 June	MUD (Multi-User Dungeon)
1980 September	Addresses with ! in them (later became common, now quite rare)
1981 August	"Usenet" (mentioned on the ARPAnet)
1981 August	"@ party" (a party for Internet people)
1982 February	"Internet" (then called ARPAnet)
1982 February	"newsgroups" (mentioned on the ARPAnet)
1982 November	Smileys such as :-)
1982 December	Addresses with dots in them (now mandatory)
1982 December	Addresses with % in them (later became common, now quite rare)
1983 September	GNU (GNU's Not Unix)
1983 November	> used to quote material being replied to
1984 January	Apple Macintosh
1984 March	>> used to quote doubly-nested material being replied to
1985 May	CD-ROM
1985 July	FidoNet
1985 August	Chain letters via e-mail (quickly stamped out until 1993)
1985 December	Addresses ending in .uk
1986 January	FSF (Free Software Foundation)
1986 January	"postmaster" addresses
1986 March	"netiquette"
1986 March	Windows (the Microsoft product)
1986 June	80386
1986 June	ISDN
1987 January	Addresses ending in .org
1988 January	Year 2000 problem (ie lots of software will break then)
1988 January	80486
1988 February	perl
1988 March	impending death of the net predicted
1988 April	"Get a life!"
1988 November	The Robert Tappan Morris worm, which quickly infected much of the net.
1989 March	GIF (a graphics format)
1989 May	IRC (Internet Relay Chat)
1989 May	LPF (League for Programming Freedom) (opposes "look & feel" copyrights)
1989 September	FAQ (Frequently Asked Questions)
1990 February	Last addresses ending in .arpa
1990 July	freenets
1990 July	"newbie"
1990 December	GUI (Graphical User Interface)
1991 March	cyber (as a prefix referring to the net)
1991 March	cyberspace (referring to the net, not to something in SF)
1991 March	JPEG

1991 June	PGP (Zimmerman's RSA-based encryption software)
1992 January	Gopher
1992 January	POP (Point of Presence)
1992 March	"Web" (as in World-Wide)
1992 May	Demon UK
1992 May	SLIP
1992 June	"browser"
1992 June	"WWW"
1992 June	http://
1992 July	"firewall" (as a part of the net)
1992 July	14.4 kbps modems
1992 July	MIME
1992 August	Windows NT
1992 October	"home page"
1992 October	"mouse balls" hoax IBM memo
1992 October	Pentium
1992 November	Linux
1992 November	Project Gutenberg
1992 November	PPP
1992 November	Winsock
1993 February	"anon server", also "anonymous server"
1993 March	"surf" (not referring to the water sport)
1993 March	MPEG
1993 April	procmail
1993 April	"National Information Infrastructure" meaning the existing net (future tense, 7/1992)
1993 June	HTML
1993 June	Mosaic
1993 July	"netizen"
1993 August	"information superhighway" meaning the existing net (future tense, 3/1993)
1993 September	"URL"
1993 November	Lynx
1993 December	"cybersex", referring to the net (3/1992 referring to SF) (1971 in a zine)

1993 December	DOOM
1994 January	"intranet"
1994 January	"roadkill along the information superhighway"
1994 April	28.8 kbps modems
1994 May	"search engine"
1994 May	"web page"
1994 July	"ISP" (Internet Service Provider) (previously "Public Access Unix")
1994 September	cgi-bin
1994 September	Windows 95 (released 8/1995)
1994 November	Netscape
1995 January	Mozilla
1995 February	NetPhone (to make voice calls over the net)
1995 March	"velveeta" (crossposting an article to too many newsgroups)
1995 April	"shell account"
1995 June	Java (not the island nor the drink)
1995 July	Windows 98
1995 August	"applet"
1995 August	IPv6 (eight octet IP addresses) discussed
1995 September	"rogue domain"
1995 December	AltaVista
1996 January	33.6 kbps modems
1996 January	Microsoft Internet Explorer
1996 January	Pentium Pro
1996 July	ActiveX
1996 October	56 kbps modems
1996 October	WebTV
1996 November	PointCast
and finally (1997 was a rather fallow year):	
1998 July	World ends, seriously damaging the net

## Censorware

CyberSitter is a piece of software censoring any 'rude' words before they appear on the screen. Ctrl-Break learnt that one programmer was rather bemused to find his perfectly PC program corrupted when viewed on the NT machine of a colleague running CyberSitter. The origin of this story is the PerForce mailing list (PerForce is a source-code control system working at TCP/IP socket level to check code in and out).

Here are the two lines in question:

```
#define one 1 /* foo menu */
#define two 2 /* bar baz */
and how they were displayed:
#define one 1 /* foo me */
# fine two 2 /* bar baz */
```

If you want to check all the words you shouldn't be using in your source code, the Moebius Group has reverse engineered the list of forbidden words and web addresses from CyberSitter. Check out <http://www.moebius.com.au/CYBERSitter.html>.





# 'Til Net us do part

**'The simplest way to file for divorce will soon be as easy as clicking the right button on your computer' – *Risks Digest*.**

It was actually a pretty typical Saturday, of recent times. He had gone into work in the morning ('Oh yeah, why don't you go into work. I realise that is the most important thing in the world to you') and she had been shopping and bought a portable phone as a birthday gift for her niece, knowing that this unaffordable extravagance would annoy him, so he drank a whole litre of her favourite grapefruit juice in one go, straight out of the carton, and had stood by the fridge and belched a glorious, shuddering twenty second belch which would have made her feel sick if she hadn't been trembling with rage.

So she went to the bedroom and slammed the door with a slam that rocked the shallow foundations of the remains of their marriage, and ran a bath, adding loads of the green sweetish bubble bath whose fragrance he loathed. She'd taken the portable phone with her (not a proper portable, but one of those ones which lets you wander around the flat cordlessly), and it had been her intention to spend 90 minutes or so in the bath ringing up her girl friends and catting about him with them, emerging in due course from her toilet perfumed and reassured for the main shouting scene of the evening, which was their usual Saturday night treat. This plan having the secondary benefit that with all that liquid in him he was bound to need a pee quite soon, and with her bolted into the bathroom he would have to whistle for it.

So after she had defuzzed her legs with his razor (an old trick – but hey! Don't knock it, it works) she lay back in the water for a few minutes and planned a suitably vivid description of the grapefruit incident, embellished for public consumption. But when she reached for the phone and pressed the 'Talk' button, instead of the dialling tone she heard the rasping of the, correction *his*, modem. Outmanoeuvred.

Then she heard his voice calling through the bathroom door – not his sneery voice, but his ordinary voice, such as she hadn't heard for ages – 'Hey! Come and look at this!' Suspecting a trap she called back: 'What?' but the reply, a repetition of 'Come and look' again sounded genuine. Reluctantly she dried herself and reached for her bathrobe.

It was a web site – naturally. She said: 'If this is more porn...' but he shook his head impatiently and gestured at the screen. She read:

*Divorce now!*

*Are you trapped in a miserable sham of a marriage?*

*Answer a few simple questions and you could be legally divorced in minutes\*!*

*Don't wait – regain your freedom for just £100\*\*. This site accepts all major credit cards.*



*\*Decree Nisi by email within 30 minutes. Decree Absolute will be forwarded by post.*

*\*\*Minimum fee. Cases involving one or more children may cost more – click below for details.*

She looked up at him, wonderingly. 'Don't you see?' he said. 'We could be free. Tonight. Right now. You could watch *Blind Date* a single woman.'

Together they explored the site. There were a lot of questions to be answered. Issues of ownership of property. Income and bread-winning. Cohabitation and co-operation. And some rather personal questions too, relating to extra-marital affairs, and perception of one's partner's sexual abilities. 'I'm not answering these with you watching', she said. 'You won't need to – I'll leave the room. I can't find out what you put... see: you choose a password here...' 'I suppose you want me to pay for it?' she asked. He reached out his wallet and put his Visa card down by the keyboard. 'Be my guest. Frankly, this will be the best £100 I have ever spent. We are so miserable – this could be our chance!'

'Are you sure it's legal in England?' 'Well, it says it is. Look: here' and he guided the mouse in her hand.

Finally she was satisfied – nearly. 'Shall we do it? It seems such a... Shall we do it now?' For the first time in months, he touched her – a gentle caress on the nape. 'I really think we should.'

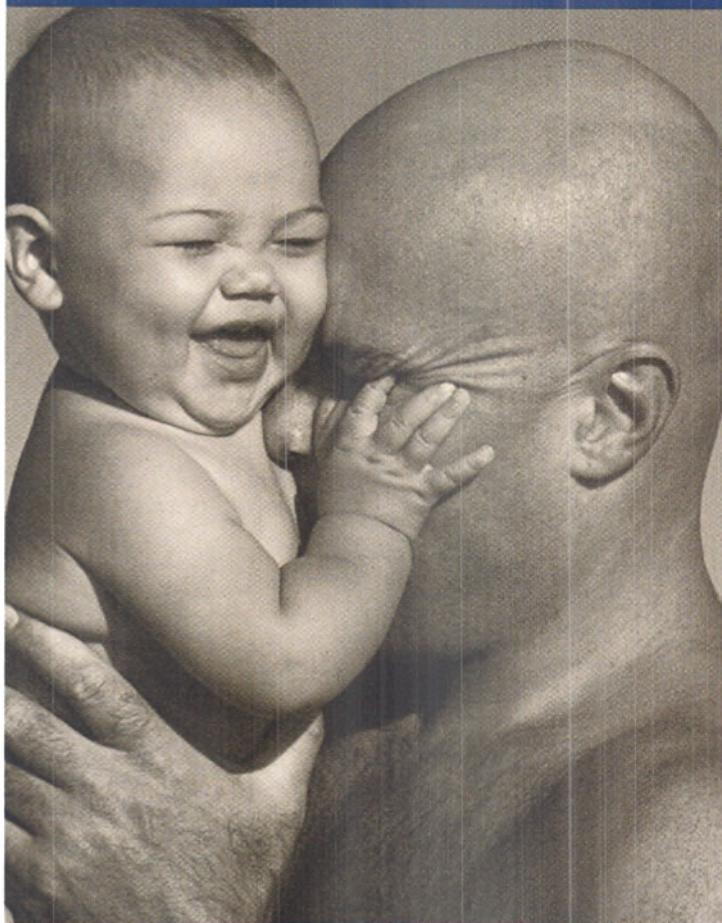
So they did it. First him, and then her; they filled in all the unpleasant and impertinent questions. He lingered in the doorway while she did hers, until she caught him, or thought she caught him, trying to read what she was typing in the mirror. So she insisted he went into the kitchen, which he did with bad grace, calling 'Have you finished yet?' every two minutes.

But in the end they got to the terminal 'Send' button, and they both clicked the mouse together as a final act of unity. For once the World Wide Web delivered on its promises; within a few minutes they got an email back with a provisional outline settlement – pretty favourable to her, although he put a brave face on it. Then there didn't seem any point in her staying, so she packed her suitcase and set off to stay with her friend in Ealing – but not before they had kissed goodbye.

And when she had left the flat (without slamming the door) he collapsed into paroxysms of laughter. After he had finished laughing, which took several minutes, he poured himself a gin in honour of the first Trojan horse he had written since stealing the head of geography department's VAX password at college, back in 1986. He went back to the PC, used Explorer to open a file, and began reading. ■



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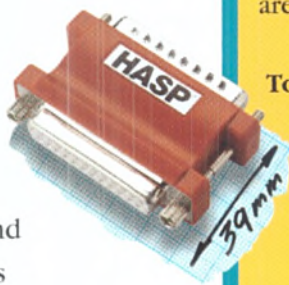


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**Here's what the users and press say about TRACK and TRACKWeb.**

### What Users Say:

"The ability to get users up and running with TRACK in a very short period of time is invaluable. Most people are able to use TRACK without ever reading the documentation."

— Greg Bryant, Principal Software Engineer, NEC Technologies, Inc.

"Using TRACK we're able to look at exactly what happened on a project and come up with accurate time estimates for future releases."

— Kirsten Thompson, Quality Assurance Analyst, Pepsi International

"After using TRACK for several months, we have found that it has streamlined our problem reporting and tracking efforts on a corporate basis."

— Rory Roybal, Director of Engineering, Phoenix Technologies, Ltd.

### The Press Agrees:

"TRACK automates interactions with related tools."

— Peter Coffee, PC Week, March 4, 1996

"TRACK wins hands down in the flexibility, power and ease-of-use areas."

— Data Management Review, January 1996

Soffront Track - [Defect - C:\Dbase\DEMO.BT5]

File Edit Record View Help Query Report Setup Window Help

Defect Id: 36 Priority: Medium Status: Closed Assign To: A.Lau

Product: DrawCAD Module: Display Version: 2.00 Submitter: G.Tam

Date: 03/01/94 Time: 14:36:43 Copy To: admin

Synopsis: Overlapping viewports can't be displayed

Detailed Description:

To reproduce:

- 1) Load DrawCAD by clicking it's icon
- 2) Create two viewports
- 3) Choose EDIT, OVERLAP command

Comments:

Attached Files: demo.jpg

System: LCP286-4

Opened Date: 03/01/94

Closed Date: 10/21/94

Days Open: 234

Last Change: 10/21/94

Changed By: admin

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