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News & Views

RoboHELP 5.5

RoboHELP 5.5 now supports the creation of nine different professional Help formats including Blue Sky's new cross-platform WebHelp, Microsoft Windows CE Help and Netscape NetHelp 2.0. WebHelp is a new cross-platform Help format that is browser independent. The new Multi-Level Index Designer uses drag & drop and an integrated keyword editor lets you add both K- & A-keywords on the fly.

RoboHELP Office 5.5

RoboHELP Office is the new name for WinHelp Office, Blue Sky's award-winning Help authoring suite. It features the new RoboHELP 5.5, RoboHTML 1.0, and 16 state-of-the-art WinHelp and HTML Help authoring tools. These 16 innovative tools are included in the Moving to HTML Kit, Help Video Kit, Help Tool Kit, and Mastering Help. RoboHELP Office now provides Help authors with everything they need to quickly and easily generate all major Windows Help and HTML-based Help formats.

DataTable 4.0

DataTable 4.0, with its new Microsoft-compatible data-binding support, is the perfect choice for your Internet/Intranet or enterprise-wide system solutions. This new version also features printing (including inside IE 4.0- the only grid with this feature), word wrapping as well as reading & writing configuration and data to and from disk.

Data Explorer 2.0

You can now place ANY ActiveX Component, Form or Window in the Right-Hand Pane of the Data Explorer! This new version allows each tree node to have its own view in the right-hand pane. Create an application with a calendar, VB Form, grid component...all within the easy-to-use windows explorer metaphor.

InstallShield 5.1 International & Bilingual

The International and Bilingual variants of InstallShield 5.1 Professional are now available, so you can use all of its new features for your foreign language installations.

DemoShield 5.3

The latest version of DemoShield lets you localise your demos into over 20 languages, create interactive demos, have background images for full screen demos, create Internet demos (ActiveX or plug-in) and has an integrated spell checker.

ProtoSpeed 2.0

ProtoSpeed's distributed Java and Internet protocol debugger enables developers to avoid time consuming 'trial and error' debugging. ProtoSpeed can debug and monitor Java applets, applications and protocol communications between clients and servers.

LEADTOOLS 9.0

The latest version of the award-winning imaging toolkit offers more than 500 functions, properties, and methods to integrate black & white, grayscale, and colour imaging into your applications. Among the new features are common dialog boxes to speed development, support for over fifty image file formats, and optional FlashPix, Video, and OCR modules.

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Eyes only



By the time you read this, the government should have announced its plans regarding encryption. An announcement was rumoured to happen at the end of February but it was cancelled due to 'completely wrong announcements on the Internet' (according to a DTI official). This is surprising, if there are some rumours or some confusion then surely an early clarification should be the rule? What has been leaked is that the Government would ban strong encryption and create a network of Trusted Third Parties (TTPs). These are organisations licensed to provide encryption to all and sundry – with a small catch.

These TTPs will keep a key of all the software and services they sell. And the software will be engineered in a way that the keys cannot be modified.

As more and more communication is becoming electronic, any restriction on encryption is a threat to our personal privacy. With a ban on strong encryption all electronic communication between law-abiding citizens will be trivial to tap by any security agency, the police, and... criminals. Of course criminals are by definition not respectful of the law and will be the only individuals able to continue to use strong encryption.

By this point you might wonder why I'm writing this column – I haven't mentioned anything really related to

software development. There are two reasons why you – EXE reader – should be particularly concerned by this issue. First, it does concern every UK resident and, second, the encryption technology is extremely complex. Software developers are among the few who have the background to grasp the consequences of such a ban.

For instance how can such a ban be enforceable? Look at all the hidden Easter egg credits hidden in many large pieces of software. Most of them managed to pass all the checks done by the Q&A department. And if you consider that this is more a reflection on the professionalism of Q&A teams, there are some simple (to use) steganography programs available on the net which let you hide information in graphic files. So everyone having electronic data could be believed to have some strong crypto hidden and hence

become a suspect.

If you want to ensure the authenticity of your software you need to provide a digital certificate for it. If these certificates are based on weak crypto sooner or later they will be cracked and someone else will be able to masquerade some software as being issued by you. The same applies for digital signatures, with potentially even worse effects. When digital signatures become legally binding (it has already happened in some countries), anyone who can bypass the crypto will be able to impersonate you and possibly ruin your life.

I just hope it is not too late to react. Get a copy of PGP while you still can. Voice your opinion. If you have any suggestion for an effective opposition please send it to EXE and we will relay your ideas. My PGP key is available at <http://www.exe.co.uk/panda/#PGP>.
David Mery

A new approach to OOP



The growing complexity of modern programs makes us look for new approaches to software development. While we may have many new technologies which allow us to create programs in an easier and faster manner, we often have to sacrifice flexibility in favour of simplicity. Let's consider an approach which may help us to overcome this kind of defect. It is based on two main principles.

The first principle is 'unclosed logical chains'. Any process may be described as a single stream with many branches often crossing each other. However, we can present an opposite approach. There are a number of streams and every such stream is a sequence of

actions executing only while the current situation strictly satisfies some crucial conditions. When the situation is changed another stream may begin running, and so on. In other words, we consider a process as a group of streams, and each of them describes one possible way the process will work. Several streams may work together simultaneously. They may cover all the process or only part of it. Thus we have a process similar to the traditional one but one with an open structure.

By varying its contents, by adding or removing different streams, it is easy to modify the process logic without the need to change any program code.

The second principle is 'wholeness'. We often forget that an object is not simply a structure encapsulating data and functions. It has to be united, to

work as a single body. Hence, it must have a parameter characterising its total state. Any changes to that parameter must immediately change the work of the object methods. The method logic connects directly with the object's state and always satisfies the current situation. We can easily co-ordinate the work of several objects so that they will work as a single body.

By combining these principles we can make a system very flexible and expandable. The process of program creation becomes much easier, even if we develop it step-by-step from a simple system to a very complicated one. There is no need to foresee everything which will happen with the program. We always work with concrete situations. And if an unexpected situation should arise then the system

will make no wrong steps. For that reason, we always describe behaviour of the concrete object in a concrete situation, paying no attention to other possible moments. We can reach a high degree of complexity while still working with simple elements.

These principles may also be applied to technologies which build systems from standard blocks. Such a block may be modified, without changing existing code.

Such open systems may become very attractive to software developers. They are able to meet any customer demands and satisfy any computer configuration. All programs may be so closely integrated with each other that they really become a single system on the computer.
*Alex Rakov, Programmer
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DPR, run by Rick Spence, is a training, consulting, and development company with offices in St. Augustine, FL, and Painswick, UK. We specialize in teaching programmers how to develop database applications, and in developing applications for other companies. Our motto is "Programmers Teaching Programmers". We're programmers ourselves, and we only teach programming.

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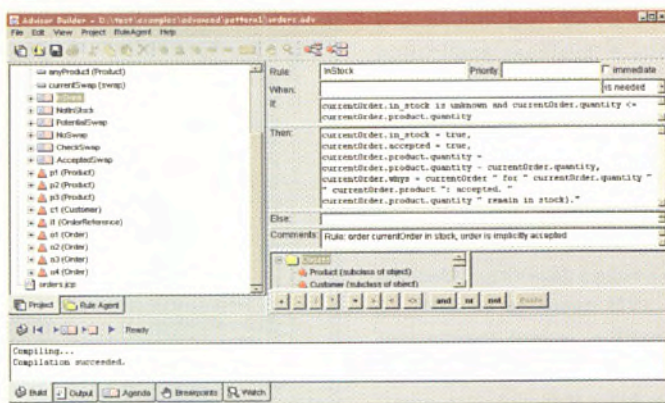
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An engine for Java business rules

Advisor 2 is a 100 % Java rules-based engine and development platform, which fully supports the JavaBeans component architecture. It is one member of Neuron Data's Elements for Java, a component framework for creating rules-driven Java applications. It is targeted at assisted-service or self-service, web-enabled, applications. Or wherever business rules are subject to frequent change.

Elements Advisor 2 contains Advisor Builder and Advisor Engine. Advisor Builder is the business rules development environment, enabling developers to compile, debug, and model business objects and processes automatically. The business rules are expressed in an English-like syntax ('if...then...and do...or else...') and there are wizards to integrate business rules with objects, data, and transactions. Existing Java classes to be imported, for incorporation, should follow the JavaBeans conventions for data access methods.

Advisor Engine is the Java business rules 'kernel'. It can be deployed on the server or client side to implement local or global busi-



ness rules within an application. There is support for multi-threaded environments. It allows for both goal-driven processing ('is this a valid customer?') and data-driven processing ('at this value, buy or sell?') to simplify the definition of rules for more complex behaviour such as diagnostics and fraud detection.

The two key features are the separation of business logic from application logic and the advantages of a Java implementation itself. A selling point is that, in theory, 'maintenance' is done by business analysts, as opposed to monolithic applications resisting the incorporation of new criteria.

There is full Java functionality with support for server-side Corba services as well as client side applets. For portability, it is available for any platform with a JVM.

Advisor's Open Object Model supports integration with application products such as SAP and Peoplesoft, and with development environments such as Visual Basic.

A full, time-bombed, version of Advisor 2 can be downloaded from the Neuron Data web site. For a limited period Starter Packs are available, for £25000, which include training and consultancy and one year's support.

www.neurondata.com

InstallShield 5.1 Professional enables developers to compile scripts and build distribution media from the command line, or batch file – independent of the IDE. Templates for use of **ODBC**, DAO, RDO, MFC, OLE DB, and ADO, among others, have been added. www.installshield.com

US Software has created another add-on module, Internet Access Package (**IAP**), for its real-time embedded USNET TCP/IP protocol stack. The module enables communication from mainframes or PCs to **embedded** devices on factory floors or in remote field sites.

www.hitex.co.uk

HomeSite 3.0, the HTML editor from **Allaire**, is to be bundled with NetObjects **Fusion 3.0**, the web authoring tool from NetObjects. It creates a complementary web site building package: the flexibility of working directly with **HTML** and the benefits of a site-oriented graphical authoring environment. www.unipalm.co.uk

Two into one goes faster

Btrieve Pro 7, an embeddable database, is designed to provide 'best of both worlds' transactional and relational data access from a shared engine. Its architecture enables packaged client/server applications to access a single database engine with the speed of navigational databases and the flexibility of **SQL**. It integrates the underlying architecture of Pervasive's **B**trieve and **Scalable SQL** products and contains features to provide increased performance with easier installation and maintenance.

It is claimed that new logging technology and microkernel thread management combined with platform specific optimisation increase Btrieve Pro 7's performance up to 10 times over previous generation Pervasive products.

InstallScout is a new installation utility which scans new installation environments for potential configuration issues and guides the user through diagnostic and set-up procedures. A help desk feature guides end-users through typical maintenance issues such as adding clients to the server or installing applications.

Configuration and monitoring utilities can be used remotely. With features such as dynamic file expansion, automatic index balancing, and continuous operation **Btrieve Pro 7** seeks to eliminate the need for a dedicated database administrator.

www.pervasive.com

Rogue Wave strong on MFC

RogueWave is to acquire Stingray. RogueWave's multi-platform experience will benefit from Stingray's knowledge of MFC. For client platforms the companies will work specifically on ActiveX and MFC, and on the server platforms, ASP, MFC and ATL will be introduced into most products. RogueWave is equally committed to Java and C++. Obvious products for integration, such as ObjectGrid support for dBTools.h++, should be the first to appear after the acquisition.

Other projects include Pathfinder, a multiplatform development environment with a very thin client (about 40 KB). This should be shipping in June.

www.roquewave.com

The **Distinct ONC RPC/XDR** Toolkit 3.0 provides a client/server programming environment allowing developers to build applications that execute procedures on other **network** computers. It includes support for an External Data Representation (**XDR**) standard used for data transmission.

www.componentsource.com

ISO has adopted the joint proposal of **Apple**, IBM, Netscape, Oracle, and others to use Apple's **QuickTime** file format as the starting point for the development of a unified digital media storage format for the **MPEG-4** specification
www.apple.com

All singing, all dancing

Release 1 of the **PINEAPL** (Parallel Industrial NumErical Applications and Portable Libraries) Numerical Software Library is available. The library, from **NAG** Ltd is targeted at engineers, scientists, and financial analysts with large scale computing applications.
www.nag.co.uk

SELECT Estimator is an addition to **SELECT Software Tools'** Component Factory product line. It enables project managers to estimate the scale and complexity of **CBD** (component-based development) projects, when used with **SELECT's** component modelling toolset, **SELECT Enterprise**.
www.selectst.com

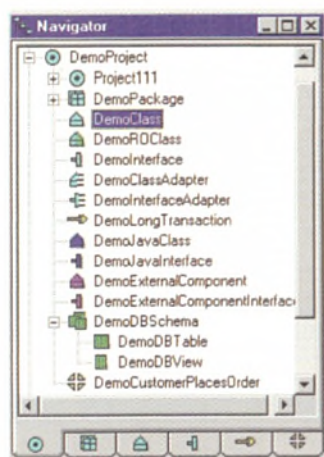
ACIS 3D Open Viewer 3.0 embeds 3D models into Office97 documents and **HTML** pages. The ActiveX control can load and manipulate 3D models created in applications supporting the ACIS SAT file format.
www.spatial.com

To expedite the development of Solaris-on-Intel applications **Sun** has released a **Solaris Development Kit** for Intel. This follows the recent agreement between Sun and **Intel** to port the Solaris operating system to Intel's **Merced** processor.
www.sun.co.uk

IAR Systems support the National Semiconductor **CompactRISC** embedded processor family with the **IAR Embedded Workbench**. The Windows based development environment includes an optimised **ANSI C** compiler for the 16- and 32-bit RISC architectures
sales@iarsys.co.uk

Software AG has announced **Bolero**, a 'business application factory'. At this stage it is only an announcement as you'll have to wait until October to get the product. The object-oriented development platform will run on NT and the application server on any platform having a Java Virtual Machine (the JVM needs to be JDK 1.2 compatible, ie not the current Microsoft one).

Dr Peter Mossack, vice-president of Research and Development, explained that Java means three things: a component model, a language, and a platform. **Bolero** is based on Java as a development platform only. Though **Bolero** applications compile into Java byte-code, if and when you have to write code in the environment you do not write Java code. It uses the **Bolero** language which is sort of a crossover between Java and **Software AG's** **Natural 4GL**. It's more verbose than Java and more high-level. For instance, it supports a



currency type, which allows for easy currency conversions. One nice feature is the support of **OQL** (a subset of **SQL3**), this means that **SQL** queries can be checked at compile time, as opposed to embedding **JDBC** queries in text strings in Java. The language supports calls of Java class libraries.

Bolero is aimed at e-commerce

applications and includes specific features for this. One of the main ones is long transactions. For instance if an email order is later cancelled, you can't just rollback a database, you have to send an email back to the customer. This is done automatically by what is termed 'compensation'.

Distributed applications will be possible with **DCOM**. **JavaBeans** and **RMI** will be there as well. **IIOP** will only be featured in the second version planned six months later, however in the meantime developers could use **Software AG's** middleware **EntireX DCOM** which creates **DCOM** wrappers for Unix and mainframe applications. Dr Peter Mossack is convinced that **DCOM** has won over **Corba** as the de facto standard for distributed objects.

The development environment will have a cost of \$5,000 per developer seat. The cost of the application server has not yet been decided.

www.softwareag.co.uk

CommX for Win32

Greenleaf Software will begin shipping **CommX**, an ActiveX control to support PC based **RS-232** asynchronous communications. It is for developers working in **C/C++**, **Visual Basic**, **Visual C++**, **Delphi**, or other development environments compatible with **ActiveX** technology.

CommX features include support for standard **COM** ports for **Windows 95**, **98**, and **NT**; port controls, call connection and disconnection, **TTY** and **ANSI** terminal emulations, and several file transfer protocols; file transfer template dialogs; and exposed base component interfaces to allow customisation by developers who want to modify a built-in file transfer protocol.

The suggested retail price for the **Greenleaf CommX Control** is £199. The component is distributed by **Silicon River**.

[0181 317 7777](tel:0181317777)

Write once secure anywhere

For e-commerce security, **J/SSL** is a secure communications toolkit written in 100% pure Java by **Baltimore Technologies**. The toolkit was built using **Baltimore's** Java cryptographic class library, **J/Crypto**.

J/SSL provides a full implementation of **Secure Sockets Layer (SSL) 3.0** which addresses the requirements for secure transactions, being designed to provide a guarantee of confidentiality and data integrity. **SSL** is implemented in practically all Internet browsers.

Because **J/SSL** is built on top of **JCA** (**Java Cryptography Architecture**), other cryptographic libraries, which are **JCE** compliant (**Java Cryptography Extension**), can be plugged in as the cryptography provider for **J/SSL**.

An **API** is provided, including an **SSLSocket** class that creates a secure, authenticated connection to any **SSL Server/Client**. This **SSLSocket** exchanges certificates and allows the application developer to open input/output streams which can be written and read from any normal Java i/o streams.

As **J/SSL** is written in Ireland it is not subject to **US** export restrictions and therefore provides full 128-bit encryption. **PKCS#10** certificate requests can be generated using **J/SSL** which can then be submitted to a Certification Authority.

J/SSL is compatible with **JDK 1.0.2**, as well as **1.1**: it can be used to build applets for older browsers, including **Netscape 3.0** and **IE 3.0**, as well as the latest generation.

www.baltimore.ie

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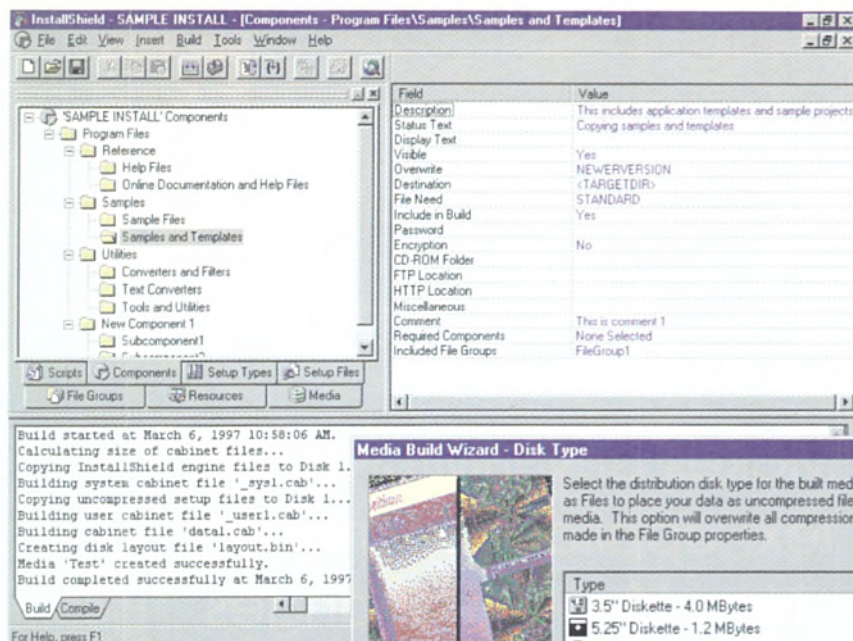
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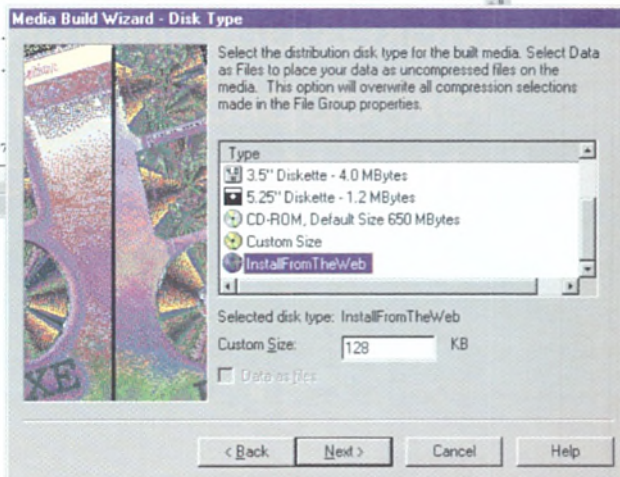
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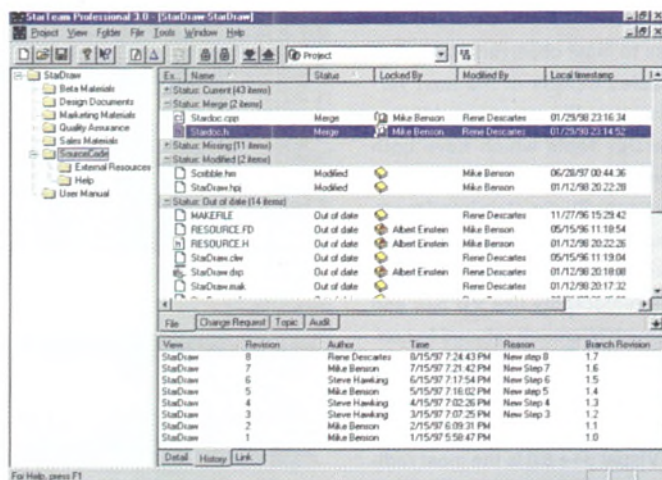
InstallShield is a registered trademark of InstallShield Corporation.

Configuration written in the stars

The StarTeam 3.0 suite of software configuration and project management tools, from StarBase, enable development teams working on Windows 95, NT, or Unix to work together, remotely.

The StarTeam Professional 3.0 edition provides visual configuration management, collaborative communication, proactive change management, and customisable reporting as integrated components of the visual interface. There is full licensed support for Intersolv PVCS archives within the StarTeam repository and compatibility with Visual SourceSafe to incorporate these products within additional StarTeam functionality.

Project administration, including user management and security features, is provided by VirtualTeam Server 3.0. It can use any ODBC compliant DBMS and provides remote access to the central repos-



itory of projects over the Internet, LAN, or WAN.

Both data encryption and compression of data transfers are provided for remote StarTeam client access (no applets or plug-ins are required). Only lines of code that have been altered are transferred to

the server, for optimal performance. The web browser interface enables team members to access StarTeam projects from most platforms.

StarTeam Professional 3.0 costs £345 and StarTeam VirtualTeam Server 3.0 £850.

www.contemporary.co.uk

UI toolkit updated

Version 2.0 of the ActiveX Component Suite, from ProtoView, contains new versions for the three individual Suite products: Data Explorer v2.0, DataTable v4.0, and the WinX Component Library v2.0.

Data Explorer v2.0 extends its existing explorer metaphor. Previously it was limited to a ListView (with pop-up Text View) for the right-hand pane, while now it can allow any ActiveX component or form to be displayed in the right-hand viewer pane. Features to enhance the ListView include discrete sets of Column Headers per node, gridlines, and drag and drop for Column Headers. For drag and drop capabilities, the copying and pasting of simple text to the Windows clipboard has been added, and data can be pulled into Excel or Word with a mouse drag.

The DataTable v4.0 supports additional data sources. With compatibility with Microsoft's RDS (ADC) as well as RDO & RDC it can integrate with ASP/HTML Intranet applications. Data and configuration can be written and read from disk.

The WinX Component Library v2.0 focuses on browser-based applications. The TreeView, all of the input components (MaskEdit, Time, Currency, Numeric Edit, and Data Edit) and select display controls (Picture, Marquee, and Text) have data-binding properties. They have CAB file support, for faster delivery over LAN/WAN or TCP/IP connections, and Apartment Model Threading for tighter integration with Microsoft IE 4.0.

The ActiveX Component Suite retails at £249 (upgrade £99). Data Explorer 2.0, DataTable 4.0, and WinX Component Library are available individually for £135 (upgrade £75).

Free trial versions of all ProtoView ActiveX and JavaBeans components are downloadable from the web.

www.protoview.com web site t 01903 538058

Stored Java

Apptivity is made up of an application server written in Pure Java (it's a 'value added Java server') and a database-oriented development environment which runs on Windows 95 and NT. Version 2.0 has recently been made available. It features a cross platform distributed debugger. Applications can access data via JDBC and ODBC.

Dennis Moore, vice-president of Apptivity, views Java as clearly belonging to the server and not to the client. He sees Java as a strong contender for a standard for stored procedures: 'within a year Java will be standard in all databases apart from SQL Server'.

Progress plans to move its main products – Apptivity, Progress, and WebSped – to a 'Universal Application Architecture' model. The goal is to provide access to any application by any client and connect to any data source. The move starting this year should be completed in 1999. The last step will be the delivery of a Corba-based open application server.

www.progress.com

A Graduate grade of membership has been introduced by the Institution of Analysts and Programmers (IAP). It will be available for graduates from an IAP-approved course of formal study and examination.

0181 5672118

The ASNA Visual Basic Wizard helps provide record-level access to AS/400 databases. The wizard takes as input DB2/400 files (through ASNA DataGate) and generates VB source for either a class or an ActiveX control.

www.asna.com

Microsoft has released Internet Explorer 4.0 for Sun Solaris 2.5 and newer versions of the Solaris Unix platform. Features that have been added since the Platform Preview version include AutoComplete for the faster entry of URLs and support for Active Channel content.

www.microsoft.com

Enhancements to Sterling Software's COOL:Gen, the component-based development environment, enable the automatic generation of interfaces that conform to Sun's JavaBeans component architecture and Microsoft's Component Object Model (COM).

www.sterling.co.uk

Embarcadero's Rapid SQL 4.0 features an 'unlimited SQL workspace' concept. Developers of cross-platform database applications can set up virtual desktops which can include windows for multiple SQL scripts, result sets, and object browsers for each database. It includes an enhanced SQL editor, increased flexibility for result-set handling, and SQL script step execution.

www.winsoft.co.uk

Microsoft abandons trad for RAD

The **Cyberprise** strategy, announced by **Wall Data**, is designed to enable companies to make their existing systems **web-enabled**, to extend those systems to remote users, customers, or vendors. The Cyberprise product line will be available in the first quarter of 1998. www.cyberprise.com

ILOG Planner 2.2, an enhanced version of the **ILOG Solver** add-on used to build planning and scheduling applications, is a C++ class library to solve planning problems involving a mix of linear and **logical constraints** and conflicting preferences and objectives. It runs on Windows 95, NT and Unix. www.ilog.fr

Netron Connectivity Framework is an **application framework** for building client/server systems. It enables mainframe and Unix servers to integrate with front-end clients built with Sun's **Java** and **Visual Basic**. The framework is available in the new release of **Netron Fusion 3.2** for Windows NT. www.netron.com

Stingray Software is shipping **Objective Toolkit/X**, a docking form for **Visual Basic**. The two elements of the toolkit are **Docking Forms**, enabling the developer to dock or float any MDI child, and **Collection/X** for the population and manipulation of object collections. www.stingray.com

After being petitioned, **SCO** has made source licenses available for most versions of PDP-11 **UNIX**, for personal, non-commercial use. The licence costs \$100 and covers research Editions 1 to 7 and 32V. www.sco.com

In a move which came as little surprise to most observers, Microsoft revealed details of the next versions of its Visual J++ and Visual InterDev tools which have both moved away from the code-oriented Developer Studio-style interface to a much more Visual Basic-like RAD interface. Both of the products now look remarkably like VB 5.0, and although Microsoft refused to confirm that a similar transformation would be applied to Visual C++, it seems likely that it will.

Visual J++ 6.0 is the most radically transformed of the two products. Microsoft has abandoned any pretence that it has the same Java strategy as Sun, with a tool that specialises in producing native code Windows applications, reducing Java to the status of just another development language. VJ++ 6.0 includes the Windows Foundation Classes, a set of MFC-like Java classes encapsulating the Win32 API, and the IE4-style DHTML and HTML object APIs.

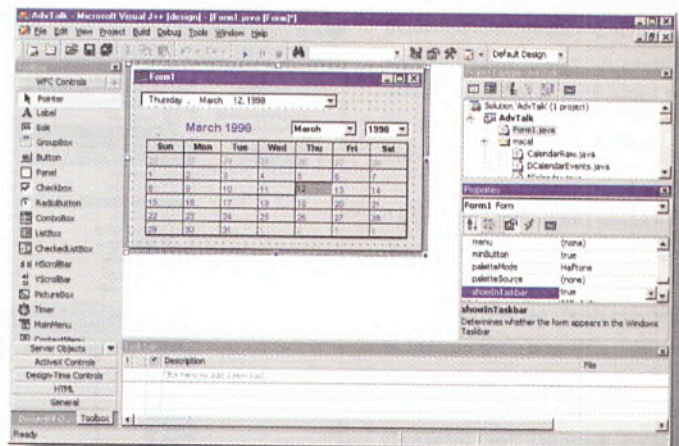
Software broadcasting

Computer screens emit stray electromagnetic radiation. With some form of receiver (a modified TV set) it is possible from a distance to reproduce what's on your screen. The only solution against it, so far, has been to completely shield the computer and the room in which it is used. Expensive stuff reserved for the military.

Markus Kuhn and Ross Anderson from the Computer Laboratory at Cambridge University have just found a way to broadcast a different message to any potential eavesdroppers.

The purely software project started at the request of Microsoft, but the company has decided not to use the result of Kuhn and Anderson's work. You can find more in a fascinating paper on their web site.

www.cl.cam.ac.uk/~mgk25/ih98-tempest.pdf



WFC was developed for Microsoft by ex-Delphi architect Anders Hejlsberg. Although developers can build traditional JDK 1.1 JVM-hosted Java applications, most of the enhancements seem to be concentrated on the native Windows side of things. JDK 1.2 support will not be forthcoming unless the current lawsuit with Sun is settled amicably – which appears increasingly unlikely.

Visual InterDev, meanwhile, gets a facelift, with a FrontPage 98-like visual editor and extensive autogeneration facilities for ASP and DHTML code.

The Visual J++ 6.0 beta is available for download from Microsoft's Web site (if you have a fast enough connection – it's huge), while the InterDev beta should be available soon.

www.microsoft.com

Live Database Pages for web authoring tool

A series of database enhancements to **HotMetal PRO 4.0** will be available to current 4.0 users as a free download, and they will be integrated into the next version of the product.

The upgrade features **Live Database Pages (LDP)**, which use **DHTML** and **XML** for database access to improve ease of use and to provide full control over data formatting. LDPs enable web authors to create forms that allow site visitors to enter data, create queries that return data as a table or a single record, and create and manage databases. For example, the creation of guest books or diaries of events. Authors can choose to have queries returned in a number of formats, including **XML**, **HTML**, or as a spreadsheet. Site visitors with **IE4.0** will be able to take advantage of **DHTML** to customise the display of data – filtering, sorting, and charting – without having to return to the server.

Users work with LDPs through the **HotMetal FX Chooser** library, which has been expanded to include database objects. Once the database objects have been dropped in from the library, the **Live Database Page** can be customised to conform to the overall look and feel of the site.

The LDP upgrade contains a built-in database engine and server-side middleware, or it can be used with any **ODBC**-compliant databases via **Microsoft Active Server Pages**.

Version 4.0 of **HotMetal PRO** is available for Windows 95 and NT 4.0, priced at £99.00 (upgrades £49.00).

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Given that it's a programmer's magazine, you'd expect that most of the adverts in EXE would be for development tools. Over the years the nature of the tools has changed, from procedure libraries ten years ago, through class libraries, to component libraries now.

But one class of advert has stayed resolutely the same, introducing no new buzzwords or abstractions for years. Dongles. Judging from the number of adverts, you'd think that protecting their creations was the biggest problem programmers face after getting their code written. The marketplace doesn't seem to share this problem though, and fewer commercial programs are using dongle protection.

There is a reason for that. Partly it's because mainstream software isn't worth anything any more. It's fiercely expensive to write, and relies on the widest possible distribution to break even. The last thing a modern, mainstream software publisher wants to do is *restrict* circulation. Instead, he'll give his work away for little more than the cost of duplication, and use the exposure he gets to try to get a bundle deal with a box shifter which will get him a 2% profit margin. He has no support costs, and the value of the program is determined by the number of (accessible) features. Niche software, of course, doesn't work in the same way. There, the software does have value, and that value is determined not by the facilities the program provides (generally, it either does the job or it doesn't), but by the size of the market (which is often very limited) and the support effort required (which is frequently considerable).

Looking at these two examples, it seems to me that information (whether a program, or some other data) comes in two very different kinds, depending on how it acquires its value. Type A is the kind whose value is

Developing dongles

Users hate them, programmers don't like them, and they don't work too well in any case. Jules wonders about dongles.

diminished the more it moves around (that's information like industrial secrets, private keys, or work in progress). Type B is the kind whose value is increased the more it moves around (that's information like music, horizontal market programs, and advertising). Naturally, someone owns all data whichever the type (and normally the owner would wish to derive some benefit from the reproduction of that data) but it seems to me that these two need different kinds of protection. As the data originators and suppliers become more sophisticated about their market, the dongle companies don't seem to be keeping up.

In principle a hardware device with a number hidden inside it can provide protection as good as the secrecy of the hidden number, but in order to take advantage of that protection you have to know a fair bit about cryptography. Most programmers don't. Instead, they do no more than make a periodic call to a routine which interrogates the dongle. A routine which has been provided by the dongle manufacturer and contains all the magic numbers, and which even an amateur hacker can bypass in ten seconds flat.

It's a shame that this technology is being under-used, because no other copy-protection scheme gives the user the opportunity to take unlimited backup copies, but the fault lies as much with the programmers as with the dongle manufacturers. I guess it's understandable that someone

investing man years into a program values it disproportionately, but the user values the program hardly at all. He knows he doesn't own the only copy of the program, so he regards all software as being type B. In fact, he's right that a vertical market program derives its value from its support, not from its code, and even a vertical market program needs wide exposure to be accepted. Protecting a program is pointless. It's also lousy public relations. Imagine telling a customer to his face that you don't trust him, and that's why he has to put up with the inconvenience of a dongle (and the risk that it will be stolen). Dongle protection of programs is a disincentive to buy.

There is another, more subtle disincentive. Given the difference in 'finish' between vertical market and horizontal market software, the price of paid-for software seems excessive to the point of mickey-take to many users. Users are fearful of committing many hundreds or thousands of pounds on a program which may be unusable or unreliable. They have become used to test-driving cars and trying on clothes, and want the same from software.

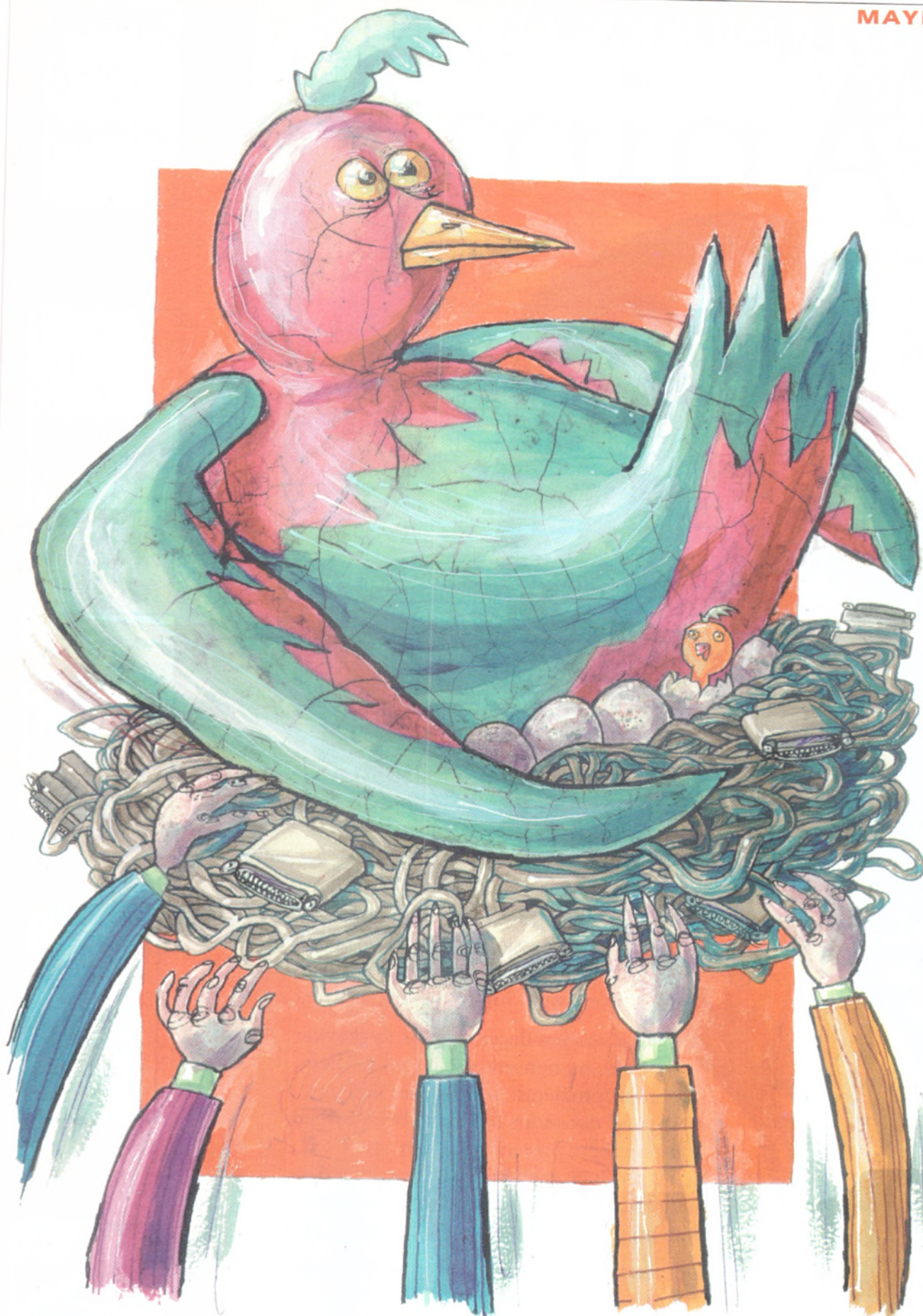
In contrast, users will take anything free, and will use anything useful. I remember playing a game where, after a few levels and just as I was getting into the character, the program stopped, saved the game, and told me that if I wanted to go any further I had to pay for a kosher copy. I did, right away. I remember a help

authoring tool which worked completely, but would contain just enough primitives for its own help system if you wanted more, you had to pay for it. I did. (I remember a lot of other software which tried the same trick, but because either the demo was inconclusive, or the software was simply grotty, I didn't pay.) The stuff I bought was good stuff, and I didn't mind paying because I knew exactly what I was getting.

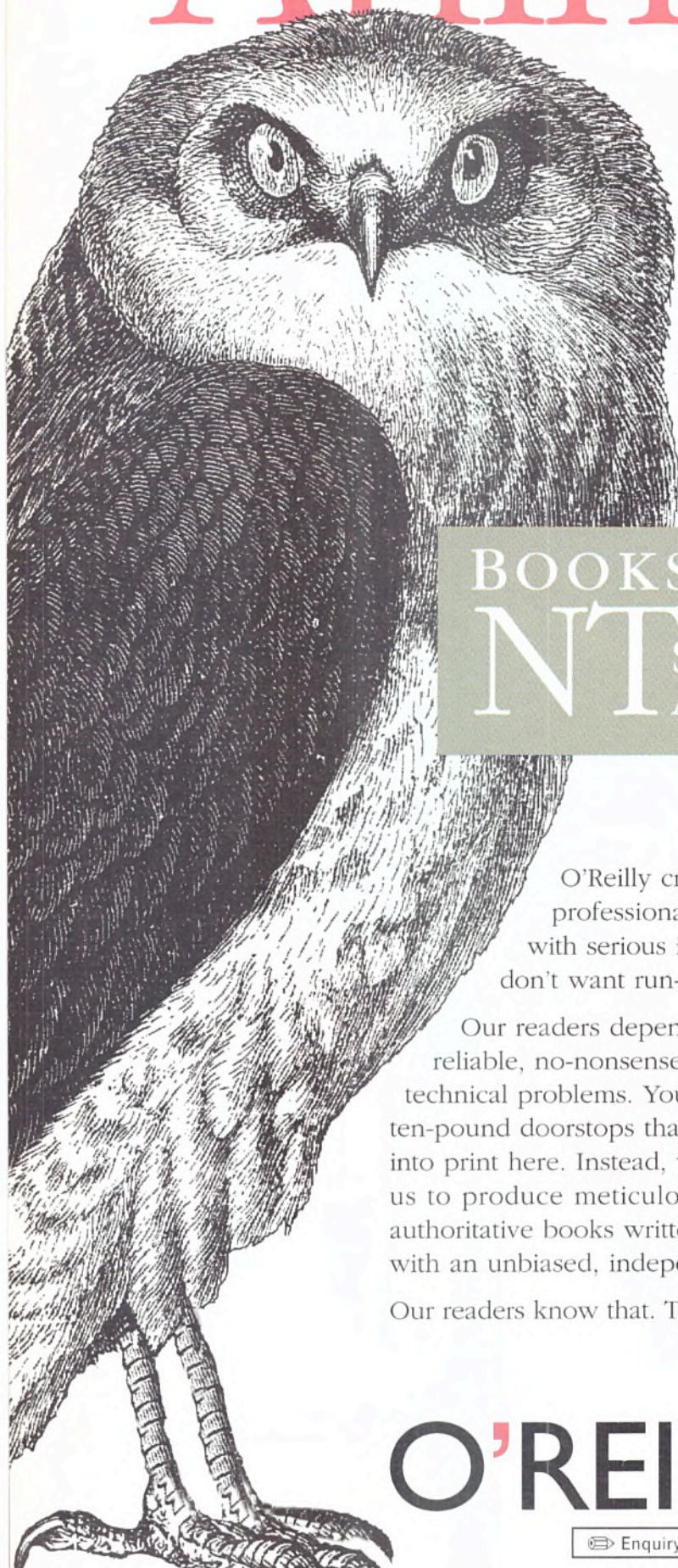
If you think your software is any good, and you want the public at large to know how good it is, give it to them free. If they like it enough, make a charge for support, or for enabling more program features, or enabling the same features at a larger scale. Dongles can help manage this support, and can actually provide very fine-grained access to facilities.

More important, though, is that if you're going to use a dongle, don't make the deal one-sided. Give the user some benefit. Use the dongle to provide encryption of the user's own data (which, if you think about it, is all type A, unless and until it graduates). That way, the dongle represents a real advantage to users and because each user can choose whether to use the dongle or not, and even when to use it, he won't resent having it. ■

Jules' office is littered with dongles in various states of undress. If you have a use for cracked security products, call him on 01707 662698, or email him at jules@cix.co.uk



A DIFFERENT KIND of Animal



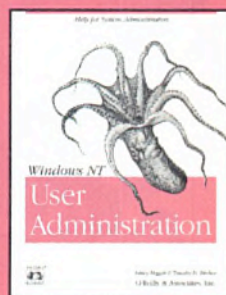
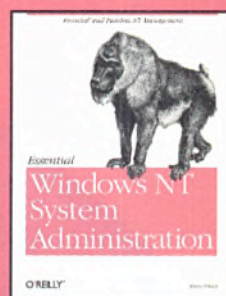
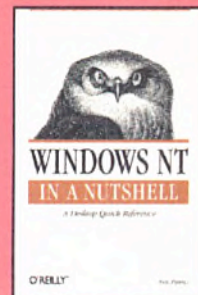
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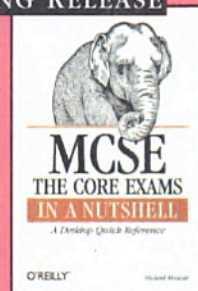
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SPRING RELEASE



What are you really worth?

How much are you paid? What language do you use? How many years have you been in software development? Here's the chance to compare yourself to your peers.

For the first time in its history EXE has surveyed developers on questions related to salary. The survey form was sent with the January and February issue. In addition the Association of C & C++ Users (ACCU), the UK Borland User Group (BUG), and QBS distributed some surveys. The first result is an astounding 316 replies received by the end of February (we are still receiving a few). If only so many of you would send us that many letters regularly! This proves you have a genuine interest in the more global picture and how you fit into it.

For a start, let's shatter one common cliché: that people seek IT jobs for the money. Our survey suggests not. We asked 'is earning potential the main reason for working within IT?' Only 16% felt this was their main reason, an overwhelming 82% specified that it was not. However, the core issue regarding remuneration for work is often whether people feel they are getting what they *deserve*. It is a close run thing, a small majority (51%) feel their current salary does *not* accurately reflect their skills and abilities, while 47% are happy. (See Figure 1 for a related question.) Given human nature, this is perhaps a surprisingly high score of satisfaction. An important factor in such calculations can be whether a bonus is also received. In fact, only 30% do receive an annual bonus as part of their income, while 67% said they did not.

However salaries are increasing from year to year and expectations in three years time are high as can be witnessed in Figure 2. Even though, 2.5% of respondents experienced a decrease on the previous year.

Salary and language

We were pondering whether there is a correlation between languages used and salary (see Figures 2 and 4). Across the main languages (C, C++, VB, HTML, Delphi, Java, Assembly, and Perl) a definite characteristic of the spread of salary can be seen. There are two peaks and they reflect the general trends for the current salary as seen in Figure 2. For all languages, the salary range £23-26k has the highest representation. Having built to this peak, the number of people earning salaries in the range of £26k to £35k falls away – only to build steadily towards a second peak, culminating in the £50k+ range.

What are the exceptions to this distinct pattern? Visual Basic, Delphi, and HTML all experience an earlier (sub) peak in the £15-17k category, dropping into the £17-20k range. Delphi and Java do not climb progressively toward the high-end peak of representation: both drop off into £38-41k range before resuming their climb. However Delphi, again, actually peaks at the £41-50k range and is the only language whose representation falls for the final £50k+ category.

C and C++ are heavily represented in the peak areas of £23-26k and £50k+. While C has a greater representation than C++ in the first peak of salary in the £23-26k range (11.1% against 8.9%), C++ outscores C in the second peak of salary, for the £50k+ range (6.6% against 6.3%).

Is it time for a change?

You are experienced software developers! In response to the question 'how many years' have you been involved in software development?',

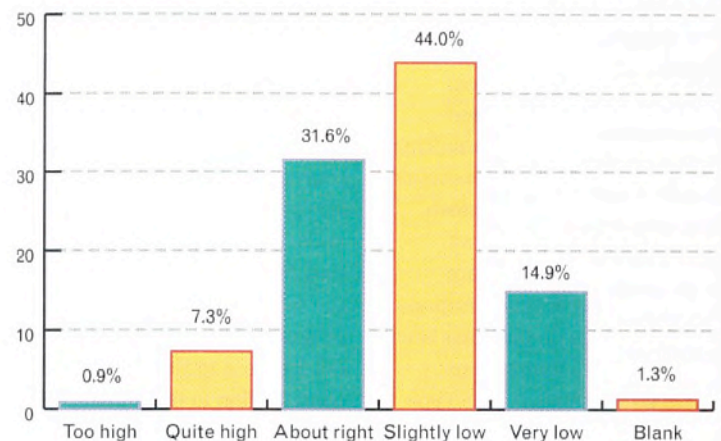


Figure 1 – You feel your current salary is...

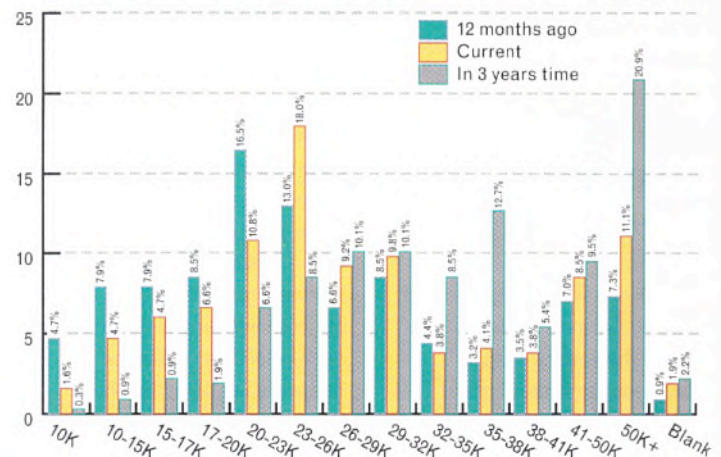


Figure 2 – Salaries (past, current and future).

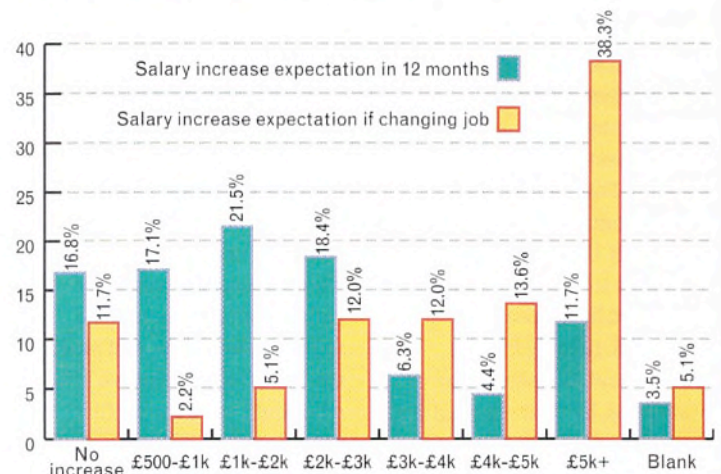


Figure 3 – Salary increase expectations.

nearly half (49%) had 10 or more years experience. The response is almost proportionately weighted towards length of experience, with 20% having 6 to 10 years experience, the second highest category, and 12% having 4 to 6 years. Developing software for less than one year accounted for only 2% of respondents. As (sadly) expected, 97% of respondents are men.

We asked about changing jobs: 'how long ago did you last change job?' We found a (surprisingly?) stable market: 24% had not changed for over 5 years and 16% were in the range of 3 to 5 years (13% had not changed jobs at all). More frequent changes were evenly spread among

the remaining categories: less than 6 months (10%), 6 months to a year (12%), 1 to 2 years (13%), and 2 to 3 years (11%).

For those who have changed jobs, we asked whether salary was the primary reason for changing. Again, overwhelmingly, the answer was no (70%), with only 17% specifying that salary was the reason for changing. The big question for this second group was 'how much did your salary increase?' Almost half (49%) had received an increase of £5k or more, which suggests a magic figure for prompting a move (13% specified £3-4k as the increase which made them move).

What was the primary reason for changing jobs then, if salary was not the primary criteria? Career development ('career change' or 'career development') was the main reason (33%). The role of location (14%) and the question of job satisfaction (13%) figured significantly. Redundancy accounted for 10% of responses. Not surprisingly low scores were registered by 'job security' (2%) and 'better working environment' (3%) – finding a rewarding job being the foremost priority for developers. See Figure 6.

The means that people would seek such a move were also queried. Recruitment consultants would be used by 65% of respondents and magazine or newspaper advertisements provide the relevant information to 57%. Word of mouth is followed by 30% and direct application to employers is a tactic employed by 30% as well.

Better the devil you know

How many years have you worked for your current employer? The highest category (22%) was 2-4 years. Next were those (21%) who had been with their current employer less than a year. Over a quarter (29%) had been with the same employer for 6 years or more (16% having stayed 10 years or more). Given the dynamic nature of the IT industry and marketplace, this again represents a perhaps surprising degree of stability. Obviously, developers progress within the same organisation and the question 'how many years have you held your current job title?' (see Table 1) revealed more change – 47% changing their title within 4 years (20% changed in 1 to 2 years). However, 11% had held the same title for 6 to 10 years, and 9% for over 10 years. Perhaps, technically skilled people are missing out on the progression available through a 'management' career path, becoming technical specialists rather than project managers.

Stability is also in evidence for the question 'do you foresee a long-term career with your current employer?' It is surprising that 55% of respondents said yes. Only 39% said no. An immediate comparison with the question about salary-reflecting-skills, suggests itself. As mentioned, under-half (47%) thought their current salary reflected their skills, but here, over half (55%) see a long-term career with that same employer.

For the bread and butter issues, we asked about the question of full-time/part-time employment: 90% of respondents were in full-time employment and over 50% had been for 10 or more years (5% had been for less than one year). Of those not in permanent, full-time employment, 11% were working part-time. On the question of self-employment, 76% of those not in permanent employment were self-employed. Almost 14% of respondents said they were not in full-time employment 12 months ago. It should be acknowledged that the general focus of our questions was towards permanent employment: some contactors did point out that for some questions there was no easy fit for themselves.

Strongly typed development

What sort of software is being produced by the respondents? For the different types of development, 64% are involved in bespoke software development, 20% work on system software, 18% are involved in pro-

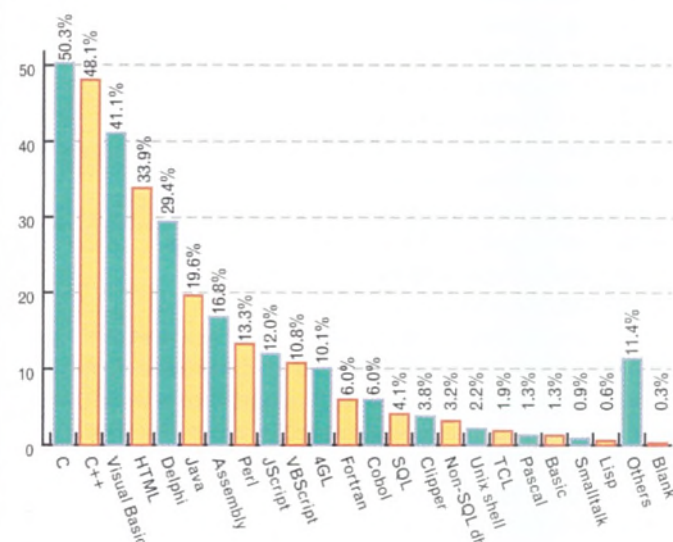


Figure 4 – Programming languages used at work.

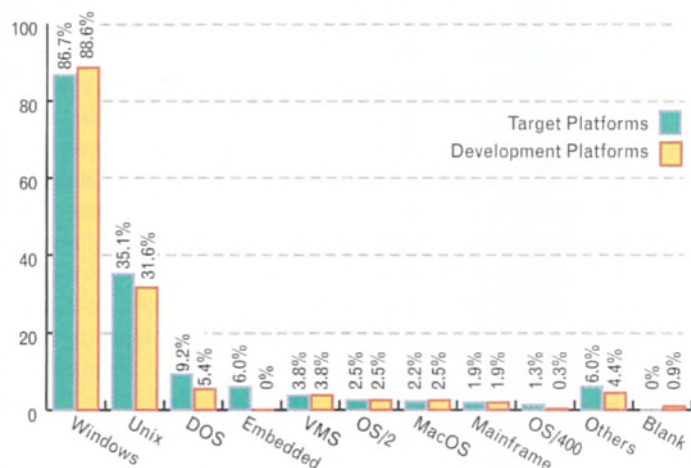


Figure 5 – Operating systems.

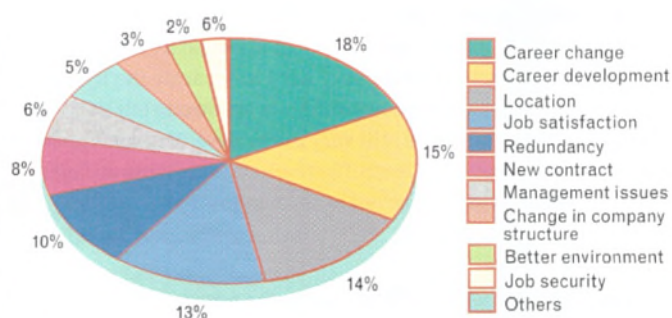


Figure 6 – Primary reason for changing job.

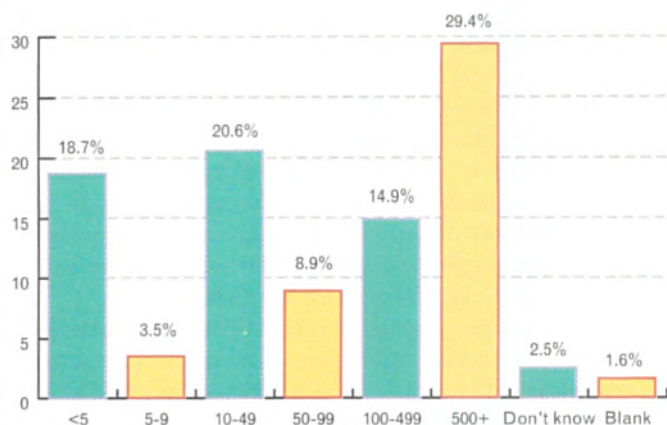


Figure 8 – Number of employees.

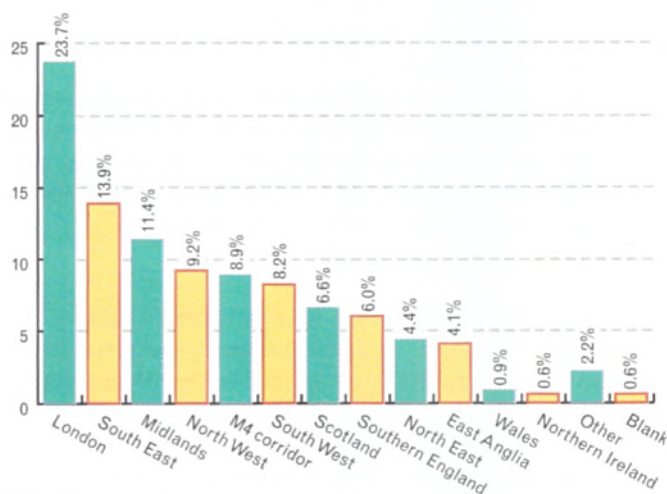


Figure 9 – Location.

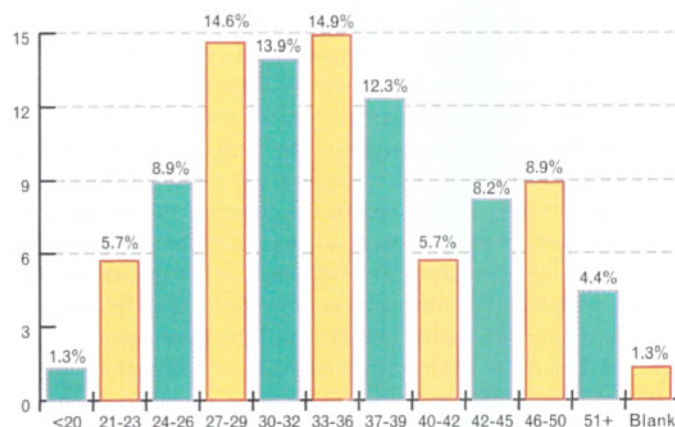


Figure 10 – Age range.

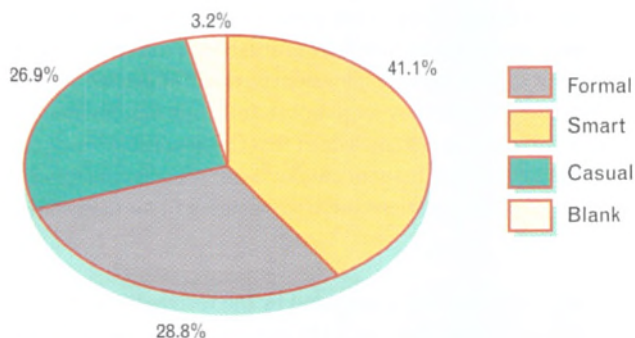


Figure 11 – All about dress sense.

ducing off-the-shelf packages, and 10% produce embedded software. Obviously, as the percentage totals indicate, some are involved in a mix of development work. A related question regarded the 'consumers' of the software. Users of the software produced are primarily 'in-house' for 36% of respondents and external for 63%.

Which department are you in? The largest department, as it were, is 'Development' (9%), with 'IT', 'R&D', and 'Software Development' next (6%, 6%, and 4% respectively). After 'Engineering', 'Software', and 'Technical Support' (all 2%), the remaining replies were spread evenly (only 1%).

Are you a member of any professional body or association? ACCU (18%) and BUG (7%) were first and third highest for responses. This seems to correspond to the spread of languages used at work: C or C++ being covered by 50% of respondents and Delphi by 29%. This was not the case for VBUG (1%) which does not score highly against the 41% who use Visual Basic at work. BCS was the second highest category (17%), with IEE (5%), IEEE (5%), and the Institute of Analysts & Programmers (3%) being the other main categories.

Working practices

On more general issues, flexi-time is part of the holy-grail for those seeking more enlightened working practices. We found that it is currently enjoyed by 23% of respondents. The 74% who do not, presumably, are still free to work any time they choose – as long as they start before 9am and leave after 5:30pm! That leaves the 3% who did not complete the answer, perhaps they are just *always* late for work and have to 'catch up later'. In a similar vein, we asked how people were expected to dress in the workplace (see Figure 11). Only 27% of respondents are allowed to dress 'casual' at work. The category most expected is 'smart' (41%), followed by 'formal' (29%). It should be noted that there is no correspondence between casual dress and flexi-time arrangements. Those who worked to a flexi-time arrangement covered, almost equally, the range of dress codes.

Jolt

This survey revealed quite a few surprises and confounded many clichés. To recap on a few salient points, you tend to be an experienced developer with preponderance towards C and C++ followed by Visual Basic and Delphi. Java features only in sixth position even after HTML (this is interesting as it's very hard to separate the hype from the reality). As expected Windows and Unix are strong but DOS, especially as a target platform, is still very much alive. The same goes for VMS. As to the archetype of a scruffy developer surviving on Jolt cola and pizza, well, that should go out of the window too!

Alun Williams & David Mery.

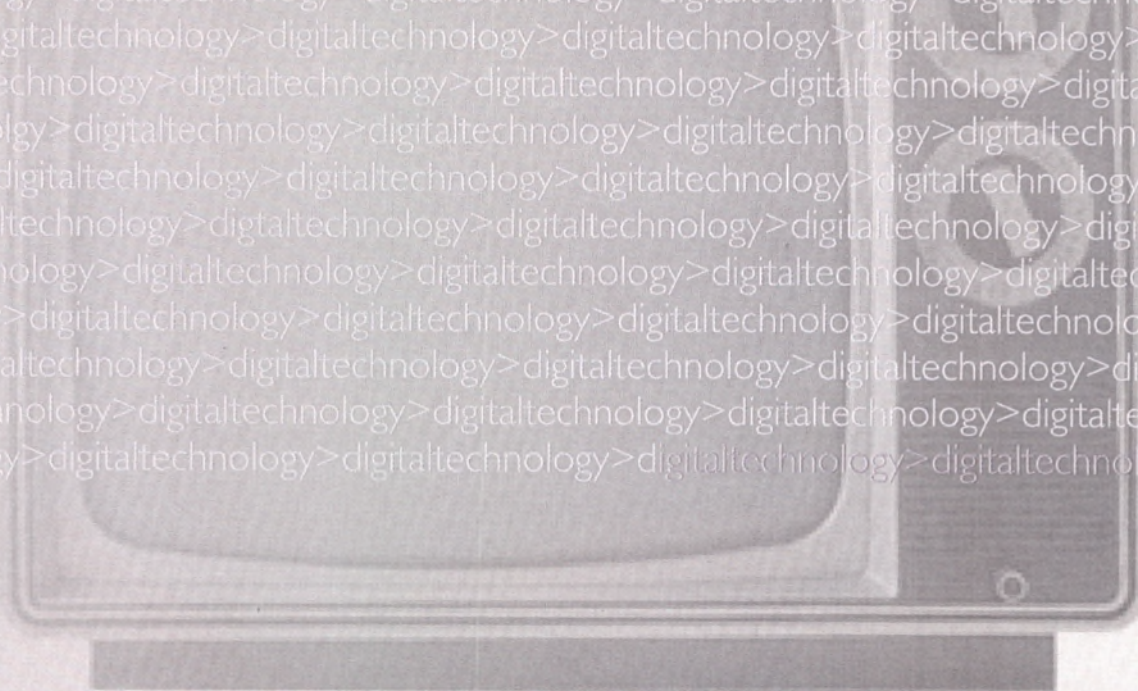
We would like to thank, in addition to all who responded, Francis Glassborow from ACCU, Joanna Pooley from BUG, Sky Quinn and Mike Paterson from QBS, and Ian Adams from Media Prospect.

Rank	Most Common Job Title
1	Software developer
2	Software engineer
3	Analyst/Programmer
4	Consultant
5	Technical director
6	Contract programmer
7	Database developer
8	Software architect
9	PC programmer
10	Information manager
11	Technical support
12	System analyst
13	System designer
14	Web developer
15	Project engineer

Table 1 – Job titles.

Delphi Developers

Page 71



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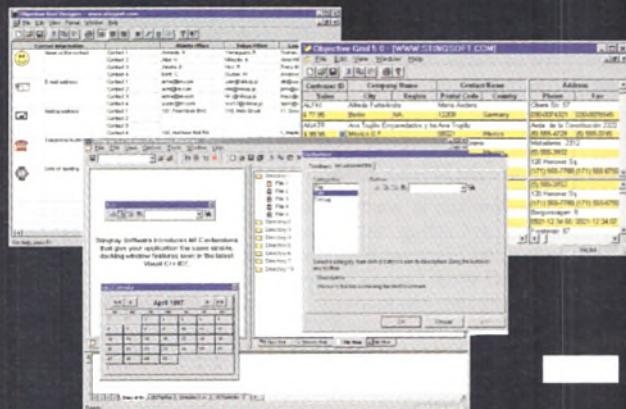
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C++ meets packages

Has Borland's RAD C++ environment finally caught up with Delphi? Dave Jewell reviews the latest Borland C++ Builder 3.0 (Beta).

Borland is committed to a new product release every quarter; you may be aware. This quarter, it's the turn of C++ Builder 3.0 and we understand that Delphi 4.0 is waiting in the wings for release later this year. In fact Zack Urlocker, one of the head honchos over in Scotts Valley, has even been heard muttering about Delphi 5.0 from time to time...

In this review, I take a look at a late beta (Borland call it a gamma) build of C++ Builder 3.0. I understand that the feature set is pretty much complete and that this build is representative of the functionality to be found in the shrink-wrap. At the time of writing, Borland UK has just announced the product – it should be available through the usual channels by the time you read these lines.

Start me up

In the past, I've noted the way in which Borland's C++ and Pascal development teams seem to be locked in a perpetual game of 'catch me if you can', with Delphi normally blazing the trail of technological integration while C++ follows close behind. This, of course, is just as it should be. (What – me biased?) The primary aim of C++ Builder 3.0 is to bring the C++ development system to more or less the same level as Delphi 3.0. I say more or less, for reasons which will become clear during the course of the review.

When you fire up C++ Builder you'll see something like that shown in Figure 1. It looks a great deal like Delphi 3 and you'll see much the same set of components installed on the palette. However, there are a number of interesting differences, such as the enhanced Project Manager window which you can see lurking behind the code editor in the screenshot. The new Project Manager supports project groups (shades of Visual Basic 5) meaning that you can split up a complex system into a number of separately compiled subprojects, DLLs, and so forth. There are three different types of project file recognised by the IDE. These are .BPR for a simple project, .BPG for a project group, and .BPK for building a package. Each of these corresponds to a traditional makefile although it's obviously best to leave the IDE to handle the makefiles for you wherever possible.

As you can see from Figure 1, the Project Manager window now displays a project hierarchy. If you click a project node you can set options for that project independently of others in the group. You can add non-C++ components such as text files, to-do lists, or anything else you want. Personally, I think it's about time that Borland added integrated resource editing to its RAD IDEs. It would be rather nice

if you could add .BMP, .ICO, and other resource files to a project and edit them with a double-click. For years, Delphi programmers have been slumming it while Borland C++ programmers have enjoyed integrated resource editing. Now that C++ is going RAD, it's time for C++ developers to kiss goodbye to integrated resource editing too. Such is progress... While I'm at it, I think it's high time Borland added an HTML viewer to the IDE. After all, you can buy a very nice shareware HTML viewer component for *a lot* less money than Borland's got in the piggy bank. Come on guys, I know you can do it...

With a little insight...

Another addition to the C++ development system is Code Insight. Unfortunately, this is a somewhat stripped down version of what's available in Delphi. You can, for example, hold the mouse over a variable in the debugger and a small tool-tip window will show its current value. There is the same code template facility to be found in Delphi, whereby you can instantly add a skeletal `case` statement, `for` loop, or whatever to your code. These code templates can be edited according to taste, and custom

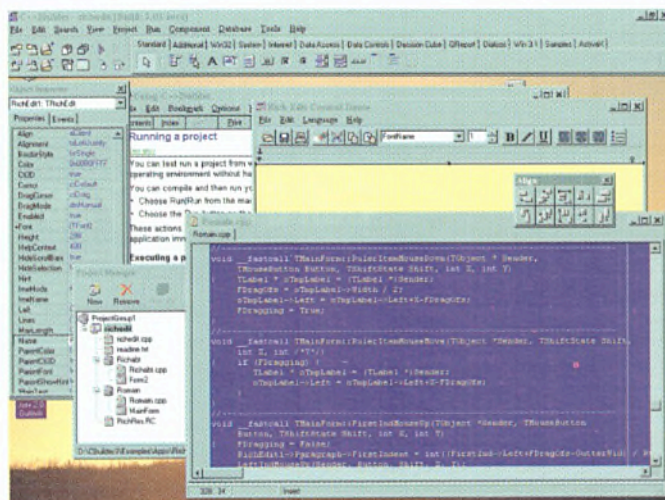


Figure 1 – Here's an unexpurgated view of the Full Monty! Note the Delphi 3 lookalike component palette with project build time displayed on the caption bar. The new, hierarchical project manager window is coyly peeking out from behind the code editor window.

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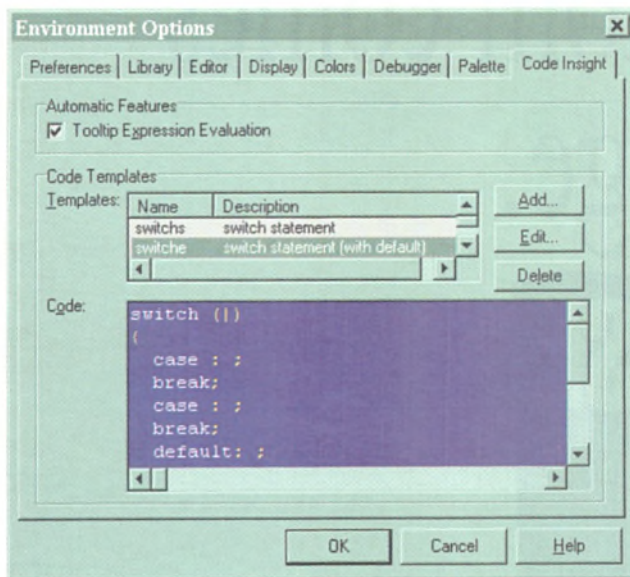


Figure 2—The Environment Options dialog sports a Code Insight page, although it's somewhat more sparsely populated than the Delphi 3 equivalent. Code Completion and Code Parameters are sorely missed...

templates can be added. But, oh dear, where are those delightful Code Completion and Code Parameters features? (If you're not too familiar with Delphi, Code Completion displays the available properties, methods, and events relating to some object when you type the period following the object name, whereas Code Parameters pops up a little window showing you each formal parameter's type as you key them in.)

Borland has made a number of changes to its linker technology in order to provide package support, and recommends that you should use the incremental linker for all new projects – if you're using the IDE, it happens automatically. Personally, I've always had something of a love/hate relationship with Borland and Microsoft's incremental linker technologies. On the one hand I love the way that incremental linking speeds up project build times but on the other hand I loathe the way in which linking even a simple 'Hello World' project can sometimes consume megabytes of disk space. Now and again I almost expect a splash screen to pop up: 'Incremental linking is brought to you by IBM, Quantum, Micropolis, and other fine hard disk manufacturers...'. What *do* they put in these monster disk files? Have these people never heard of sparse arrays and data compression?

Having had my rant, it has to be admitted that incremental linking is definitely worth having. On my shiny new 300 MHz Pentium II, you can edit the source code of a C++ Builder application, hit the Build button, and you're ready to run again in less than a second. In fact, C++ Builder displays the build time on the caption bar so I can tell you it's 0.88 seconds to be precise! I suspect that having 128 MB of RAM helps as well, since C++ Builder is fairly memory hungry. Borland recommends 32 MB of memory, which is probably on the low side – you'll need a lot more if you're running any Office97 applications alongside the IDE.

This fast build time eliminates one of my major gripes with C++ as a development system. I recently heard someone on Cix wishing that they had a faster C++ compiler because they often did a build of their project something like ten times a day. Ten times a day? Excuse me? If you're using Delphi, you can often build a decent-sized project

literally hundreds of times a day with minimal delay. With the new incremental linking in C++ Builder 3.0, C++ developers can use the same edit-test strategy without having to laboriously maintain a list of bug fixes and then test them one by one against the next build of the system. Okay, these arguments don't apply so much to team-based development, but I'm sure you understand what I'm getting at.

While on the subject of speedy project builds, I'd advise you to build your project using runtime packages during development, even if you don't plan to deploy it using packages. This reduces the size of the executable and thereby speeds up linking. Another trick is to check the 'Use Dynamic RTL' checkbox on the linker page of the Project Options dialog. This causes your project to dynamically link to a DLL-based version of the C/C++ runtime library, further reducing executable size.

TASM revisited

Turbo Assembler (TASM) makes a welcome return in this version of C++ Builder. Version 5.2b of TASM is included as a command line utility and is fully integrated into the IDE. You can add .ASM files to your project and there's a TASM-specific page on the Project Options dialog. From this page you can control assembler behaviour such as number of passes (useful for removing NOPs that have been inserted when forward-referencing symbols on the first pass), format of the output list file (if any), together with hash table capacity, maximum symbol length, and so forth.

Speaking of retro-tools, C++ Builder 3.0 includes a new wizard which you can use to import .RC and .DLG scripts into a C++ Builder project from a more traditional development system. The wizard will convert dialogs and menu definitions into the equivalent form and menu definitions within C++ Builder.

Another nice feature in C++ Builder 3.0 is the addition of dynamic functions, à la Delphi. This, let me quickly say, has got 'nowt to do with dynamic linking and DLLs. As you'll probably appreciate, when you define a class which uses virtual methods, each virtual method always occupies a slot in the VMT (virtual method table) of that class, and in the VMT of any derived classes. This makes for a fast dispatching mechanism, but

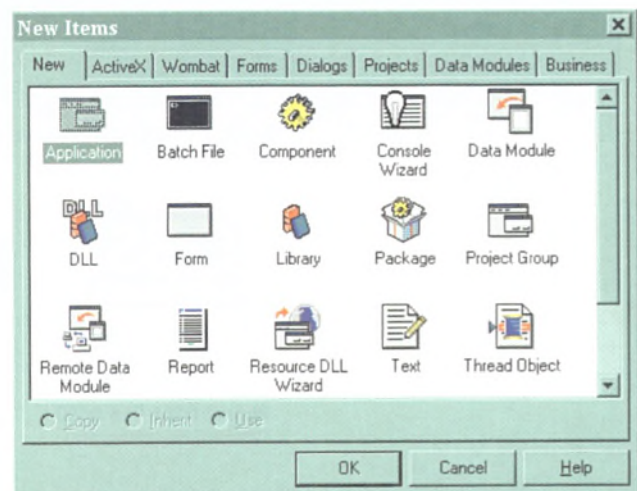
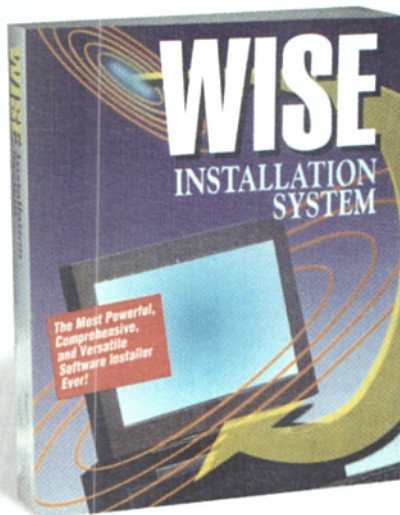


Figure 3—The New Items dialog has a variety of new goodies, including Project Group, Console Wizard, and Resource DLL Wizard. As you'll see from the dialog, it's possible to create library projects.

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Enquiry No. Ap13

in a complex class hierarchy with many methods defined for each object, it can waste a lot of space because of the number of large VMTs which are involved. Using dynamic functions, the VMT array is effectively sparse, and the function is internally identified by a number (within the RTL code – this identification mechanism is completely transparent to the programmer). The RTL dispatch code chases back through the chain of ancestors looking for the most recent declaration of the method and then calling it. Thus, you get a somewhat slower dispatching mechanism but smaller VMTs. Under C++ Builder, dynamic methods are only available in classes derived from TObject.

A new Debug Inspector window is available during debugging. Similar to the Object Inspector, this tabbed dialog has pages for Data, Methods, and Properties. It can be used to inspect local variables, and the implicit 'this' pointer. Imported VCL 'globals' such as Application can also be inspected.

Other goodies? Well, for my money one of the most important aspects of this release is the greatly improved online help. (Pause for rousing cheer.) The help files included with Delphi 1 weren't at all bad, those in Delphi 2 were unspeakably awful, and those in Delphi 3 were full of broken links. In fairness, the updated help files in 3.01 and 3.02 are *much* better, but Borland is still struggling to regain its former reputation in this area. The help files in C++ Builder 3.0 should go a long way towards doing that. While speaking of Help, C++ Builder 3.0 sees the debut of a new help system, OpenHelp, which makes it very much easier to customise the help system by adding and removing individual help components. Just as importantly, I noticed that when I installed C++ Builder on the same machine as Delphi 3, it spotted some existing Delphi 3 help files and used those rather than installing a duplicate copy from the CD. Good stuff!

There are other assorted additions to the development environment which bring it into line with Delphi 3. You get new ActiveX wizards for one-step ATL control creation and automation servers, new web deployment facilities with CAB support and code signing, and a set of advanced C++ compiler options which (among others) allow you to choose between Borland, Unix V, ANSI, and K&R language compliance. Lastly, on the compliance front, there is compatibility with the latest ANSI draft of RogueWave's standard template library.



C++ meets packages

Perhaps the most significant new 'catch-up' feature in C++ Builder 3.0 is the inclusion of package support. If you're a Delphi developer then you'll know that Delphi 3.0 allows you to create tiny executables by hiving off the VCL component library into one or more separate runtime package modules. Not only do you get very small EXE files, but project build times are much improved because there's far less code to link in. One of the most fascinating aspects of Delphi packages is the way in which the interface part of a unit automatically gets exported from a package without any need to manually export DLL entry points in the usual way. Creating DLLs has *always* been much easier with Borland Pascal than it was with C++, but the introduction of Delphi packages made the application-DLL barrier become completely transparent. Not only that, packages provide transparent export of important variables as well as code.

Well at long last, packages have come to C++. If you choose to use the optional package support in C++ Builder 3.0, most of the VCL library code used by your application will reside in a file called VCL35.BPL. (Yes folks, C++ Builder is running version 3.5 of the VCL library). This file is around 1.4 MB in the beta software reviewed here, but if that's too big for you then you can use something like Shrinker 3.2 to bring it down to a more manageable size. It's interesting to speculate on why Borland used an extension of BPL – Borland Package Library. Delphi 3.0 uses .DPL files as an abbreviation for Delphi Pack-

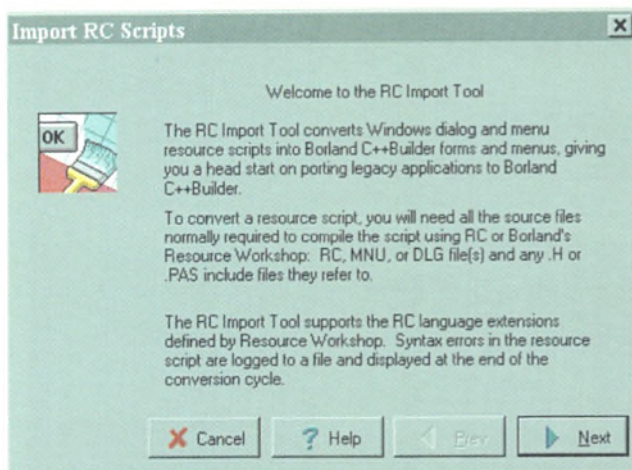


Figure 5 – RC Import Tool is one of the various new wizards lurking inside C++ Builder – this one takes RC script files from old-style development systems and generates equivalent forms and menu definitions which can be used in C++ Builder.

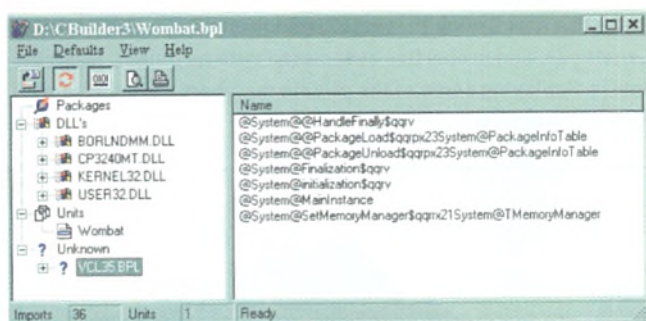


Figure 4 – Take a peek inside a package file built with C++ Builder and you'll see that it's enough like a Delphi file for it to be recognised by Merlin's EXE file viewing utility. You can see the reference to VCL35.BPL, the main VCL package file, and to CP3240MT.DLL, the runtime library. Notice the classical C++ name mangling – how are they going to make Delphi 4 compatible with this?

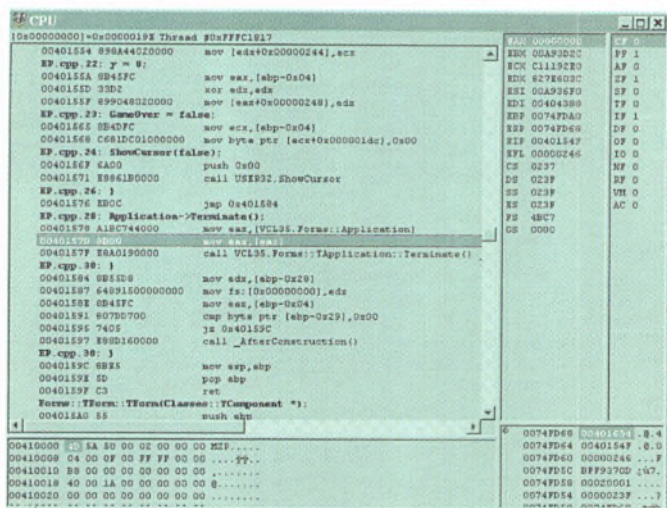


Figure 6 – Here's the CPU View Window in C++ Builder 3.0. The highlighted line shows how an implicit indirection is applied to variables which are exported from VCL packages, thus making it as easy to access published globals as it is to access code. See the section 'C++ meets packages' for more details on how this works.

age Library, so why didn't they choose CPL for C++ Package Library? To answer that question, we need look no further than Delphi 4.0 which will be launched by Borland later this year. I've heard very little about this product on an official basis, but the rumour-mill suggests that Delphi 4.0 and C++ Builder 3.0 will be binary compatible at the package level – hence the new .BPL designation. Thus, you'll be able to generate a package in one development environment and be able to use it directly from the other. Exciting stuff! Just as Borland has broken down the application-DLL barrier, it looks like BPL files may give you complete freedom to write parts of your application in Delphi and other parts in C++.

Note: that's what the rumour-mill says, but I'm less sure myself. A peek inside various BPL files reveals that all the exports use C++ style name-mangling, so how are they going to make Delphi compatible with that? Delphi already provides type-safe linkage without the need for klunky name mangling which would be seen – rightly – as a retrograde step by Delphi programmers. As ever, time will tell...

Anyway, enough speculation. If you want to know how to use packages from a C++ application, and how to add your custom components to a package, it's essentially the same dead-simple process as with Delphi. When you install a component, you get asked what (new or existing) package you want to place it into, and everything just happens. If you want to create packages from scratch and then add your units

to them, you can just select Package from the New Items dialog under the File|New menu item. As with Delphi, design-time packages can be dynamically loaded and unloaded from the IDE and you can use packages to implement your own experts and IDE add-on technology. If you create yourself an empty package with C++ Builder, it starts off at around 10 KB in size. The source code to a simple 'Hello World' package can be seen in Listing 1 – everything was generated for me with the exception of the MessageBox statement.

The USEPACKAGE macro tells the compiler what packages are used by the module being compiled, in this case the main VCL 3.5 package. Incidentally, the smart_init directive in the package pragma is used to ensure that packages get initialised in the correct order. When you build a package a number of different file types are involved: a .CPP file is used to store the package source (as above), a .BPI file is created and used as an import library for the package, and there may also be a .LIB file for statically linking the package into your application. In addition to all this, you've got the aforementioned .BPL file which constitutes the DLL itself.

By the way, you may be wondering how it is that Borland's package technology allows you to export not only procedures from a package

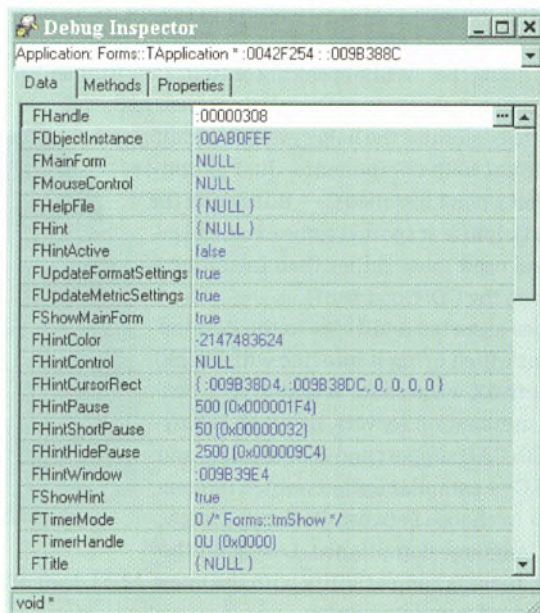


Figure 7 – The new Debug Inspector window can be used to display data, methods, and properties associated with an object. Here, the window is displaying some of the private members associated with the Forms::TApplication object.

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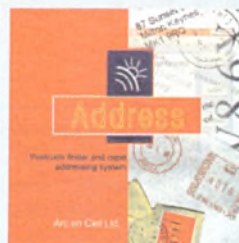


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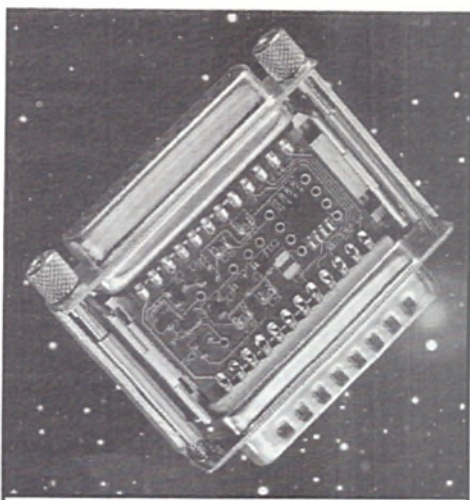
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REVIEWS C++ MEETS PACKAGES

```
#include <vcl.h>
#pragma hdrstop
USERES("Wombat.res");
USEPACKAGE("vcl135.bpi");
//-----
#pragma package(smart_init)
//-----
// Package source.
//-----
int WINAPI DllEntryPoint(HINSTANCE hinst,
unsigned long reason, void*)
{
    MessageBox (0, "My first package", "Hello Mum", MB_OK);
    return 1;
}
```

Listing 1—A simple 'Hello World' package.

but also variables. The secret lies in an indirection approach – when you refer to an imported package variable, you're actually referencing a memory location which contains a pointer to the variable back in the package. When the dynamic memory linkages between an application and the various packages are resolved, the Windows loader patches these memory locations with the correct values. Because the compiler is 'in the know' it generates code to perform the necessary indirection behind the scenes whenever one of these imported variables is used. If you're familiar with the technology of Windows 32 dynamic link libraries you'll appreciate that this is directly analogous to the way in which all API calls are vectored through an intermediate memory location which is patched by the loader. In a nutshell, this is the only way it can work because all the loader is interested in doing is patching memory locations in the module which is importing the DLL references.

C++ Builder vs Delphi

In practice, I'm not at all surprised that facilities such as Code Completion and Code Parameters are missing from C++ Builder 3.0. At the risk of harping on too much about the superiority of Delphi, the fact is that the Delphi IDE understands far more about what you're typing as you type it. Because Delphi's DCU files are essentially hot-pluggable 'snapshots' of the compiler's symbol table, it's a relatively low-cost operation to have instant access to the type and parameter information which is required by features like Code Completion and Code Parameters. By contrast, C++ Builder views each OBJ file as a black box – once it's compiled, that's the end of the story until

link time. For just the same reasons, you won't find Delphi's Code Browser in C++ Builder either. I fear that these shortcomings won't be resolved until Borland finally bites the bullet and adopts a much more RAD-ical approach to its C++ compiler technology!

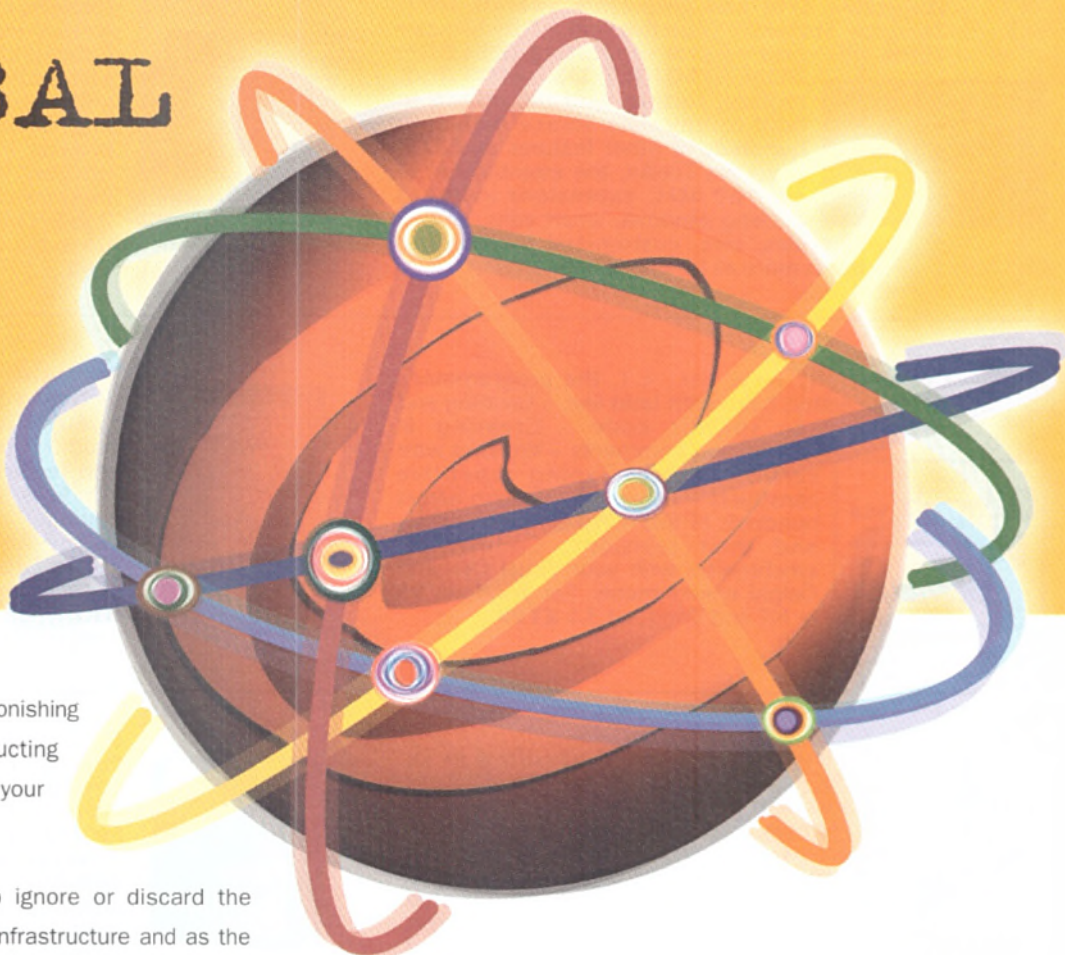
Having said that, I'm very impressed with C++ Builder 3.0. It does a good job of bringing the C++ development system into line with Delphi 3 while improving on it in areas such as project groups, RC importing, Debug Inspector, TASM integration, and online help. Perhaps most important of all is the drastic improvement in build time that you get from the new incremental linker. No, C++ Builder 3.0 isn't about to lure me away from my love affair with Delphi, but if I were writing C++ code for a living, then this is definitely the development system that I'd want to use – no question.

C++ Builder 3.0 is available in three versions: Standard, Professional, and Client/Server. Space doesn't permit me to go into details about what features are in what version. However, you can find a detailed product feature matrix for the development system by pointing a Web browser at <http://www.borland.com/bcppbuilder>. ■

Dave Jewell is a freelance consultant, programmer, and technical author specialising in low-level systems programming, development systems and compiler design. He is the author of 'Instant Delphi' published by Wrox Press. You can contact Dave at Dave@HexManiac.com. ESPs (Estimated Street Prices) for C++ Builder 3.0 are £84.00 (Standard), £399.00 (Professional), and £1599.00 (Client/Server). Upgrade deals are available from existing products.



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Finalising C++

Francis Glassborow gives a special report on what may prove to be the final addition to the language.

Those of you who have read my last couple of columns will know that I have recently been spending a lot of time studying the fine details of the C++ grammar. Some of the things which I have discovered have been surprising. This short item is to report on what is probably the most surprising of them all and one that led to considerable debate during the most recent meeting of the Standards Committees (WC21/X3J16) at Sofia Antipodes in Southern France.

We discovered that one consequence of the grammar of C++ is that an eval operator has been lurking in it. Before I go into more detail, a little background.

Mixing and matching

All computer languages, I think, have some mechanism for forcing evaluation. Some provide an explicit mechanism. The best known of these is probably the eval operator of Lisp (and languages derived from Lisp such as Logo).

Some languages provide mechanisms to support a degree of mixed language programming. One of the most powerful was the ability of Cobol to pull in a compiler for another language, as and when required. Indeed that – alongside Cobol's excellent file handling facilities (probably ten years ahead of its time) – was the major motivation that persuaded sane programmers to write in such an otherwise verbose and clumsy language.

One of the things which has made porting programs written in BBC Basic particularly difficult was the facility that language provided for inserting chunks of raw 6502 assembler into your program. C++ has had a similar facility for many years. Fortunately for the sanity of those involved in maintenance work very few C++ programmers use the `asm` keyword.

C++ also has the facility for linking in code written in other languages via its `extern` "`<linkage specification>`". This is used extensively for mixing legacy C code with C++. Some compiler implementers have added support for languages like Fortran with declarations such as `extern "fortran"`.

No room below

One of the design criteria for C++ was that there should be no room for a lower level language. We could paraphrase this by saying, anything that you can do in any language can also be done in C++. There has been a slight cost in providing for this. You might summarise this as 'C++ does all things well but nothing perfectly'.

That being the case, where is C++'s eval operator and where is C++'s ability to call in other compilers? The `extern` "`<linkage>`" provides some support for the latter. You have to compile the other language separately and persuade your compiler implementer to support the required linkage. Not easy when you remember that Microsoft does not support `extern "VB"` in its C++ implementations.

The eval operator has been in C++ all along. It takes two forms, one of which is better known as the sequence or comma operator. The other operator that forces evaluation is the semicolon. The result of inserting a semicolon in your code is to force evaluation of the preceeding expression even if it is not a complete statement. This is important; otherwise the syntax of the `for`-statement would not work. Some programmers have viewed the semicolon as a statement terminator; not only is this clearly wrong in the case of a `for`-statement but it is wrong in the case of a compound-statement which is terminated by a brace.

Operators can be overloaded in C++ unless there is some specific exclusion placed on them. There are very few exclusions. The delimiter (white-space) is one of those that may not be overloaded. The history of that particular operator is interesting. Bjarne Stroustrup presented a paper proposing mechanisms for overloading white-space. While the contents were taken very seriously its timing was considered inappropriate and the C++ Standards Committees chose to rule it out. More recently, we came to recognise that overloading the dot operator could be useful but the Standards Committees decided that it was too late to make the requisite changes.

Unfortunately, they have been hoist by their own petard.

The rule is that whatever is not forbidden is allowed. No one had realised that overloading the eval operator (`;`) had not been prohibited with the result that it is allowed. The question that may arise in your mind is what exactly is meant by overloading the eval operator. Before I outline that, let me fill in the other details so that you can complete your table of operators. The eval operator has the

lowest precedence (coming after the comma operator). It is a unary operator with its single operand coming immediately before it. It is evaluated in strict left to right sequence.

The way forward

If you have followed the above then you will realise that the eval operator is exactly the one we need to provide the facility for calling compilers for other languages. As for all other operators, the compiler must collect the set of overloaded definitions whenever it locates a semicolon in your code. It must then apply the overload resolution rules to determine the best match.

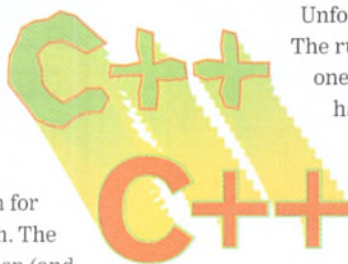
In normal C++ there is no problem with these rules because very few programmers have been providing overloads for the semicolon. The compiler has attempted to parse your code according to the C++ rules. If it has failed it simply issues a syntax error.

Once you provide one or more overloads for `operator ; ()` life becomes much more fun. The compiler must now parse your code for all provided definitions. This either results in a single interpretation (ie all but one choice results in a syntax error), or several definitions result in equivalent results (more than one language will work but the choice is irrelevant), or the result is ambiguous.

It was this last possibility which caused what we all hope was the final addition to the C++ language. At the very last minute, by unanimous agreement of all those present, a new cast was provided: `language_cast<>`. As soon as implementers support it you will be able to write things like:

```
language_cast<VB> date = 01/03/1998;
```

to force assignment to meet the requirements of Visual Basic even when writing C++. That of course assumes that you have successfully worked out an implementation of `operator ; ("VB")`. In future, C++ will be able to claim that it can do everything any other language can do, and do it as efficiently. ■



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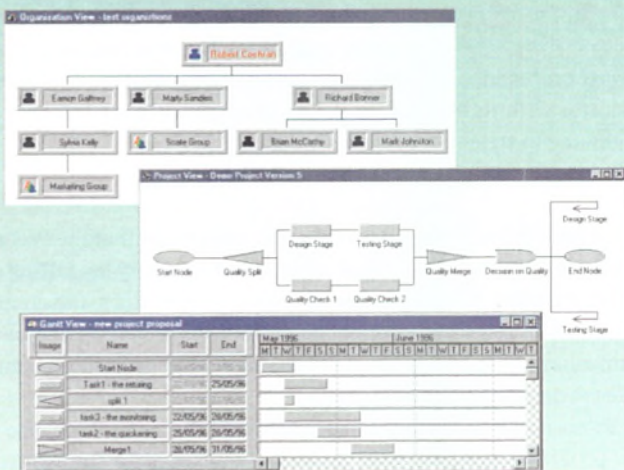
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The multilingual struggle

Socket servers, arrays of Winsock controls, Perl modules, JDBC drivers, and finally, C. Duncan Wilcox tells the tale of constructing an SQL gateway.



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From time to time I happen to act as a system integrator (aka he-who-fixes-other-programmers'-bugs). Often it's more kludging than fixing, of course. One particular client, a medium sized ISP, wanted to structure the expansion of its legacy Unix systems by moving data related to administration and accounting into a central database. The goals included: cheap hardware and software, accessibility with standard office apps with acceptable performance from Windows boxes, good performance from Unix boxes, and ease of use from C and Perl client code.

We started looking for an SQL engine which would fit our needs. Ignoring the Windows NT and BackOffice server, which the pro-Microsoft faction in the client's company had installed before we could blink, we evaluated a few Unix SQL engines first (as planned). The free and cheap ones, that is. The client wasn't planning on spending a bundle on a database from a leading database vendor running on a workstation from a leading workstation vendor. The result was disappointing: all the engines we got our hands on had incomplete SQL implementations, bad performance, or a lack of usable, stable ODBC drivers. In fact, it looks like only commercial SQL engine vendors bundle a reliable ODBC driver. And only the largest (and most

expensive) provide access drivers from Unix, and then probably not for the Unix dialect we used (BSDI).

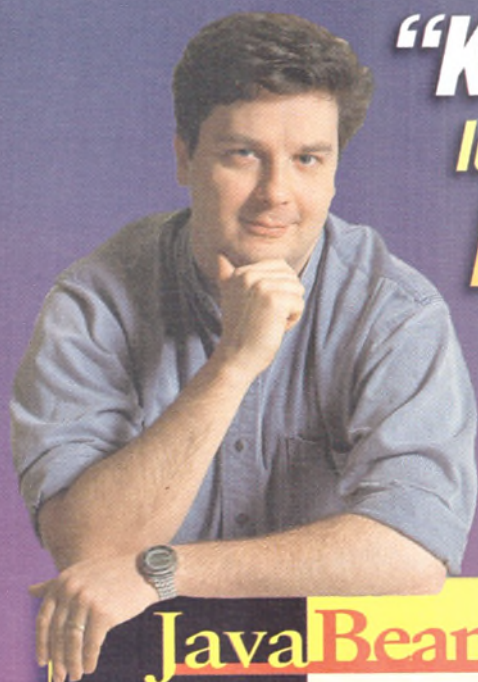
We found a driver to access Microsoft SQL Server from BSDI, developed by a vendor specialising in data access drivers. It had the price tag of a fully-fledged SQL engine, and we traced crashes in the sample code down to the portion of the driver only provided as object code. Dead end.

After having a good laugh at the pro-Microsoft guys who suggested that we should port all the legacy code under Windows, we decided we would write some Windows code – to bridge the client Perl code on Unix boxes from socket connections to ODBC requests. After all, our 'gateway' server simply had to read a plain text line from a socket, perform an SQL query, and send the result back. We started looking at a Pentium box with NT 4.0 and SQL Server 6.5, plus half a day of patches.

A gateway server

A server must do three things well: concurrency, client management, and resource tracking. Performance is of course a desirable feature.

By 'concurrency' I mean the ability to smoothly service multiple clients at the same time. This is necessary because one client's



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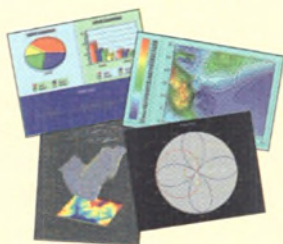
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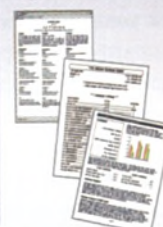
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request might take a long time to service, and other incoming clients shouldn't be starved. In the Unix world this is usually approached by spawning an additional server process for each incoming connection. This won't work under Win32 though, because sockets aren't file descriptors under Windows and they

aren't inherited by child processes. On the other hand multiple processes cannot wait on the same socket, which meant multithreading is the only solution for Windows.

By 'client management' I mean being able to detect that the client hasn't completed its request and to cleanly exit. Failure to handle dead connections will fill the system with server processes which wait forever. What is worse, when you're working with a database, you can keep records locked and prevent other clients from accessing them.

By 'resource tracking' I mean freeing all allocated memory, closing all open files, and generally cleaning up after the server. Under Unix, this is often 'solved' by letting the system automatically free all resources when a service process exits. Under Win32 this is impossible because, as mentioned, servers have necessarily to be multithreaded. Explicit (and tedious) resource accounting has to be performed.

Under Unix a server can process requests either by creating a socket directly and waiting for incoming connections, or by being called by the `inetd` superdaemon - which greatly simplifies the server structure. The former is generally considered a higher performance solution, and certainly gives more control over the connection. The latter isn't usable under Windows anyway because `inetd` relies on sockets being file descriptors, and in fact it connects the socket input and output streams to the `stdin` and `stdout` of the server it runs. Moreover, under Windows NT, servers are automatically started by the service control manager and have to integrate with its API (though shortcuts do exist).

Perl

The people I was directly in contact with are Perl junkies, and Perl is a pretty good tool on Unix boxes, so we tried out a Win32 port of Perl, using Dave Roth's Win32::ODBC Perl module to access the SQL engine.

We whipped up a simple gateway server in a few hundred bytes of

```
#!/usr/bin/perl5
$myport = 10000; # test TCP port
socket(SOCK, 2, 1, 6); # INET, STREAM, TCP
bind(SOCK, pack('S n x12', 2, $myport));
listen(SOCK, 5);

# unbuffered mode
select(CLI); $| = 1; select(STDOUT);

for(;;) {
    accept(CLI, SOCK);
    if(! fork) {
        # server process
        alarm(5); # request timeout
        $req = <CLI>; # read request
        alarm(0); # clear timeout
        # process $req here
        alarm(60); # send timeout
        print CLI "$req"; # send answer back
        alarm(0);
        exit(0);
    }
}
```

Listing 1 - A quick and dirty, but complete, Perl socket server

Perl, enough for test purposes. The test server would only service a single request at a time. Listing 1 shows a functionally complete socket server (with hard coded constants and no error checking).

Unfortunately the Win32 ports of Perl don't support `alarm()`, commonly used for client timeout detection. Moreover they don't support `fork()`, and even if they did, sockets wouldn't be inherited. Finally, to the best of my knowledge, Perl doesn't support multithreading.

```
import java.io.*;
import java.net.*;

public class Server
{
    public static void main(String args[])
    {
        Server s = new Server();
        s.initialize();
    }

    void initialize()
    {
        ServerSocket server;

        try
        {
            server = new ServerSocket(10000);

            while(true)
            {
                Socket client = null;

                client = server.accept();
                ServerThread t = new ServerThread(client);
                t.start();
            }
        }
        catch(Exception ex)
        {
            System.out.println(ex);
        }
    }
}

class ServerThread extends Thread
{
    Socket s;

    ServerThread(Socket s)
    {
        this.s = s;
    }

    public void run()
    {
        try
        {
            BufferedReader i =
                new BufferedReader(
                    new InputStreamReader(
                        s.getInputStream()));

            String req = i.readLine();
            // process req here, send reply
            s.close();
        }
        catch(Exception ex)
        {
            System.out.println(ex);
        }
    }
}
```

Listing 3 - Skeleton of a Java socket server.


```

Type serverdata
    inputline As String
    used As Boolean
    ' other query related data here
End Type

Dim tcprec(50) As serverdata

Private Sub Form_Load()
    For i = 1 To 50
        Load tcpserver(i)
        tcprec(i).used = False
    Next

    tcpserver(0).LocalPort = 10000
    tcpserver(0).Listen
    Show
End Sub

Private Sub tcpserver_ConnectionRequest
    (Index As Integer, ByVal requestID As Long)
    If Index = 0 Then
        found = False
        ' find free server
        For i = 1 To 50
            If tcprec(i).used = False Then
                found = True
                Exit For
            End If
        Next

        If found Then
            tcpserver(i).LocalPort = 0
            tcprec(i).used = True
            tcprec(Index).inputline = ""
            tcpserver(i).Accept requestID
        End If
    End If
End Sub

Private Sub tcpserver_DataArrival
    (Index As Integer, ByVal bytesTotal As Long)
    Dim data As String
    tcpserver(Index).GetData data
    tcprec(Index).inputline = tcprec(Index).inputline
    & data

    If Right$(tcprec(Index).inputline, 1) = Chr$(10)
    Then
        ' process inputline and send result here
        tcpserver(Index).Close
        tcprec(Index).used = False
    End If
End Sub

```

Listing 2 – Skeleton of a VB socket server.

Visual Basic

The pro-Microsoft faction talked me into trying out Visual Basic. It did make some sense, since VB5 supposedly produces tight compiled code, is closely integrated with the Windows environment, and socket support is provided out of the box. In fact, one of the guys had gone as far as hacking some sample code into a simple, working prototype of what we needed.

However, Visual Basic's documentation about server socket support is a little too optimistic, by stating that '[...] it is possible to accept several connection requests using the same control by creating a control array. In that case, you do not need to close the connection, but simply create a new instance of the control [...], and invoking the Accept method on the new instance.'

An ever growing control array seems awkward, and the provided sample code doesn't do much to explain how it should work (but I'll blame this on my scarce knowledge of Visual Basic). Anyway, creating new servers on the fly was a bit slow because we also needed a connection to the SQL Server which is slow. It seemed easier to pre-allocate both database connections and Winsock controls.

The code my colleague had written was littered with global state variables (he hadn't understood VB's documentation either): it simply couldn't work with multiple connections. I hacked it to use arrays of state variables, pre-allocated to allow for a maximum of 50 connections (ending up with 50 Winsock controls, 50 ADODB connections, and 50 arrays of state variable records). Ugly, but it had more hope of working.

Listing 2 shows the skeleton of the server. What ruled it out was the simple test of running 10 concurrent clients: socket connections would often be refused. The server didn't keep up with incoming connections when it started getting busy.

In an attempt to analyse the cause, it should be noted that the handling of the socket close has been simplified in the listing. The problem with the code as shown is that the Winsock control's Close method doesn't appear to implement what is known as a lingering close. This is a delayed shutdown of the socket connection if packets in the output buffers haven't been completely sent. Visual Basic's Winsock control won't wait for all packets to be sent but will close the connection right away. To work around this problem, the real code used a timer object and closed the socket when the timer expired. With this fix the results seemed to correctly find their way to the clients.

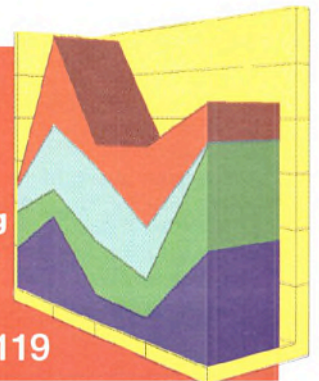
The above fix is dangerous in general however, because clients that don't wait for the server to close the socket might quickly use up all 50



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servers, leaving them in my home-made, lingering limbo. In our case, however, the client was strictly synchronous, waiting for the server to close the socket before performing a new request. This means 10 concurrent clients would use at most 10 servers (and suffer in performance because of the sub-optimal socket close).

I am not familiar with VB internals, but the event driven model imposed on the Winsock control, clearly discernible in the server code, suggests that VB only executes one method at a time. Since we have a fully-fledged, time consuming SQL query running in the Winsock DataArrival event, the ConnectionRequest event might indeed be starved long enough to signal that no connection is available to clients.

Java

Project cost, and hence development time, was of course a concern. After taking a look at the Visual C++ socket sample code – too simple and naive for a robust server – we thought we'd try out Java. After all, the language is inherently multithreaded and the built-in garbage collection would save us from tedious resource tracking. There was a precedent: the W3C had an ongoing project to build a Java web server, called Jigsaw, with encouraging results (albeit with some garbage collection problems). Listing 3 shows the skeleton of the Java socket server. Database connectivity was later added in the form of a connection pool, controlled by its own thread.

Because of its performance reputation, we initially picked Microsoft's Java Virtual Machine. You would think that connecting Microsoft Java with Microsoft SQL should be a snap, right? Sure, but not through 100% pure Java, of course. Microsoft's JDK doesn't include JDBC which meant we had to use its proprietary Data Access Objects (DAO) package. Unfortunately we found DAO to work fine when used casually, but to fail often, in the form of an internal error returned by the DAO query method, when 'stressed' by the 10 client test. It was starting to sound like a recurring theme from Microsoft products.

We decided we would take the performance hit by switching to Sun's JVM, which only had a beta JIT. There are four JDBC driver categories to choose between (categorised in relation to their dependency on the client or server environment). From categories one to four, JDBC drivers can be: mapped over an ODBC driver, mapped over a vendor specific client API, all-Java on the client side but mapped to a specific server or server extension, or finally, all-Java with direct connection to the native database interface. The

JDBC over ODBC driver is generally regarded as the worse performance JDBC driver category, but that's all we could use with SQL Server.

Surprisingly it worked as advertised and it worked reliably, without dropping connections, failing SQL queries or crashing. We finally had a working gateway!

The original JDBC initialisation code looked something like:

```
Class.forName("sun.jdbc.odbc.JdbcOdbcDriver");
String url =
    "JDBC:ODBC:localserver;Database=TheDB";
Connection con = DriverManager.getConnection(url,
    "user", "pw");
```

This first part forces the JDBC over ODBC driver to be loaded, and then gets a connection to the database. Since we had our hands in the code, we tried to switch driver using IBM's beta AS400 Java Toolbox to connect to an AS400 through the included category four JDBC driver. We changed the above to read something like:

```
Class.forName("COM.ibm.as400.access.AS400JDBCdriver");
String url = "JDBC:as400://the.as400.addr/TheDB";
Connection con = DriverManager.getConnection(url,
    "user", "pw");
```

It worked on the first try! Everybody was really impressed. Two 'works as advertised' in a row, for the same client/server technology and bridging to the hostile AS400 world.

We started setting up all kinds of batch programs, to keep the legacy data and the new SQL database in sync through incremental and nightly massive updates, and we moved some services to the new database.

Unfortunately, one morning we found the Java Virtual Machine had ballooned to some 80 MB. Overnight, the SQL Server had gone crazy and filled the disk with a 700 MB log file which we had left around to show to 'the experts'. The NT box was crawling as it tried to grow beyond the 250 MB left on the disk. It might have been a bug in my code, but it scared my colleagues away from Java. They had also tested Microsoft's Internet Information Server and had benchmarked fetching a non existing document to be an order of magnitude faster than the Java server. They wanted to switch.

It was time to look at C again.

C

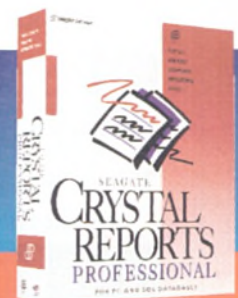
'A web server, huh?' I grabbed the Apache 1.3b3 source archive and started hacking out the unneeded stuff. Modules, logging, http, I trimmed it down to an essential server. Essential but multithreaded, with extensive resource tracking, integrated with NT's service registry, and somewhat tested.



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It took me quite a few crashes to sort out all the details, but I eventually managed to understand enough of Apache's internals to get it to work. I added calls to DB-Library, the SQL Server native API, and it wasn't too hard to get it going, even though the documentation was again incomplete regarding multithreading support and I had to look for sample code on the Microsoft Developer Network to find out how it really worked.

There's not much to be said about C programming and debugging that hasn't already been mentioned in columns, except that debugging a service shouldn't be half as hard as it is. All in all, it took ten times as much work as the Java or VB servers. Looking back at Java, the only other server that really worked and that was more developed, it was great to have 'crashes' in the form of informative exceptions with complete call stack traces.

Performance

200 milliseconds. If you've done socket programming, that number should ring a bell. We were experiencing the Nagle algorithm. The Nagle algorithm is part of TCP/IP stacks, and states that the stack should delay sending partially filled packets in the hope that the application will send more data. In most TCP/IP implementations it can be disabled by setting the `TCP_NODELAY` flag. While active, the Nagle algorithm will wait for more data to send for up to 200 milliseconds.

After having solved the Nagle algorithm problem in our clients and servers, the C server runs about five times faster than the Java server, as long as networking is the bottleneck. With the average load we were expecting to have, 10 parallel clients, on our hardware the

References

Dave Roth's PerlWin32::ODBC<http://www.roth.net/odbc/>
 W3C Jigsaw<http://www.w3.org/Jigsaw/>
 JDBC<http://java.sun.com/products/jdbc/>
 AS400 Java Toolbox<http://www.as400.ibm.com/>

Java server maxed out the CPU, while the C version was around 70% – the C version was over ten times faster than the Java version.

The right tools...

Software is late, budget is low, OSs are religions, and I picked the wrong tools a few times. I had a chance to refresh a few well known facts, and cut through the hype. Perl is deeply rooted in the Unix world, Visual Basic is not for mission critical use, Java is still immature but already has some clear advantages and, finally, with C you can do anything.

And there's the OS. Notwithstanding the massive amount of service packs applied to the NT box, my colleagues don't feel too safe with Windows NT, having experienced glitches, freezes, and crashes. They have developed a set of Perl scripts running on two Windows NT boxes with the same database and gateway server, to manually mirror the data (waiting for Microsoft to deliver in The Next Release). I have a feeling they'll soon buy some big Unix system and we'll do a rewrite in Perl.

Duncan Wilcox is a freelance consultant and programmer. You can contact him at duncan@mclink.it.

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It has taken Borland two and a half years to release a 32-bit upgrade to Visual dBASE (VdB). The jump from v5.5 to v7.0 is no doubt partly to keep in step with the opposition but it also signifies that it is very much more a new product than a normal upgrade. In fact, it is arguably a replacement for the core xBASE language itself, much of which dates back to the original dBASE II of 15 years ago.

A description and assessment of the revised language, data handling methods, and other new concepts is likely to be of most interest to programmers. We must also look at the many improvements to the design tools and a number of new components. Finally, how well has Borland presented such major changes in respect of both documentation and build quality?

Easy on the eye

The Desktop and Visual Designers are where most interface development will be done. VdB generates full source code for *everything* which is built visually. However, a masochist could write a complete application in a DOS editor! The code is streamed to the Editor window as components are placed on a form. It is a totally two-way environment, arguably three-way as many properties can be modified on the Form window, in the Inspector, or in the Editor. Changes to the last reflect back on the form once focus is moved to another window. In most respects it must be a near ideal working environment. Besides the Form, Inspector, and Editor windows there are Component and Field palettes. A TreeView panel to the left of the main Editor window proves a great aid to code navigation. As first shipped, Borland has chosen to make the Inspector, Component, and Field windows 'always on top' so that the Form itself is 'always at bottom'. An early correction to this is promised and is certainly needed. Even then, with so much on-screen real estate, a 14 inch screen would prove very frus-



dBase — new face

trating. For any serious development work a 17 inch screen (at 1078 x 768) is really a minimum and 19 inch would be preferable.

An integral report designer completely replaces Crystal Reports, as used in v5.5. Creating a report is similar to creating a form. Components and fields are dragged onto the design surface, positioned as required, and text entered. A *PageTemplate* determines the general appearance of a report and would include an overall title. A *Streamframe* contains column headings and the data streamed from tables. There are the normal provisions for detail and group bands plus a footer. Navigational controls can be added either singly or in combination as a custom control.

Reports default to view mode but they can then be printed. They can be outputted as HTML files but the formatting is not quite right and a single HTML file for a long report is far from ideal, especially if over 2 MB as on one test! A labels designer sadly lists US label sizes only. As with forms, the Report Designer generates full source code which allows further fine tuning through the properties and methods of the report objects. Overall, the report tools are a big step forward but need rather more development. Such as smoother positioning of objects, better facilities for conditional selection, the ability to print the character &, and more templates than just one for a basic listing.

Other improvements include a new Project window with a tree view of all the relevant files. The Inspector also shows objects as a tree view

A smarter face and a new vocabulary. But is it still dBASE? Bob Rimmington reviews the new 32-bit database, Visual dBASE v7.0.

in its drop down list and there is a new Navigator window. The previous Catalog feature has been replaced by the Project tool. The Code Editor is much improved. Besides the excellent TreeView panel, it can now be customised in many ways, including a choice of Classic dBASE or Brief settings. No change though to the traditional Command window, a facility possibly unique to dBASE and beloved by all programmers.

Components and customs

The long awaited Grid falls short of expectations. There is no facility to set properties by cell (such as red for overdue accounts) and setting some columns to read-only requires a work-around such as making them calculated fields. Changing properties for column headings and content is so convoluted, via the Inspector, that it is a relief to be able to do it manually in the code editor!

A container control is an ideal tool for holding groups of buttons and other components. The Notebook control is another very welcome new feature and seems to work well. Other new controls include ListView, TreeView, Slider, Progress, and Report Viewer. The last one allows a report to be displayed while working on a form. ActiveX controls are supported too.

The Editor Control now understands, and can optionally display, basic HTML formatting tags via a popup context menu. A neat Format Toolbar is also available to set heading style, font typeface, HTML size and colour, text attributes, and alignment.

VdB handles object inheritance through custom forms and controls. These are designed in the normal way but then saved as custom objects. Individual controls (such as a set of navigation buttons) can be saved as a custom container. It is best to subclass everything, even entry fields, and build an application from such custom objects. VdB works very well this way. All custom properties can be changed in individual forms and built-in methods can be overridden. For example:

```
function form_open
.... do something
return BOOKINGSFORM::open()
```

will first run your code and then call the built-in `open()` method to open the form.

As with v5.5, a collection of reusable custom controls for v7.0 is already accumulating on websites and the CIS Forum libraries.

Language, old and new.

The traditional DOS interface commands such as @, x, x, and GET have gone completely but most of the old commands remain. With a very big proviso. From its earliest days dBASE introduced the concept of work areas to allow multiple tables to be open and accessible. These were used through what is described as the Database Manipulation Language (DML) comprising 132 commands and functions. However, VdB 7 has adopted SQL methods for handling the traditional DBF tables as well as all other types. With this has come a completely new OODML (Object Orientated DML) comprising 164 Classes, Objects, Properties, and Methods. A DOS dBASE or Clipper programmer would recognise very little indeed of the new VdB 7 source code. At present both DML and OODML are available but Borland is recommending the latter and some new controls such as the Grid will only work with OODML. The implication seems clear. DML is retained at this stage to allow the immediate use of legacy code

with minimal change but is unlikely to remain a permanent feature.

Other changes include a TRY ... CATCH ... FINALLY ... ENDTRY structure which allows improved trapping and handling of exceptions and errors. Assignment (`=`, `+=`, etc) and increment (`++`) operators are new to v7. The assignment operator can only be used with an existing variable or property, a useful way of minimising typos.

SQL Objects and Data Modules

How then does the new SQL and OODML concept work? At its simplest, the icon for the relevant table is dragged onto a form at design time. An SQL icon then appears on the form and the code for an SQL Query Object is inserted into the source code for the form. A Field palette fills up with all the fields in the table and these can then be dragged onto the form, each with the field name as a default text legend. Can anything be simpler? For a basic form, well yes, you could let a wizard do it for you!

For less simple tasks, an SQL Designer allows queries to be created visually with options for selection, criteria, grouping, group criteria, sorting, and joins. Normal SQL code is generated which may be viewed and optionally modified in an Editor window. As with the other design tools, this is entirely two-way with any changes reflecting back into the Designer. There is also a facility to save SQL statements to a Property Builder for reuse in other queries.

Although SQL Objects can be used directly, a Data Module Object will often be preferable. This is a container for other objects such as SQL queries, stored procedures, and databases. It can contain statements such as `lookupSQL` which will support a combo box picklist showing fields in one table but data-linked to a field in the selected table. Data Module Objects can then be dragged onto forms to instantly set all the required links to tables. Done this way, the Data and Form objects will also automatically handle Sessions. These are the way VdB allows multiple users to work on the same tables and also enables each user to access a table for different pur-

```
ALIAS()
APPEND FROM
BROWSE
COPY STRUCTURE
DELETE
FLDCOUNT()
FOUND()
INDEX
KEYMATCH()
PACK
RECNO()
SEEK
SELECT
SET FILTER
SET ORDER
SKIP
USE
ZAP
```

Listing 1—Typical xBASE DML commands and functions.



Figure 1—The Form Designer Desktop.

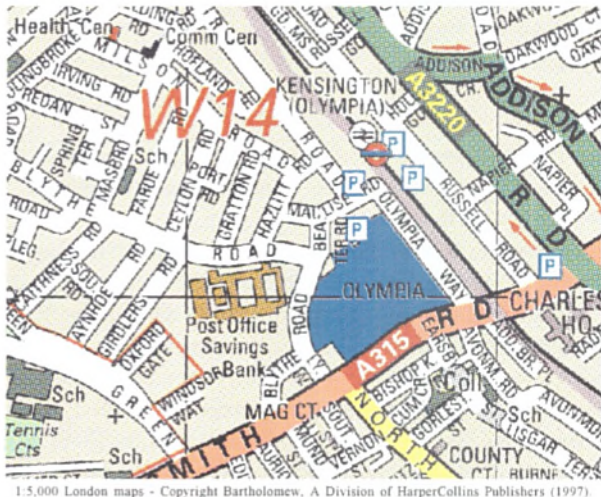
```
form.rowset.abandon()
form.rowset.append()
Grid Control
beforeGetValue()
form.rowset.delete
form.rowset.fields.size
form.lookupRowset
form.rowset.masterRowset
form.rowset.refreshControl()
form.rowset.rowNo()
form.rowset.findkey()
form.rowset.save()
form.rowset.filter
form.rowset.indexName
form.rowset.next() statement
Database object emptyTable()
```

Listing 2—The new OODML way

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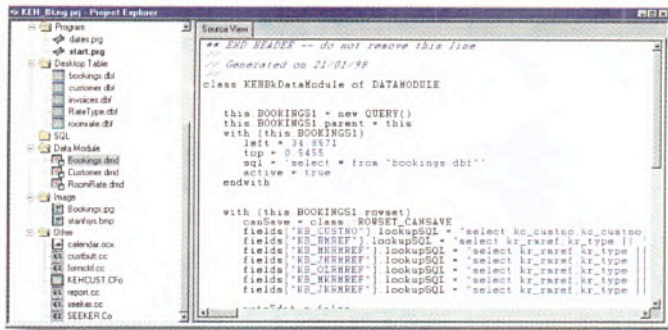


Figure 2 – The Project Explorer.

poses such as lookups while a report is running. Up to 2048 simultaneous sessions are supported.

Out with DML, in with OODML

This is clearly a major new concept for dBASE programmers and there is no doubt that many will initially blanch at the implications. Listings 1 and 2 give some examples of the now semi-redundant DML commands and a selection of the new objects and methods. In essence, forms and program code will address *rowsets* derived from tables through SQL statements and not the tables themselves. The *Rowset* class contains properties and methods which handle many of the tasks previously done through DML commands. Others are handled by further new classes such as *Field* (each rowset has a *fields* property which points to an array). See Listings 3 and 4 for examples of old and new code.

Some rowset properties can supplement or replace part of a typical SQL *SELECT* expression. For a report, an expression defining relationships, order, and any filter will normally be fine, but for a form anything as complex as that makes the rowset read-only. Hardly suitable for adding or editing data. In these cases a simple *SELECT* statement can then be supplemented with rowset expressions to set (and change) table links, index order, and any required filter. The rowset filter property is in itself an SQL expression which does not look immediately intuitive, for example:

```
form.rowset.filter:=[surname==""]+this.value+[""]
```

Setting an index order is much easier, just:

```
form.rowset.indexname:~<TAG name>
```

Not all the old DML commands have new equivalents and ones such as *SET*, *CARRY*, and *KEYMATCH()* will require more complex alternatives. See Listing 4 for fuller examples.

Typical of the changes which developers will need to address is the effect of changing to a different index tag while in a form. For example, as when a user is given a facility to view a grid in the sequence of each of the displayed columns. Until v7 the record pointer did not move, now it always reverts to the top of the rowset. It cannot be moved back by noting and setting the pointer back to a record number because a rowset has no record number. It does indeed have a *Bookmark* but this only applies to the current sequence. The *Debugger* looks as if it might prove useful but has some odd quirks and single steps only slowly, up to 10 seconds per step if many variables are displayed.

Unfortunately, Borland is strangely reticent about it all. None of its pre-launch publicity mentioned the effect of the new data objects. There is no guidance on how to switch to the new approach while the definitions of the new methods and properties are woefully short of essential

examples. In fact, some important methods such as *tabledbf()*, *dbfindex()*, and *load()* are not even mentioned at all. Developers will need to rethink their whole approach to how they construct their applications and will be looking for more help than they are getting.

Compatibility and deployment

No attempt has been made to maintain any compatibility with DOS programs and even v5.5 applications will not automatically run in v7. It is best to open and then re-save forms in the *Designer* to stream out the new style code. This will achieve much of the necessary revision and there is a tool to assist in the conversion of reports. However other changes will normally be required and may not always prove easy. For example, the default *ScaleFontSize* and *FontSize* properties have increased from 8 to 10 points and this will certainly need correction. Many are likely to keep with v5.5 (soon to be v5.6 through an inline upgrade) for most existing applications while switching to v7 for systems still evolving and for anything new.

Another major change is that VdB7 is aimed strictly at developers (there is no longer a Standard version, just Professional and Client/Server). It still has all the interactive features of v5.5 and in various ways they are better. Presumably, Borland has given up the unequal struggle of trying to compete with an Access which comes with MS

Office. Borland no doubt hopes that this will end a common (but mistaken) assumption that VdB is an end-user application rather than a serious tool. It is now positioned as one of the range of Borland development packages and is targeted at both dBASE programmers and as the best tool for extensive database projects.

The source code for forms and all other files is automatically compiled to object code when a form or application is run. A complete application can be made into an EXE file through options on a *Build* menu when the *Project Explorer* is open. *InstallShield Express* is bundled to allow the creation of a set of disks for installation of a system on machines without a copy of VdB7. Besides the EXE itself, the disks will include a large runtime file, some DLLs, and much of the BDE. However, program changes require only a new EXE to be copied onto the user machine. Any additional applications can make use of the first installation of runtime and BDE files.



Code streamed for an entry field control:

```
DEFINE ENTRYFIELD ENTRYFIELD1 of this;
PROPERTY;
height 1,;
left 16.1427,;
top 9.7727,;
width 7,;
Datalink BOOKINGS->KB_BEGINS
```

Replacing a field in all records:

```
Replace all KB_FEE with RoomRate->KR_RATE
```

Copying a binary field to a file:

```
COPY BINARY <fieldname> TO <filename>
```

Seeking in a different work area:

```
cRateRef=KB_RMREF
SELECT RoomRate
SET ORDER TO nKr_RmRef
SEEK cRateRef
lRateFound=found()
```

Listing 3 – V5.5 and DML code examples.

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Code streamed for a custom entry field control

```
this.ENTRYFIELDKB_BEGINS1 = new RRCUSTENTRYFIELD(this)
with (this.ENTRYFIELDKB_BEGINS1)
    height = 1
    left = 16.1429
    top = 9.7727
    width = 7
    metric = 0 // Chars
    dataLink = form.bookings1.rowset.fields["KB_BEGINS"]
    borderStyle = 7 // Client
endwith
```

Replacing a field in all records

```
form.rowset.first() // ensure at top of rowset
do while not form.rowset.endOfSet // loop through rowset
    form.rowset.fields["KB_FEE"].value =
        form.roomratel.rowset.fields["KR_RATE"].value
    form.rowset.next() // = skip in old DML
enddo
```

Copying a binary field to a file

```
cFile = putfile ("MyLogo", "*.BMP")
form.rowset.fields["Logos"].copyToFile(cFile)
```

Seeking record in another table

```
cRef=RIGHT(TRIM(form.rowset.fields["KB_RMREF"].value),3)
form.DataModRef1.ref.roomratel.rowset.indexName="KR_RMREF"
lRFound=form.DataModRef1.ref.roomratel.rowset.findkey(cRef)
```

Carrying data from an existing record to a new one.

```
function beginAppend // override Form method
aCarry = new array()
for nCtr = 1 to this.fields.size
    aCarry.add(this.fields[nCtr].value)
next nCtr
super::beginAppend() // now call Form method
for nCtr = 1 to aCarry.size
    this.fields[nCtr].value = aCarry[nCtr]
next nCtr
```

Listing 4 – OODML code examples.**Data Objects & the DBF table**

The data objects work through the BDE (Borland Database Engine) which is better than ever. It will handle DBF, Paradox, MS Access, and FoxPro CDX tables as native types (plus Oracle, Sybase, Informix, InterBase, MS SQL, and DB2 in the Client/Server version). ODBC connections are fully supported, and those tried worked very smoothly. One such connection that might interest many developers was with Sage 4 files through the Sterling 32 driver. The important point to note is that the new data objects allow all

these varying types to be handled in just the same way. No doubt this was a major reason for the switch to SQL and OODML even for the traditional dBASE DBF tables.

Significant changes have been made to the default DBF table structure. There are four new field types:

Long	4 digits	Positive whole number
Double	8 digits	Positive whole number
Autoincrement	4 digits	Long integer auto incrementing
Timestamp	17 digits	Date plus time as HH:MM:SS

Distinct indexes (no duplicates allowed) and primary distinct indexes are now available, but index expressions including UDFs are no longer possible. Custom field properties enable picture, colour, and range criteria to be set at table level. A field is in fact an object which can even include properties such as a `lookupSQL` statement (ideal for combo box picklists) or methods such as `beforeGetValue()`. This enables what appears on the screen or a report to be a derived rather than an actual value. For example, a stock description rather than the stock code actually in the field. The DBF table format can now be said to have the capability of a Data Dictionary. Finally, there is a total change to the default value of fields. In the past, numeric fields defaulted to zero, logical fields to False, and character fields to a nil length string. Now all default to NULL.

This change is merely mentioned in the *Developer's Guide* as a new feature for character fields only, but there is no discussion in the documentation of the many implications. These include the following. An average of a numeric field is calculated by dividing the total by the number of entered values, not the number of records. An accumulating total reverts to nil every time a record with a NULL value is encountered. A string concatenation (such as `Title+Initials+Surname`) will return nil if any of those fields are NULL. A logic check for True or False will fail if the value is NULL.

Programmers will need to find an answer to this and so must either initialise every field at time of entry or include a check for field type in every calculation. It is a pity that Borland made no effort to explain this. Nor how to handle tables shared with other xBASE products as is otherwise possible with the inclusion of the CDX index format for native connectivity. A simple method is to set the BDE level to 5 but this will exclude the new field types in level 7.

A flawed presentation?

Borland had committed itself to a release in the last quarter of 1997. It achieved this, just, but there are various indications that another month or two would have



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been well spent on testing and refinement. There are various detail bugs of course and some general fragility. With so much fresh material to learn many developers will nevertheless welcome the early release. It is usable and is capable of building applications which can be delivered. An inline upgrade is promised 'soon'. However, Borland's track record on such upgrades is not good. For v5.5 the first took a year and the second (just released) two and a half years, to address major issues such as the leakage of GDI resources described in the (October) EXE review of v5.5 in 1995.

Of more concern is the documentation. The Professional edition does not even include the *Language Reference Guide* (£15 extra, plus postage in the UK). There are the omissions of some descriptions, far too few examples, and nothing on the implications of NULL as described above. Worst of all, there is no guidance at all on how to tackle a new project using OODML instead of the traditional approach. Attempting to learn by the 'lets try this, now try that' approach just brings up brief and often misleading error messages. Which in turn reveals another major omission, no detailed list of error messages with suggestions for rectification. At this point, over two months after its release, even a simple ASCII list of known bugs and documentation omissions is still awaited. It is said to be 'too early' for this. Too early for Borland perhaps but urgently needed by users.

Another difficulty is the overall effect of all the programming changes. They will require a largely new approach by xBASE programmers plus a familiarity with all the new OOP methods. Traditional xBASE is often so near to a sort of stilted English that many developers think through their routines in those terms. Such as SET FILTER TO SURNAME = "Smith" OR TOTAL ON



Borland's reactions

Borland is reacting positively to bugs and other points raised by the writer and many others. An early version of an inline upgrade sighted while preparing the review confirmed that many of the flaws have already been removed. The inline to be released as a download will include further bug corrections but a release date was not available as we went to press. Revised Help files are promised too.

CUSTCODE TO CUSTTOTS. The new syntax is far less memorable and at first sight a lot more verbose. It is difficult to assess how far the apparent extra complexity arises from merely trying to replace old code with new on a line by line basis.

Though form and report design might prove quicker these are not, as seems to be assumed, the principle part of all applications. For example, the current use of EDI (Electronic Data Interchange) between customers, suppliers, and distributors is intended to minimise the entry of data into forms by users. Instead, to extract and process data received as files may require thousands of lines of complex code working quite unseen to the user. Discovering to what extent a completely fresh approach to program design might bring benefits of performance or simplicity is likely to require a long learning curve.

Initial blemishes

VdB 7 shows great promise, it may well prove to be the ideal tool for moving the many DOS database applications still running into the Windows environment. However, Borland has done itself no favours by supplying a version with rather too many initial blemishes and with quite inadequate guidance on how to use the new data classes and OODML. Nevertheless, although it would certainly benefit from a little more development work, it is usable as it is now. Providing of course it is accepted that it now has only a passing resemblance to the dBASE of old!

Bob Rimmington is an independant xBASE and Clipper consultant. He can be contacted through Stanford Systems on 01444 236352, or email BobRimmington@compuserve.com. A UK dBASE User Group (dBUG) has a web site at: <http://ds.dial.pipex.com/gemsys/dbug>. Visual dBASE v7.0 costs £249 (upgrade £149) for the Professional version or £995 (upgrade £795) for the Client/Server version.

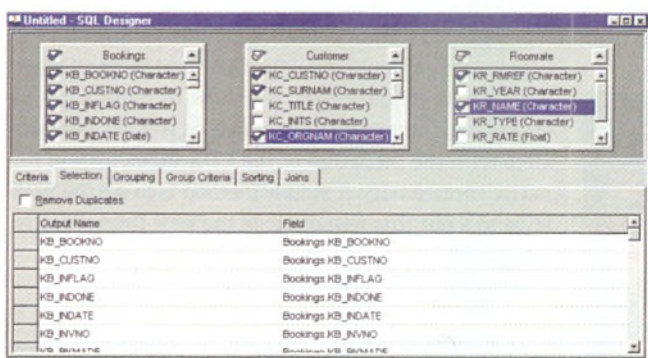


Figure 3 - The SQL Designer.

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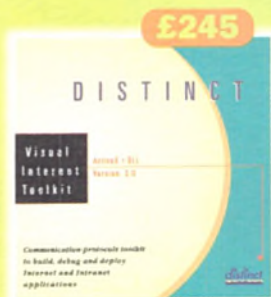
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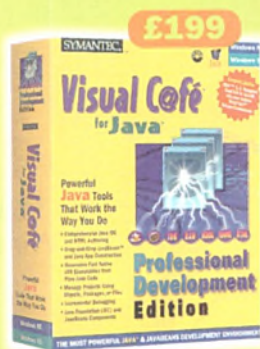
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Nearly all the articles I write for EXE spring from something I am doing at the time I sit down in front of the empty editor window and start emitting words. If you read last month's article you'll know that I've been engaged in creating interactive web sites in the last few months. By 'interactive' I mean that the sites are composed of pages which are generated on the fly for the viewer, using information that's stored in files or databases.

Last month I talked about one technique I am using, working with a macro processor written in Perl to add information into templates prior to sending the file to the viewer. With several other pages on the same site I'm using Server Side Includes (SSI). With these, the source page contains some magic syntax which tells the server to run a program whose output is to be included into the page before it's dispatched over the net.

Since I've been programming in the shell for considerably longer than I've been using Perl, it seems natural to me to use shell scripts to implement the little programs which are run by the server. Later, I started wondering whether the SSI program could run faster; maybe



Seek and ye shall find (with regular expressions)

With Server Side Includes invoking C programs, Peter Collinson uses regcomp and regexexec for the compilation and execution of regular expressions. Basic or extended.

the script could be replaced by a program which should be quicker. I suppose that this follows the old Unix maxim of 'make it run, then make it run faster'.

I have also had a few qualms about odd things which seemed to be happening on the server. Sometimes SSI pages appeared to stall, and looking at the server it was running and running. I suspected that the server was losing its pipe connection to the child SSI process. More recently, it transpires that this was a bug in the particular version of the server I am using. I have upgraded to a more recent release and the problems have apparently gone away. However, I was considering whether a single process would cure the problem and wondering whether I should re-implement some of the scripts.

The SSI script which seemed the best candidate for rewriting is the one responsible for generating an index into a set of news items, each stored in a file. Each news item consists of some text and a headline. The headline is a normal HTML header that's been carefully marked in the file using a pair of HTML comment statements, like:

```
<h3>
<!-- START OF HEADLINE -->
The Headline
<!-- END OF HEADLINE -->
</h3>
```

The script searches all the files looking for the headlines, and then generates appropriate HTML for each file so that the headline acts as a link to the file which contains the news item. Of course, we want to

present each headline in reverse time order, so that the most recent news item appears at the top of the page. A reversed timestamp is used to name each file: *yyyymmddhhmmss.html*, where the italics are appropriate numeric values. These names sort automatically into date order using the alphabetic rather than numeric collation order which is standard in the Unix `ls` command.

Thus the shell script uses `ls -r` to generate the list of files in reverse creation order. Each file is passed into the `sed` command to extract the headline, and each of these headlines is passed into a print phase where appropriate HTML links are constructed to inject into the output page. I use the timestamp in the filename to generate a human readable date, like '12th February 1998, 12:33', so viewers know how recently the news item was created.

Putting this into C

I suppose that I've been coding in the best high-level assembly language ever invented for slightly longer than I've been writing shell scripts, so again it seems natural to consider redoing the script in C. How might this be coded in C? Well, I guess that the directory reading part isn't hard to see how to do. We can scan the directory, save the appropriate file names, and sort them using the standard `qsort` routine. Perhaps the most interesting part to consider is how we seek and find the headline in each file.

The first way which we might do this is to read some lines from the file until we find a line containing `START OF HEADLINE`, then store

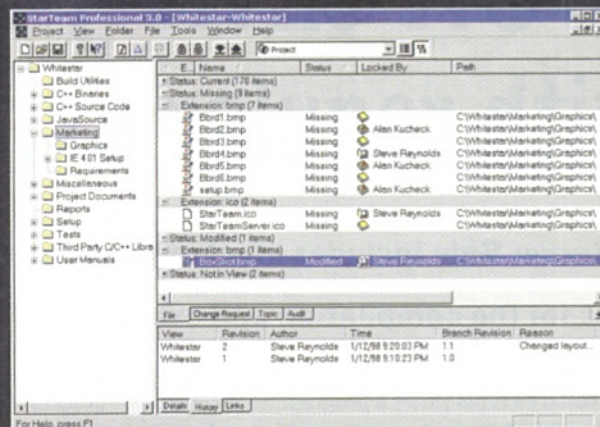
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some lines until we find a line with `END OF HEADLINE`. I have always preferred to code this type of pattern recognition using a finite state machine, something like:

```
open the file
state = SCANNING
while (get a line) {
    switch (state) {
        case SCANNING:
            if the line matches start of headline
                then state=STORING
            break;
        case STORING:
            if the line matches end of headline
                then exit from while loop
            else store the line
    }
}
close the file
```

We now have a single loop that processes the file, while a well-controlled state machine decides what should happen to the data. In this case, data is discarded until we find the start pattern and then stored until we find the end marker. I use this pattern of code in many circumstances where I want to deal with a stream of data and decode a pattern inside that stream. Often, the `while(get a line)` is `while(get a character)`, and the state machine passes through several distinct values recognising various key words or other aspects of the data.

What about the `if the line matches` statements in the pseudo code? Well, it depends on what we know about the data. If we are convinced that the start and end markers will always be at some known point in the input line then we can simply use `strcmp` or `strncmp` to match the data we are looking for. However, if humans have touched the data, then perhaps we cannot be so certain of where the start and end markers might be.

We need to generate string matching which will cope with variation in the input data, and still find the start and end markers. Well, think back to our prototype, we used `sed` to find the start and end markers, and `sed` uses a regular expression match to find strings in the data stream. Are there standard regular expression matching routines out there which we can use? The answer is yes, at least on a Unix system.

Regular expressions

Originally, regular expression code tended to be embedded in the utility which used it. This was one reason why regular expression syntax tended to diverge, with different utilities having different flavours. There was also a period when the same utility on different versions of Unix had different regular expression syntax because some implementers had added new features.

By the time Unix System V began to be deployed, the routines for regular expression matching in that system had been pulled out of most of the source code and placed in library routines, making the same code available to all programs. Some other vendors followed suit but they had often developed different APIs to the routines. It took the POSIX committee which was responsible for Shells and Utilities (POSIX.2) to pull the various strands together. POSIX.2 defined two types of regular expressions: 'basic' regular expressions embodied the syntax which was available in some of the early Unix utilities, and 'extended' expressions reflected the somewhat more powerful abilities of some of the later commands. The committee also defined a standard API to the routines.

This work was much needed, and was aided immensely by Henry Spencer who busily implemented the committee recommendations as

they emerged. POSIX committees often had to reconcile different extant implementations and sometimes chose to invent new ways of doing things rather than handling some political hot potato which would result from choosing one vendor's version over another. Sometimes these new inventions, which seemed like a good idea in the hot-house of a POSIX meeting, were simply unimplementable or fundamentally misguided. It was good that the committee responsible for defining regular expressions was actually guided by someone who was trying to make the recommendations work. Even then, there is an inconsistency with the handling of brackets, and Spencer's code can be compiled to keep this in or eliminate it, making the code non-standard.

Incidentally, it's unfortunate that the ANSI C standard committee didn't take regular expressions onboard when that standard was defined. Had they done so, regular expression matching would have been an early part of the Windows world. I suspect that Henry Spencer's publicly available regular expression library will port into Windows, although the compilation environment is very 'Unix' and you may need to create some of the header files on a Unix system.

Compilation and execution

There are two stages to using the regular expression routines in a program. First, you need to compile the expression, taking the string representation and converting it into an internal form. You do this with `regcomp`:

```
struct regex_t regex;
if (regcomp(&regex, "START OF HEADLINE",
            REG_BASIC|REG_ICASE)) {
```

The statement compiles the regular expression `START OF HEADLINE` using the data structure `regex` to store its results. The last parameter is a set of flags which condition how the expression is to be used. Here we are asking for a 'basic' regular expression (and not an 'extended' one) but we are also asking for a match which ignores case so that the string will pick up 'Start of Headline' and other possible case variations.

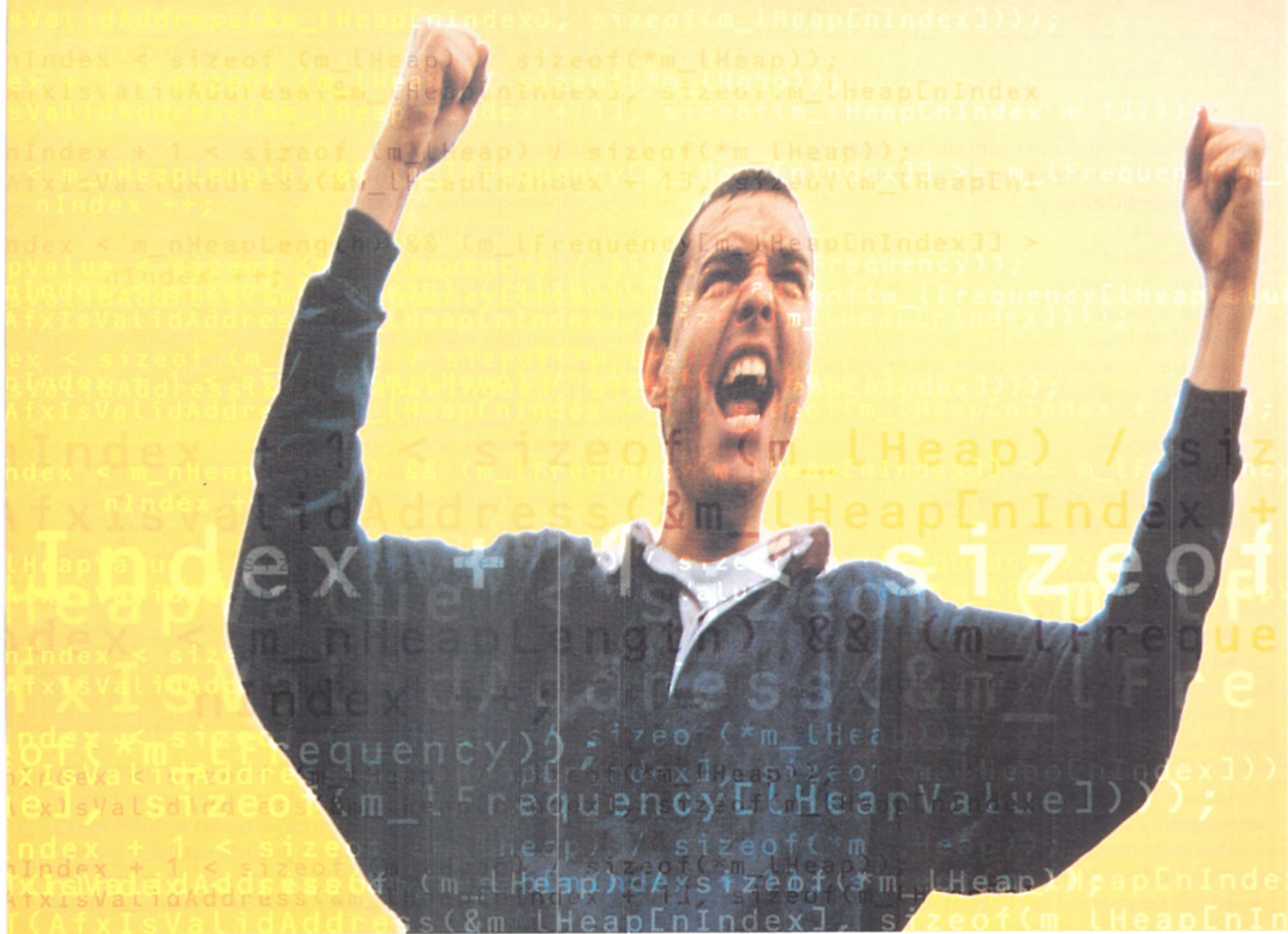
It is worth pointing out that the API is designed to be thread safe. Once the expression has been compiled into the destination structure that structure is left untouched, so that it can be used safely in different threads. The `regcomp` routine returns success or failure, 0 for success, and non-zero for failure. If an error value is returned, this can be decoded into a human readable string by use of the `regerror` routine.

Having compiled the regular expression, we can then use it.

```
if (regexexec(&regex, buffer, 0, NULL, 0)) {
    /* failed */
} else {
    /* success */
}
```

The `buffer` variable points at the line we are searching and the data is assumed to be a null terminated string, it doesn't have a terminating newline. The value returned from `regexexec` will be zero for suc-





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cess and non-zero for failure. An unsuccessful match is returned by the error value `REG_NOMATCH`.

Well, in our news headline example, we can use the regular expression code to search each line for the start and end markers, by first compiling two regular expressions and then testing each input line with `regex`. We have the ability to find the strings anywhere in the line and we can write an expression which allows for variable spacing between the words without making the code any more complicated:

```
START[ \t][ \t]*OF[ \t][ \t]*HEADLINE
```

This matches `START`, followed by one or more spaces or tabs (this is a C constant string so backslashed characters work) followed by `OF`, one or more spaces or tabs, and finally `HEADLINE`. The apparent duplication of the `[\t]` is due to the star operator. The expression `[\t]*` matches *zero* or more sequences of spaces or tabs, but we want at least one space or tab, so we explicitly have to state this. In recent times, regular expressions have adopted the `+` operator to mean *one* or more repeats of the previous character. In Perl (and several other utilities) we could write:

```
START[ \t]+OF[ \t]+HEADLINE
```

Extracting text

Having got this far in the story, it occurred to me that regular expressions could be used to extract text as well as find it. If I opened the file, sucked it all into memory as a single string, then I could use a single regular expression to search the whole file for the headline. In fact, the easiest way to access the whole file is to use the `mmap` system call to connect the file into the address space of the process. We then need to turn the file into a string, and can do this by replacing the last character with a `NULL`. The last character will be a newline character anyway, so we don't mind about doing this.

Regular expressions have always had a method of specifying that certain parts of the matched string should be stored. A basic regular expression, like:

```
\([a-z][a-z]*\)
```

will match one or more sequences of lower case letters, and store the sequence which is matched. We indicate the sequence which we want to match by placing it inside `(...)` delimiters. We can pick out several sections of the matched string using several bracketed sections. There is normally an upper limit to the number of sections which a utility is prepared to store. Often the limit is nine. With extended expressions we drop the backslashes and just use plain `(...)` sequences. If we plan to use extended expressions in our example, then a simple sequence to match the headline is something like:

```
HEADLINE -->(.*?)<-- END OF HEADLINE
```

This is constant section `HEADLINE -->`, followed by anything (dot-star) but placed in round brackets so that the data which is matched is stored, followed by another constant `<-- END OF HEADLINE`. In reality, we would want to improve on the variability of the match, coping with newlines which may appear after and before the start and end markers.

To make all this work, we use the parameters in the `regex` command which were `NULL` or zero in the previous example. We compile the statement into the `regex` structure using the flag `REG_EXTENDED` to `regcomp`, and say something like:

```
regmatch_t pmatch[2];
if (regex(&regex, buffer, 2, pmatch, 0)) {
    /* failed */
} else {
    /* success */
}
```

The `buffer` variable now points to the whole file connected in memory.

The results of the match are returned in the `pmatch` array. Each `regmatch_t` structure contains at least two values: `rm_so` and `rm_eo`, which are respectively the byte offset of the start of any match and the offset that's one byte after the end of any match. The offsets are measured from the start of `buffer`.

The `pmatch` array must contain at least two entries because the zeroth value points to the string which is matched by the whole regular expression, and the next entry in the array contains the pointers for a bracketed section. This obviously allows you to have more than one bracketed section and deal appropriately with the separate strings which are matched.

Well, coding this is quite easy and the code needed to find the headline is small. After all, most of the hard work is done in the regular expression routine which is now called only once per news file, scanning that file for the data.

Reality strikes

All this worked well on my Sun, but when I moved the code to my BSD/OS machine which houses my web server the program was noticeably slower. About 6 or 7 times slower, in fact. It seems from a comment in the header file that the regular expression routines on the Sun Solaris system have been coded by MKS while the code on the BSD/OS machine is Henry Spencer's. Looking at the manual page for Spencer's routines, it does say that the code is slow and needs recoding. I suspect that the above example fits into the worst case scenarios which he mentions.

I decided to put the code into Perl and see how that did. The Perl code works in much the same way as the C code. (I have omitted some failure checks from the example below.) We first read the file into a variable:

```
open FIN, "file";
$file = join('', <FIN>);
close FIN;
```

We then use a regular expression to pick out the data:

```
$file =~ m/HEADLINE -->(.*?)<-- END OF HEADLINE/m;
printout($1);
```

Perl's regular expression syntax is perhaps the most fully developed set that's around today. There are two main statements which use it: the `match (m)` statement which I've used above and the `substitute` statement (`s`):

```
s/old/new/
```

This borrows its syntax from the old command which was found in `ed`, made its way into `sed`, and from `ex` into `vi`, and from there to many other editors. Even the DOS `EDLIN` has this statement, I seem to remember.

Neither of the Perl statements have an argument which supplies the string to be searched. In original Perl, you were supposed to set the magic variable `$_`, so the `m` and `s` statements operated on a hidden variable. These days, you tend to use the somewhat confusing `bind` syntax:

```
$variable =-
```

which tells Perl that the source string is in the named variable. This is confusing because it looks like an assignment statement. True, it





will behave like an assignment statement for the substitute command, changing the source variable. But for the match command, the syntax only tells the command where to find its source, and the contents of the source string are left untouched. I initially found this somewhat counter-intuitive.

For both the match and substitute statements, you can pull out substrings from the matched regular expression by using the bracket syntax. You will find that the statement will then cause the variables \$1, \$2, etc. to be set to the value of the appropriate bracketed section. This is what is happening in my example. The headline will be found in the file and placed in the \$1 variable.

There is one more little bit of magic in the example. The `m` at the end of the match statement conditions the way that the statement treats the source string. The letter `m` tells the match statement that the source string is to be treated as a

multi-line string, so newlines are treated like any other character. And we can place `\n` sequences in the regular expression which will match a single newline character.

How did this do? Well, this script performed as well as the Sun version written in C, and was only very slightly slower than the finite state approach which was coded using `strcmp` to find the headlines. On the BSD/OS machine, the Perl script was 12 times faster than the

equivalent C program using Henry Spencer's regular expression routines, and this is significant. You can see the difference in speed.

The Perl script is certainly easier to write than the corresponding C code, and is certainly more portable. This reflects the fact that considerable work has been put into making Perl's regular expression code work efficiently.

It seems that making the assumption that scripts are always likely to be slower than a compiled program is not necessarily correct. The key thing to worry about is the algorithm which is used to achieve the result. This finding should not put you off thinking about using regular expressions in your C or C++ programs, because the functionality which you freely obtain for pattern matching can outweigh any problems. It's true the specific headline example which I am using happens to work poorly on certain implementations, but had the start and end markers been smaller then I think that things would have run faster.

Where to get things

If you have a Unix machine then the regular expression routines should be available to you. The Free Software Foundation has a version of the POSIX regular expression code that I haven't looked at for this article (consult your local GNU repository). Henry Spencer's code is available from <ftp://ftp.zoo.toronto.edu/pub/regex.shar>. This is a shell file, which you need to run through the Unix shell to unpack. You will also need a Unix shell and some other utilities to generate the header files. ■

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

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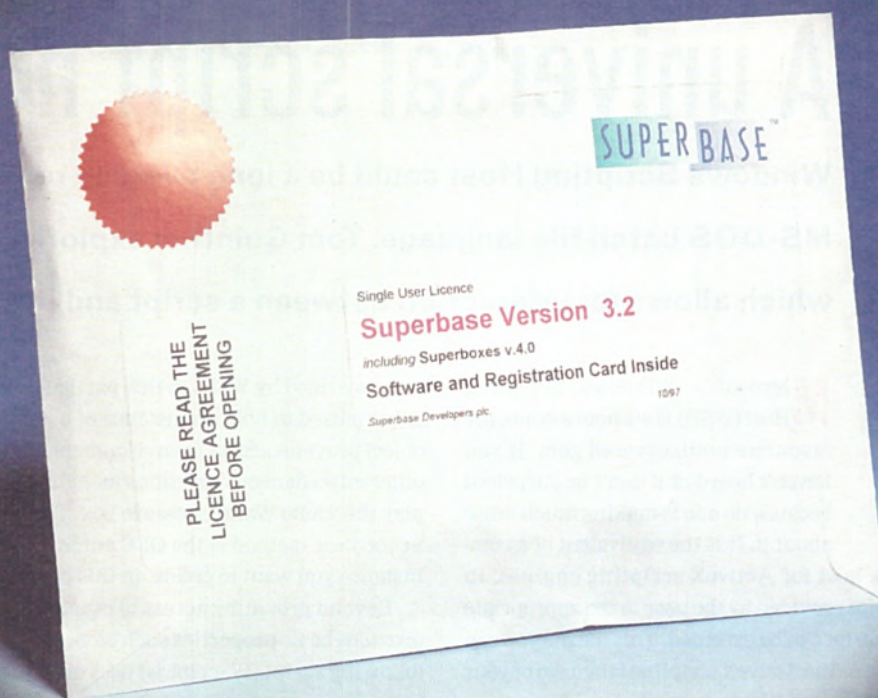
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SUPER BASE



A universal script host

Windows Scripting Host could be a long overdue replacement for the MS-DOS batch file language. Tom Guinther explores the object model which allows for interaction between a script and its environment.

Microsoft's Windows Scripting Host (WSH) is without a doubt my favourite undiscovered gem. If you haven't heard of it don't be surprised because no one is making much noise about it. It is the equivalent of a command shell which acts as a host for ActiveX scripting engines. In essence, WSH connects a script provided by the user to the appropriate scripting engine so that the script can be executed. This means you can execute JavaScript, VBScript, or the ActiveX scripting language of your choice, directly from a console or the Windows shell.

Although this is useful functionality, if you have any familiarity with COM or ActiveX programming you probably realise that you could implement this basic functionality in a day or two. If that is the case than why all the excitement? Good question. The answer is that WSH goes beyond the core functionality of executing script, providing a basic object model which allows for sophisticated interaction between the script and its environment. Although the object models are completely different, the relationship between script and the WSH object model is in principle the same as the relationship between script embedded in an HTML document and the object model exposed by the browser.

Before we go any further let's take a look at the following JavaScript example (HelloWorld.js) which uses the WSH object model to create the ever popular 'Hello World' message box.

```
var OKOnly = 0;
var InfoIcon = 64 ;
var WSHShell = WScript.CreateObject("WScript.Shell");
// Hello World for WSH and JavaScript
function HelloWorld()
{
    WSHShell.Popup
    (
        "Hello World from WSH and JavaScript!",
        0, // timeout (0=infinite)
        "Hello World",
        OKOnly | InfoIcon
    );
}
// call the function and exit
HelloWorld();
WScript.Quit();
```

Executing this example script is as simple as double clicking on the JavaScript file (HelloWorld.js) from the Windows shell, or executing 'cscript HelloWorld.js' from a console window. For more information on obtaining, installing, and using WSH see *How can I get the Windows Scripting Host?*

You will notice that a variable WSHShell is initialised by the statement WScript.CreateObject("WScript.Shell"). The WScript object is the WSH object model, acting as the gateway to the function-

ality provided by WSH. In this particular case, the WSHShell variable is initialised to hold an instance of a WshShell object. The WshShell object provides access to environment variables, the registry, and a few other miscellaneous functions including the Popup method used to display the 'Hello World' message box. The parameter passed to the CreateObject method is the OLE automation program ID for the type of instance you want to create, in this case WScript.Shell.

Beyond providing access to other object types, the WScript object provides basic properties such as Version and ScriptFullName. The following script (WScript.js) uses all the general properties provided by WScript.

```
var WSHShell = WScript.CreateObject("WScript.Shell");
// main script body
{
    WScript.Echo("Welcome to " + WScript.Name +
        " version " + WScript.Version );
    WScript.Echo("Executing script " +
        WScript.ScriptName + " (" +
        WScript.ScriptFullName + ")");
    WScript.Echo(WScript.Name +
        " is executing from " +
        WScript.FullName + " in " +
        (WScript.Interactive ?
            "interactive mode" : "batch mode"));
    var args = WScript.Arguments ;
    WScript.Echo("You passed " + args.length +
        " arguments" );
    for (i=0 ; i < args.length ; i++)
    {
        WScript.Echo("arg #" + i + ": " + args.Item(i));
    }
    WSHShell.Popup("Script Complete");
    WScript.Quit();
}
```

The following is the output of the WScript.js script:

```
C:\WSH>cscript Wscript.js testing 1 2 3
Welcome to Windows Scripting Host version 5.0
Executing script wscript.js (c:\WSH\wscript.js)
Windows Scripting Host is executing from
C:\WINNT40\SYSTEM32\CSCRIPT.EXE in interactive mode
You passed 4 arguments
arg #0: testing
arg #1: 1
arg #2: 2
arg #3: 3
```

The WScript.js example makes judicious use of the Echo method to display output to the console window. If WScript.js is run from the Windows shell then each output string will be displayed in a separate popup message. Along with the basic WScript properties, the number and value

of each argument passed to the script is displayed. Access to arguments is provided by obtaining a `WshArgument` object via the `Arguments` method. Finally, for exhibition purposes the script terminates using the `Quit` method, which will specify an exit code of zero (0) – optionally, an error code can be used, for example `Quit (-1)`.

WSH also provides the ability to execute external programs via the `WshShell.run()` method and you can create and manipulate Desktop shortcuts (`WshShortcut`) and URL shortcuts (`WshUrlShortcut`). For system administrators writing login scripts, the `WshNetwork` object is provided to allow enumeration, mapping, connection, and disconnection of network drives and printers. The examples provided with WSH show most of this functionality in action, but I wrote the following script to create two URL shortcuts to the Microsoft scripting sites mentioned in the sidebar. Note that the script uses the `SpecialFolders` method of `WshShell` to find the path of the Windows Desktop folder. When the shortcuts are created they will appear on the Desktop for easy reference.



```
// main script body
{
    var WSHShell =
        WScript.CreateObject("WScript.Shell");
    // Read desktop path using WshSpecialFolders object
    var DesktopPath =
        WSHShell.SpecialFolders("Desktop");

    var urlLink = WSHShell.CreateShortcut(DesktopPath
        + "\\Microsoft Scripting Site.URL");
    urlLink.TargetPath =
        "http://www.microsoft.com/scripting";
    urlLink.Save();
    var urlLink = WSHShell.CreateShortcut(DesktopPath
        + "\\WSH Documentation Site.URL");
    urlLink.TargetPath =
        "http://www.microsoft.com/msdn/sdk/inetsdk/
        help/wsh/wobj.htm";
    urlLink.Save();
}
```

Goodbye DOS batch files

In case you hadn't guessed by now WSH is an obvious and long overdue replacement for the MS-DOS batch file language. The documentation provided with WSH alludes to this but places more emphasis on the use of WSH by system administrators. One of the primary reasons that WSH could replace MS-DOS batch files is that it is fully extensible via ActiveX. Secondly, it is obviously very appealing because it is a universal script host, which is to say that it is language independent. While Microsoft provides ActiveX scripting engines for VBScript and JavaScript, third parties are already, or soon will be, releasing your favourite scripting language for use with ActiveX scripting hosts.

Scripting.FileSystemObject

Recently, on a project I have been working on for quite a few months, I reached that critical point where the number of sub-projects and relationships grew too large to build each component manually. What I needed was a build system. My thoughts turned to writing a batch file system. Although this seemed logical, inside I was grimacing, as I would rather poke myself in the eye than write batch file code.

I thought I would research into how I could use JavaScript instead. I knew that WSH was one key part of the equation, but I wasn't sure

How can I get the WSH?

If you are already using the widely distributed beta version of Windows 98 or Windows NT 5.0 then you already have WSH, because WSH is a standard component of these future operating systems. If you're still using the tried and true Windows 95 or Windows NT 4.0 then you need to download WSH from the scripting area on the Microsoft website, <http://www.microsoft.com/scripting>. This area contains a lot of cool stuff related to ActiveX scripting and you may want to grab the latest version of the JavaScript and VBScript scripting engines while you are there.

One thing you should be aware of is that the documentation provided at the aforementioned site is out of date. You can find updated documentation at the following URL

<http://www.microsoft.com/msdn/sdk/inetsdk/help/wsh/wobj.htm>
but there is no easy way to download the full WSH reference.

that JavaScript had the facilities to do the types of operations I would need. However, thanks to the ability of JavaScript to use objects, including objects of the ActiveX type, there was no need to worry.

It turns out that the latest versions of the Microsoft scripting engines include quite a few objects which expose the entire file system in an elegant, object-oriented way. The root object `Scripting.FileSystemObject` provides access to files, folders, and drives. You can create an instance of a file system object as follows:

```
// JScript 3.1 file system helper object
var FileSystem = WScript.CreateObject(
    "Scripting.FileSystemObject");
```

Once you have one of these objects you can do just about anything you can imagine, including copying, deleting, creating, moving, opening, and enumerating files and folders. You can easily access and extract filename components such as drive, path, file name, or extension, as well as query information about the existence of files, folders, and drives. Finding information on drives is trivial, including available disk space, total disk space, drive letter, and the type of file system on the drive.

Given the ease of use and flexibility of JavaScript, combined with the `Scripting.FileSystemObject` functionality (not to mention great WSH functionality such as `.Run()`, `.Popup()`, `.Echo()`, `.Environment`, and `WScript.Arguments`) I was sure that I could implement a great build system without using any batch file code at all.

Alas, there was one piece of functionality which didn't seem to be available in any shape or form. I spent hours online unsuccessfully searching for the 'easy' answer. What was standing in my way? Simple. I was unable to find any way of obtaining or changing the current working directory. Had I come all this way to suffer this defeat?

No. Being so close to the brass ring my giving up was not an option. The obvious solution was to create an ActiveX automation control which could get and set the current directory. Setting out to do this I was quite surprised that in 30 minutes I had a fully written and tested automation object. How I wrote the automation object is a story for another time, but until then I have included my automation object, a registration file, a `readme.txt`, and the sample scripts from this article on EXE OnLine. Until next time, enjoy!

Tom Guinther is working for Vireo, a company developing device-driver tools. He can be reached via email at 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/9804_Java.

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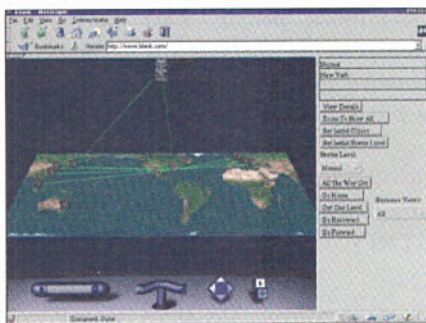
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The art of turning from C to C++

After Knuth, PlayStations, and the ACCU conference, Francis Glassborow turns his attention to the ternary operator and identifies a potential trap in the precedence of assignment.

I suppose that it might be considered churlish to complain about the continued slippage in publishing the new editions of the first three volumes of the classic work *The Art of Computer Programming*. But I really want the author, Donald Knuth, to deliver the 1st edition of volume four and five as soon as possible. The 3rd edition of volume two – *Seminumerical Algorithms* (ISBN: 0-201-89684-2) – is now out.

There are rather more changes to this volume than there were to volume one. In several places the author marks items as work in progress and I think that this is the main problem with delivery. As he moves from the deep fundamentals to more advanced aspects he faces increasing change and no draft is ever up to the minute.

Seminumerical Algorithms is a vital study for anyone interested in pseudo random number generators and general arithmetic (it includes an interesting ultra-fast integer multiplication algorithm which is probably of no practical use). Keep in mind that this work is not written for a commercial application programming level but is about the fundamentals on which good programming is built.

One interesting change between the 2nd and 3rd editions is that the tables of good values for pseudo random number algorithms have changed because of the preponderance of 32- rather than 36-bit systems. I wonder how many programmers realise that the choice of values is so sensitive to the underlying hardware architecture?

A second change is that in the few places where the author uses a high-level language, C has replaced Fortran. And I note that many more names in the index are written in the script of the person's native language. This leads to the question of why has he written his own, and his children's names, in Chinese?

Games programming

In the world of magic – conjuring, for example – the trick designer is rarely the performer. The ability to design new tricks is a talent that is rarely associated with the ability to perform to an audience. The same applies in many creative fields. Unfortunately, the computer games industry often fails to recognise this. They know that they need good games play and creative ideas (well, some do) but seem to think that this means a requirement for creative programmers. I think that is a mistake.

However, if you think you have the creativity to design a new game and the coding ability to implement it then you should investigate Sony Interactive Entertainment's Yaroze product. It comes with all you need to start exploring game development for Sony's Playstation. You need a PC and a TV and plenty of enthusiasm. And you would probably be advised to buy a copy of the special version of CodeWarrior which provides rather better support than the tools and copy of G++ (GNU's C++) which come in the box.

If you want to know more either call Sony Computer Entertainment Europe (0171 447 1600) or check its web page (<http://www.scee.sony.co.uk/>).

European C/C++/Java Developers' Forum 98

This year ACCU's conference is being held at the Oxford Union on September 11th & 12th. The inclusive (food, tax, etc) cost to members is being kept at £99.90 for the two days. Non-members will have to pay a bit more (or become members). For now, just put the dates in your diary so that you will not miss it.

While the talks and seminars will be excellent (I'll tell you more about the line-up of speakers another time) the most valuable thing about attending conferences is the chance to meet other like-minded people. Last year's event hummed in the intervals and throughout the reception. I have every reason to expect that the same will be true this year.

Last month's problem

And now to the substance of this column. Last month I set you a problem to consider: 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;
}
```

The problem line is the one containing the conditional expression. In order to understand it you must be able to parse the complete statement. To do that you need to know the precedence of the operators. You probably know that the precedence of all assignment operators is the same and that they are evaluated right to left. If you are a C programmer you will also know that the conditional operator has a higher precedence than assignments. If you are a C++ programmer you may not be so certain.

Hidden in that previous paragraph is an over-simplification. In general, languages are defined by grammars and the concept of 'precedence' is a consequence of the way in which most grammars are written. Nowhere in either C or C++ is the concept of precedence actually defined. It is referred to in footnotes because the writers believe that it can be deduced from the syntax (formal grammar). In the case of C they are correct. Let me apply the rules and see what results. The first two operators are ^= and ? :. The rules say that the first operand of ? :



must be a logical-OR expression. The simplest sub-expression which meets this requirement is '4'. We can start parsing the statement:

```
i ^= (4 ?
```

Between the ? and : we need an expression. That includes an assignment expression, which means we can continue:

```
i ^= (4 ? (i &= 7) : i
```

The C grammar requires that the third operand of a conditional operator be a conditional expression (no, that does not require the use of a conditional operator, it is part of a hierarchy; a conditional expression includes logical-OR expressions which include logical-AND expressions and so on). This means that the complete parse must be:

```
i ^= (4 ? (i &= 7) : i) |= 4;
```

We must consider the type of `(4 ? (i &= 7) : i)`. According to the rules for C, assignment expressions return an rvalue, and a free-standing variable also evaluates to an rvalue. This means that `(4 ? (i &= 7) : i)` returns an integer rvalue. But that is no use as the first (left-hand) operand of an assignment operator. This means that `(4 ? (i &= 7) : i) |= 4` generates a syntax error in C. Do I hear you grumbling that I cheated by asking about a program which cannot be compiled? Look again, where did I claim that this was a C program? Let us try C++ and we will come across some surprising differences.

It is easy to miss the first vital change with a casual glance at the formal grammar. However, if we look more carefully we will notice that the third operand of a conditional expression in C++ is an assignment expression. This has a dramatic effect. It means that the scope of a conditional operator in C++ has been extended so that it 'consumes' trailing assignment operators. The initial assignment operator is still dominated by the conditional operator but the trailing one is embraced by the conditional too. We must parse the statement as:

```
i ^= (4 ? (i &= 7) : (i |= 4));
```

There are no C++ syntax errors in this statement. We can say what the program does.

It first collects an integer value from `stdin`. It then performs an exclusive bitwise OR with the result of masking out all but the three lower order bits of `i` and prints out the result. This is equivalent to zeroing the three low order bits of the original input value. Because of the sequence points in the conditional operator (see last month's column) the statement does not exhibit undefined behaviour. However, be careful of simplification to:

```
i ^= i &= 7;
```

That does have undefined behaviour. There is an attempt to assign to `i` twice between sequence points (the only ones present are those at the end of a complete expression). You must simplify it the whole way to:

```
i ^= i & 7;
```

which is the simplest portable way of masking out the three low order bits of an integer.

Ambiguous precedence?

Strictly speaking, there has been no change to the actual operator precedence and the table on page 121 of *The C++ Programming Language, 3rd Edition* is wrong. (I believe that later printings will revert to the earlier ordering.) What has changed is the scope of the operator. In practice this looks very much like a change in operator precedence and it takes considerable thought to realise attempts to describe it in such terms are doomed to failure. What we have to recognise is where the conditional operator ends. Unlike other operators it does not end at the first operator of lower priority. It isn't the only operator to behave like this but the others, such as `()` and `[]`, have visible terminators.

Something more

You may wonder what the designers of C++ were trying to do when they changed the rules to create this surprising position. The first thing which must be recognised is that any changes they made had to be such that valid C programs would continue to compile to do the same things. After hours of threading through the C++ grammar, I believe that the changes made in this area meet this constraint. However, I am not going to stake my life on it because I have seen too many experts trip over when interpreting this area. I have the advantage of having seen their mistakes.

The big change was motivated by the desire to allow the conditional operator to return an lvalue. At the time that the change was made assignment expressions returned lvalues in C++ while free-standing variables returned rvalues (this was recently changed so that a free-standing variable is evaluated for an lvalue, ie the stored value is not fetched).

The desire to make this change to the conditional operator was motivated by a number of low-level idioms which would normally be buried deep inside the implementation code for a class. But let me give a trivial example of what the change was intended to support.

```
inline T & max ( T t1, T t2 ) {
    return t1>t2 ? t1 : t2;
}
```

If we stick to the C rules, this fails because the conditional operator will return an rvalue which can only bind to a value or `const` reference return. Making the simple change so that this function works as expected opens up the floodgates. Once we allow the conditional operator to return an lvalue we allow such things as:

```
i > j ? i : j = 4;
```

and we have to decide which the programmer should mean:

```
i > j ? i : (j=4); or (i > j ? i : j) = 4
```

I suspect that the final choice was motivated by making

```
i > j ? i = 4 : j = 5;
```

do what seems reasonable; in other words make the second and third operands behave as similarly as possible. With the changes which were made, the following two statements behave alike.

```
i > j ? i = 3 : j = i;
```

```
j <= i ? j = i : i = 3;
```

Once we have got this far we are caught in the trap that the relative precedence between assignments and conditionals will depend on where the assignment occurs, either that or break a ream of C source code.

As we see, entirely reasonable steps lead to surprising consequences. C++ has paid heavily for remaining consistent with C. Java programmers might say that the price was too high but then I think that by using C like expressions Java has paid another high price, possibly too high a one.

This month's problem

Does it matter that `i;` is evaluated as an rvalue in C and an lvalue in C++? Of course the answer is less obvious than you might think. ■

Association of C/C++ Users subscriptions: individual £15, student £7.50, corporate £80, Overload & C++ SIG £30 (including ACCU membership). For further information and application forms write to Francis Glassborow, 64 Southfield Road, Oxford, OX4 1PA, call 01865 246490 or email francis@robinton.demon.co.uk.

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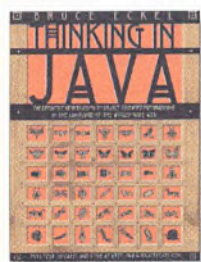
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Thinking in Java reviewed by Lloyd Blythen



To learn, teach,' runs the maxim. The insights Bruce Eckel gives in *Thinking in Java* (TIJ) go to prove it. To his new book Eckel brings years of experience of delving into programming languages and teaching them to developers – and he really knows his stuff.

Eckel's previous texts, on C++, benefited from his work on the language's standards committee. To that committee he brought an insistence on understanding why a language works as it does, and why it has strengths and shortcomings in certain problem domains. In *TIJ* he assumes that programmers share the same attitude, the better to help them exploit Java. It's a reasonable assumption, for Eckel took the laudable risk of placing successive drafts of *TIJ* on his website (www.BruceEckel.com) and inviting feedback from readers. The result is a huge – and hugely informative – tome, of 17 chapters and over 1100 pages.

TIJ is distinguished early by its chapter contents (helpfully introduced in a list of one-

paragraph summaries). Instead of slavishly opening with 'Hello, world!', which is relegated to the exercises, the first two chapters are given over to objects. Here, as everywhere, the emphasis is on how real software problems are approached and how to design clean solutions with Java.

Given how deeply *TIJ* considers its subject, it is agreeably easy to follow. Eckel introduces constructs, concepts, and keywords not so much to define Java as to impart a useful understanding of it. This eventually leads him to touch on design patterns, Java 1.2, threading, and other subjects of real interest to developers. He consistently examines limitations in Java, and explains where programmers need to be careful, and why.

There is plenty of source code in *TIJ*, all of it concise and helpful, and much of it useful. The first program, for instance, prints out system properties. Source is freely available in electronic form from Eckel's Website. No disk accompanies the book, but *TIJ* can be separately purchased on a CD which also contains seminar material.

Tradition demands finding fault with a book regardless of its excellence (in *TIJ*'s

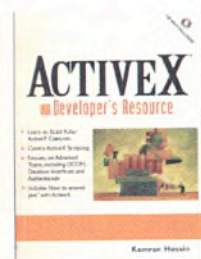
case, a call merely to nitpick). Here goes. The book is only sparsely illustrated, and although Eckel has a readable style, extra pictures might make it even easier to understand. For such a large volume the index is quite short, although this is offset by a detailed table of contents. There is no source-code index, and no index to the illustrations. But neither are there any notable omissions from the subject matter within *TIJ*'s scope; only my personal hobby-horse – the need for greater coverage of `CLASSPATH`, its implications and applications – rocks on gently.

I recently read an online lament that no text does for Java what Petzold's did for Windows; with the launch of Eckel's book, that complaint will be as outdated as non-portable code.

✓ **Verdict:** highly recommended

Title:	<i>Thinking in Java</i>
Author:	Bruce Eckel
Publisher:	Prentice-Hall
ISBN:	0-13-659723-8
Price:	\$36.95
Pages:	1152

Developing ActiveX Components with Visual Basic 5.0 reviewed by Gavin Smyth



This book is a real gem hiding under a rock. It was in my pile when I wrote the review of Visual Basic books in February's EXE but I discounted it at the time because the title suggested it was too specialised. However, it covers a lot more than ActiveX objects and overcomes two of my major complaints about most VB books. First, it repeats very little of the material included in Microsoft's online documentation (the author says in his introduction, 'I'll let you into a little secret: the Visual Basic 5.0 documentation is not bad at all'). Second, it is much more advanced than any other VB book I have read so far – little space is wasted describing the IDE or language syntax, for example.

Developing ActiveX Components with Visual Basic 5.0 starts with a little bit of history about ActiveX and touches briefly on object orientation. It then gets down to the serious business of developing and using ActiveX objects, and describes the similarities and differences between code components

(DLLs), servers (EXEs), controls, and documents. Along the way, there are discussions on, among other things: object lifetimes; events versus OLE callback functions; multiple process and thread issues; the Internet, including downloading, versioning, security, and licensing; and a brief comparison with component development in C++. There are the occasional plugs for other books by the author and software produced by his company, Desaware, but even these are not too intrusive.

Rather than just presenting a single answer to each problem, Appleman usually describes a number of approaches together with their advantages and disadvantages, giving the reader a good understanding of the associated concepts. He points out where there are problems with VB, including any bugs he has come across and any workarounds for them. Most of the examples are short and well explained, but there are two fairly substantial developments: a stock market price ActiveX server which monitors prices from the Internet; and a scrolling marquee control.

The writing style is very clear and follows a logical progression. Where there are forward references they are accomplished with little repetition of material.

The accompanying CD does not add very much to the book. In addition to the sample code, it has some demonstrations of Desaware products and a number of articles written by Appleman. The latter are quite interesting but not worth buying the book for.

The only faults I could find were the occasional slightly patronising comment and bad joke! Despite its relatively high price, this book should be on the shelf of every Visual Basic developer.

By the way, there are a few updates to the book on the Desaware web site, including a short 'extra chapter' on multithreading following improvements in VB as a result of Microsoft's Visual Studio Service Pack 2.

✓ **Verdict:** highly recommended

Title:	<i>Developing ActiveX Components with Visual Basic 5.0</i>
Author:	Dan Appleman
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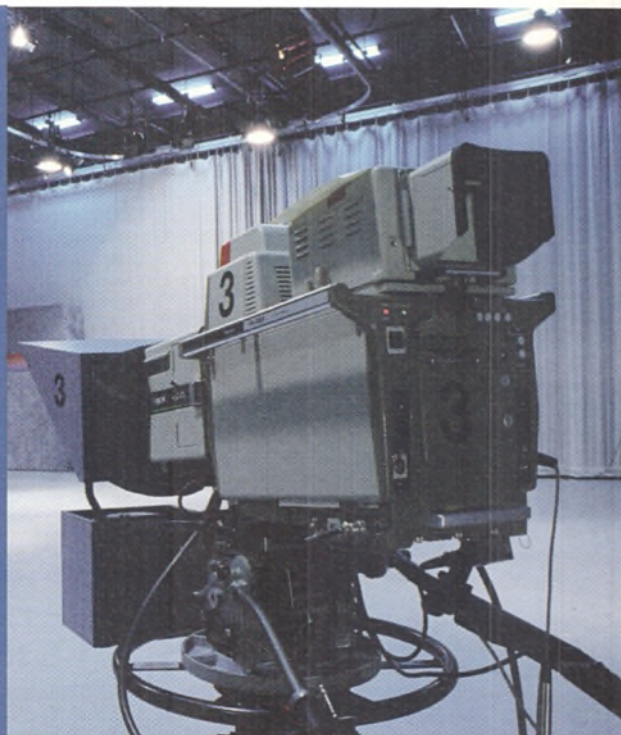
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If you like a challenge and want to work for a company on the leading edge of the graphics industry - this is the company for you! Ideally you will have experience of high level software development, C/C++ and OO. Any of the following would be a plus: OpenGL, Direct 3D, DirectX, DirectDraw, 3d/3D graphics, PC coding. You will be working on the next generation in 3D graphics, will work with people who are enthusiastic about their work, and will receive an attractive salary and great package.

GAMES SOFTWARE

Near Edinburgh grad level to £30k
My client aims to produce the best games in the world and has grown by 300% in the last year. They are currently looking for junior engineers with a good degree and C/C++, a knowledge of 3D graphics or image processing a bonus. They also require a games producer/team leader with a passion for games development and the ability to motivate, establish work priorities, manage projects, and have the confidence to achieve the high standards expected. In return my client offers an excellent atmosphere (no suits!) and interesting working, as well as a good salary and benefits package.

HIGH TECHNOLOGY HYPER-PERFORMANCE

London 30+ Positions
Graduates to Project Managers
£18K to £50K + bens

This high technology company leading the way in innovative mobile computing and telecommunications product development seeks high calibre Software Design Engineers to work on New product design. They also seek Project Leaders and Managers to be responsible for multiple projects both in house and for external clients.

You will need at least 1yrs post graduate C++/OOD design experience gained ideally in a real time development environment for all positions, for more senior positions (Team/Project Leader) either current experience gained at a similar level or excellent design experience and the ability and ambition to take on that responsibility.

An excellent salary and benefits package is on offer with real opportunity to enhance both your skills and career prospects working at the highest level of software design.

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Call James Hunt for details
Email: james@ash-associates.com

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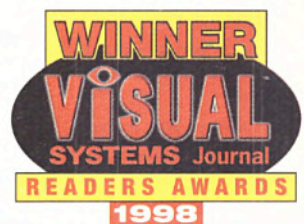
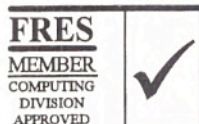
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Analyst Programmer

You should have a minimum of four years development experience including some analysis and design work. Our work is mainly based on the technologies listed alongside but whatever your background you must be keen to develop your skills to meet new requirements. Salary will be up to £40,000 plus overtime and profit related pay.

Software Engineer

You should have a minimum of one year's experience and a good degree. Our development projects offer the opportunity to work with up-to-date tools and techniques and develop your skills in new technologies. Salary will be up to £32,000 plus paid overtime and profit related pay.

To apply please send your cv with details of current and required salary to Mike Gibbons at:

Syslogic Limited, 8 Hanover Street, London W1R 9HF
email: jobs@syslogic.co.uk fax: 0171 290 2651

No agencies please

Syslogic

C/C++

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Manchester & Winchester

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- 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:

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Tel: 0161 448 2885 Fax: 0161 448 2886

E-mail: jobs@teleca.com <http://www.teleca.com>

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TELECA

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ProdDevelopment Manager - Reading - to £65k

Good bonus (up to 30% of salary) PRP etc, quality software house setting up new greenfield development operation - C++ OO Middleware and messaging so UNIX NT etc important - must have a customer orientated approach and global perspective, EU and US travel Good academic background proven experience and maturity a must

Software Engineer C++ - London - £20-50k

The role involves developing application software using OO A/D techniques, coding in C++ under a Unix platform. This telecommunications company are at the forefront of technology and therefore the right candidate must have at least 2 years relevant commercial experience in these areas on reputable projects. The Salary package is extremely competitive - you will be rewarded for your experience.

C++/Java Developers - London - to £60k +++

Again its an issue of good quality background, you may well have come from a C or Vb or assembler background, a minimum of 3 years experience is about right - very exciting role with lots of quick lifecycle proof of concept type of work - with a beady eye on new product innovations **Our client will take people with lesser experience** in this instant high quality academics would be more important!

MIS Manager DWarehousing - Bucks - £35-£45k

Plus a car & a bonus. Our Client is seeking to recruit an experienced MIS manager (5-6 years IT experience to lead a team of 4) developing Data warehousing applications in a client/server environment. This a "hands on" role requiring relational database experience, preferably Oracle and the usual desktop front ends.

Internet Consultant UKwide! - £30-37k + car

One of the leading consultancies in Europe (Microsoft's biggest 3rd party supplier) Offices UK and Europewide. It entails internet and intranet consultancy to corporates, large databases, and the web publishing of them! Not a coding role but sound technical expertise required, good interpersonal skills. Frontpage, Visual Interdev with NT. Firewall & security would also be beneficial.

Call Mike Dearing

DURNAN LINSTEAD

0171 235 6030 Fax 0171 245 6994

mdearing@cix.co.uk www.durnanlinstead.com

Directions

for Developers

Based Reading

When you're a developer, you occasionally reach a point where something isn't quite adding up. You're missing something, your deadline is approaching, and you need advice from an expert. So, you reach for the phone, or E-mail, or the internet. What kind of person do you want to be talking to?

Someone who knows more than you do. Someone who has been there and done it. Someone who spends their time tackling the thornier problems, the complex bits. A sounding board or technical mentor to bounce ideas off. Someone who, like you, has commercial experience combined with product expertise. But someone who has used that knowledge for a different kind of learning curve - involving inside knowledge, intensive training and exposure to new and cutting-edge products.

You could be part of this talented team. We're looking for energetic and motivated people with 2 years' experience of Visual C++ in a 32 bit windows environment; ideally with exposure to Microsoft Foundation Classes or knowledge of at least one other core technology. You're not a quick-fixer, but a dedicated problem solver who enjoys the challenge of continuously learning in a rapidly changing environment. You're eager to learn new things and are happy to share what you already know. You're excited by development using COM, internet, database, messaging or other leading-edge technologies on Windows NT, Windows 95 or Windows CE. Above all, you'll be committed to delivering complete satisfaction to our varied customer base and will be passionate about interacting with a wide range of people.

For the right mix of communication, technical and team working skills, we're offering an attractive salary and benefits package that includes relocation assistance (where appropriate) and stock options. So, if you want to change direction, please write with a full CV, including details of your present salary and quoting Ref: EXE, to Laura Comley-Smith, Strategic Selection Ltd, Index House, Ascot, Berkshire SL5 7EU. Telephone: 01344 636389. Fax: 01344 874103.
Email: natalieh@stratsel.demon.co.uk

For more information about vacancies at Microsoft visit our website www.microsoft.com/uk/jobs

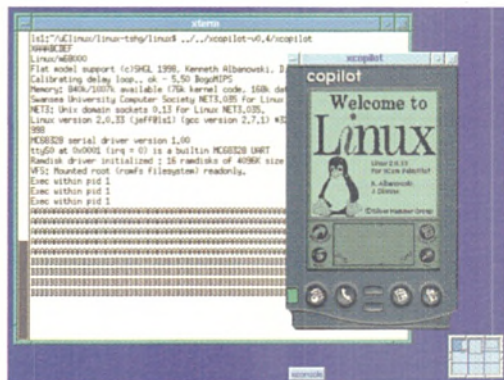
Where do you want to go
today?

Microsoft®

Y2K - it concerns your future

Most newspapers run a weekly scare story about Y2K and that trend can only increase until the fatal date. If you had the time, between reading all those old Cobol source files, to browse these stories you would, of course, notice that they all bitch about how programmers in the past twenty years have botched their job. Before considering any extreme measure you must be wary of another industry which will be hit badly by the infamous Y2K: tombstone engravers!

Let your screen saver blacken your screen's pixels and have a stroll in a nearby cemetery. You'll notice that it's not uncommon for husband and wife to share one tombstone. And this happens even when one spouse is still alive. The tombstone is then pre-inscribed with the birth date of the living spouse and, you guessed it, the first two digits of the probable year of death, ie '19'.



Linux in your pocket, a dream?

If you're a Linux aficionado, you might have despaired to see all your friends getting PalmPilot or Windows CE handhelds. The wait is nearly over! The Silver Hammer Group's programming team is working on a port of Linux 2.0 to systems without a memory management unit... and this includes the PalmPilot. The current pre-alpha kernel boots on the XCopilot emulator and on a real PalmPilot boosted up with additional RAM. To give them a hand go to <http://ryeham.ee.ryerson.ca/uCLinux/>.

Soldier of the future



Ctrl-Break sat comfortably on the sofa - with Jolt cola and pizza handy - to watch the TV program 'Soldier of the future'. It was hilarious. You'd expect the military, with all that money pouring in, to develop some really advanced stuff. Well, in the first five minutes, we witnessed the command centre (running Windows 3.1) crashing. Then the communication link (both audio and video) was lost, even though a van was driving after the soldiers with someone on the roof to reorient the aerial! When this happened, nobody knew if the soldiers were carrying good old fashioned radio equipment so they had to dispatch a humble foot soldier to run and call them back.

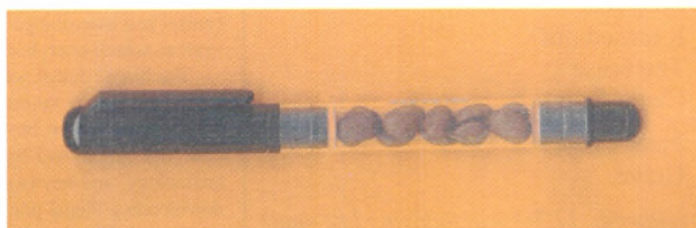
But that was the easy stuff. When it got technical - it still didn't work - really serious solutions were improvised: when the magnetic compass failed they just tried to turn it 180 degrees! When the GPS system failed they just looked around for the next signpost!

At that stage the army decided that it was a complete success, they had learnt a lot, would increase the budget, and would work on a new prototype. C'mon. Would a developer with a PDA and a GPS develop a working prototype for just under 500 quid... be charitable.

The freebie of the month

Perhaps Q is now working for KL? This month we bring you a special pen, courtesy of the KL Group - one that can make you a coffee, with simply a twist of the cap. Java coffee. Yes, those are Java beans. To help give you a caffeine shot of inspiration when jotting down Java pseudo code! James lent us his for the picture.

Next month, a small pencil sharpener, with a cleverly secreted coffee grinder! Q is busy as we speak.



Et tu, Gnome?

Private Eye is supplying material for MSN, Microsoft's Internet Service Provider. Oh, so that's all right then.

Microsoft and Mr William Gates III An Apology

IN COMMON with other magazines and newspapers, for many years *Private Eye* has represented Mr William Gates III as a ruthless, ambitious, and scary 'nerd', ruthlessly pursuing the aims of his company Microsoft using whatever ruthless means were available to him.

We now recognise that nothing could be further than the truth. Mr Gates is a gentle, understated, cultured person,

whose obsession with never releasing software unless it is absolutely tiptop quality has cost him many millions of dollars. *Private Eye* also wishes to salute his gentle handling of his commercial rivals, his clever exploitation of other people's ideas [*shurely 'his wondrous ingenuity and legendary programming skills' - Ed*], and the superb value of Microsoft BackOffice for BackOffices V6, which with its optimised SQL engine, Internet-capable ODBC integrated (*cont P94*)

Just fancy that

Hello, anyone here? I'm a P.I. from across the pond...and across the continent...San Francisco. Anyone care to share stories, tips, tricks?

(The actual first message on the MSN/Private Eye 'bulletin board')

St Cakes

Excel term is April 20th to June 2nd. There are 624 licensed Office users in the school. The annual First XV fixture against Cupertino has been scratched at the request of their headmaster Steve Jobs. Ballmer day will be held on May 3rd, and Gloating is from April 4th onwards. Parents of Exchange students are reminded that the play 'Death by Powerpoint' will be held in the Paul Allen memorial hut.

A cab driver in trouble

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



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

A Doctor writes Microsoft Content Providers

AS A DOCTOR I am frequently asked, 'Doctor, I have become a Microsoft Content Provider and now I can feel this tremendous pressure on my heart - what is it?'



This is easily answered. The condition, technically known as *Walletus Giganticus Swollenus* and colloquially known as 'billz-billz', is caused by selling out to giant software corporations. There is no need to worry, however, as most patients find the pressure soon goes away, together with their credibility.

POETRY CORNER

In Memoriam Private Eye's
Editorial Independence.

So. Farewell
Then

Private Eye's
Editorial Independence.

Keith's Mum thought
That grinding
Was her washing
Machine

On the blink
Again.

It turned out
The noise
Came from

Peter Cook's
Grave.

(*ejthribb_17.5@msn.toadying.like.mad*)

Cocklecarrot 'Netscape mad'

By Our US Legal Correspondent
Mike O'Softinthehead

A SHOCKED Supreme Court today heard Justice Java Cocklecarrot admit his preference for the Netscape Navigator Internet browser.

Justice Javascript told the court: 'Of course I use Netscape, which is rubbish. I never use Internet Explorer for browsing, even though I am stupidly cutting myself off from a huge number of unique and exciting features that work the way I do including HTML 4 and VB Script, plus many excellent and enjoyable channels that represent the future of online entertainment available from MSN and other ISPs. It is only the fact that I am completely insane that prevents me from recognising that Internet Explorer is the better product and is obviously a central and essential part of the Windows operating system, which everybody must be made to use.'

The biased Judge went on: 'I have always hated Microsoft for no rational reason. I am the sort of creep who went on buying Macs long after it was clear that Apple had been swept aside by superior technology, and anyway I only use the Internet for downloading illegal pornography.'

Internet Explorer is 4.02.

Glenda Slagg

Bill Gates, aren't ya sick
of him???

Coming over here with his boring whiney voice, his greasy hair and his Windows for Workgroups, no wonder he gets custard pie in the mush!!! Good shot Mr Belgian Bun!!?! Glenda says: put one on him from me!! Get back to America where you belong, you yawn-making Yank!!

Wadda guy!! Phwoooooaaar!!! Bill Gates - my best mate!!?! Rich, bright, handsome and rich too!!! He can handle my floppies any time he likes!

Hey cheer up Billionaire Bill - we don't give a spit about stupid Flems!!?! Glenda thinks you look Yummy!!! I would just love to be your custard tart - I'll lick the cream off you any time you want!!?! I'll soon turn your software into hardware, and if you want to handle my floppies [You have done this already - Ed.]





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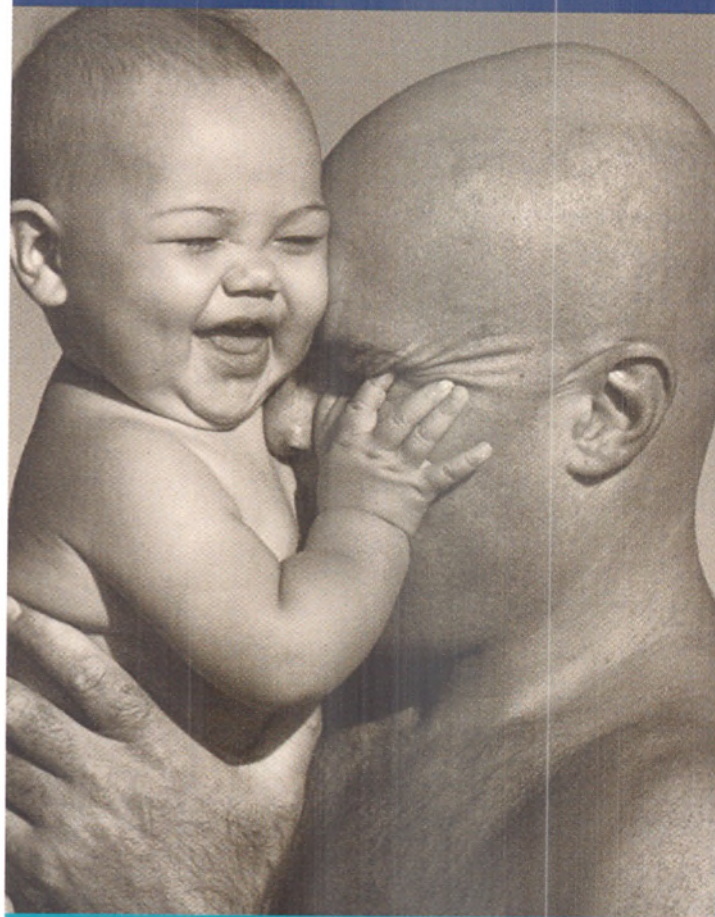
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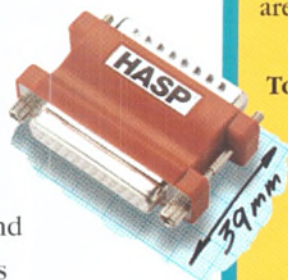
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