

EXE

AUGUST 1998

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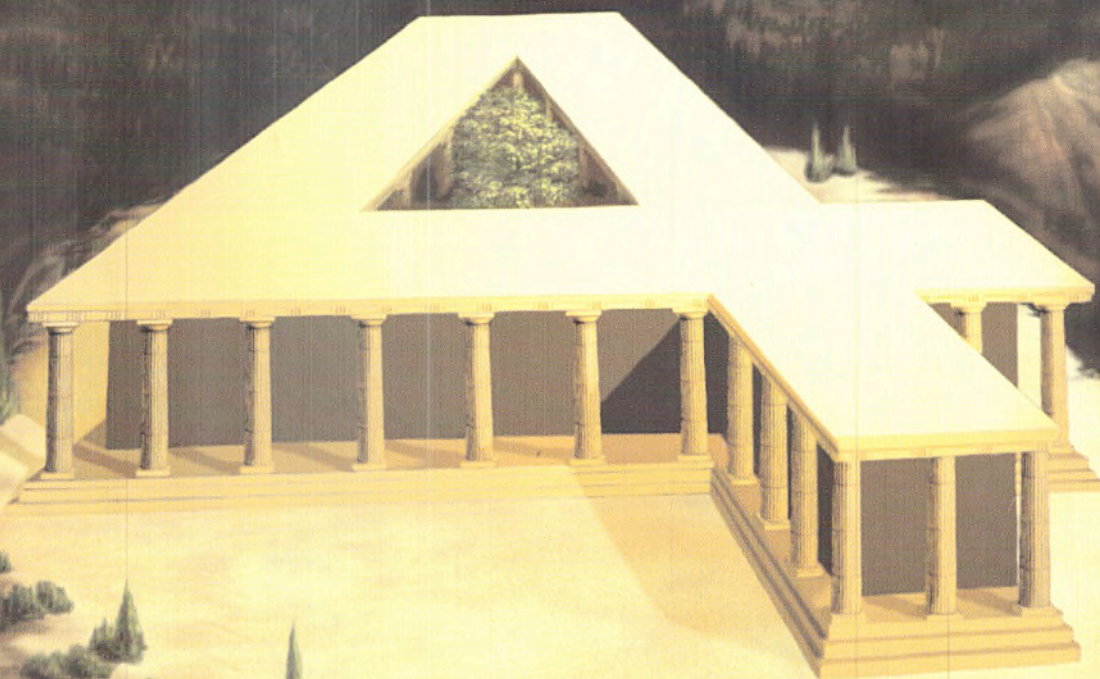
Delphi — now we are four

Mozilla:
source
matters

Events and
callbacks
in VB

C++
pointing
to danger

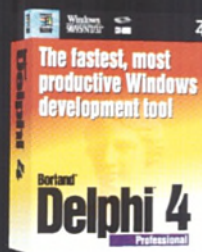
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Database guy





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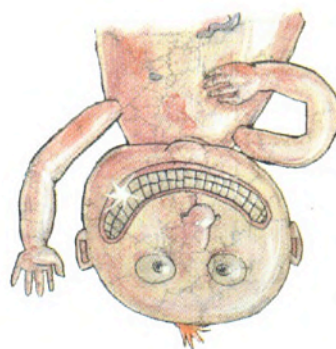
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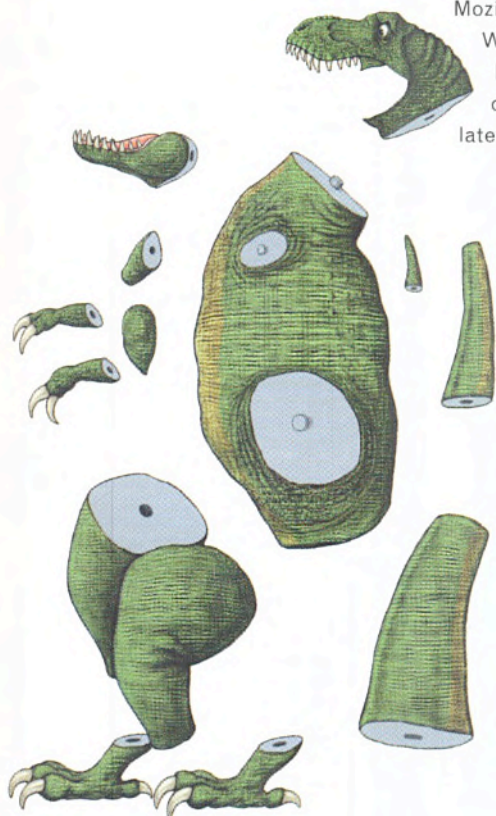
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News & Views

Delphi 4

Would You Like One Tool That Can Handle ALL Your Development Projects?

Delphi 4 is the most advanced development tool available for Windows 95/98 & NT. Whether you are writing desktop applications with local database access, client/server applications, multi-tier applications or web server applications, Delphi 4 can do it - and do it fast. You can now create CORBA objects as easily as COM objects, so Java clients can talk to Delphi servers (or vice versa).

RoboHELP 6.0

Do You Need to Create Windows 98 and Windows NT 5 Help Systems?

RoboHELP 6.0 Classic turns Microsoft Word into a full-featured authoring tool, making it easy to create Help files for Windows 3.1, Windows 95 and Windows 98 applications, along with 7 other major Help formats. It supports all Windows Help features while providing many enhancements to facilitate project management and improve productivity. RoboHELP 6.0 Office adds many other tools, including a native WYSIWYG HTML Help editor, specifically designed for Windows 98 & Windows NT 5.

PowerBASIC Console Compiler

Do You Want to Port Your DOS BASIC Apps to Win32?

PowerBASIC's new Console Compiler has a straightforward DOS interface but access to 2 gigabytes of memory and the entire Win32 API, including ODBC and Winsock. There's an inline assembler, support for threads, user-defined register variables, colour syntax-highlighting editor and integrated source debugger - it even catches General Protection Faults and takes you to the offending line of source code! Port all your existing PowerBASIC, QuickBasic, GW-BASIC and BASICA programs to fast, tight Win32 console applications. It's so easy to use, you'll find yourself using it for new projects as well - how else can you create a CGI executable for your web server as small as 10K!

Total VB SourceBook

Visual Basic Developers - Stop Reinventing The Wheel!

Total VB SourceBook is the ultimate Code Library and Code Repository for Visual Basic developers. It includes over 1,500 procedures containing 57,000 lines of fully-tested, fully-documented VB5 code that offers solutions to your most common application development problems. The Code Repository lets you store all your VB code in a central location, with multi-user access and full text searching.

SysTools 2

All Delphi and C++Builder Developers Should Find Something Here!

SysTools brings together over 800 popular routines for string handling, date and time math, high-precision math, new financial & statistical math, new Windows shell access, sorting, registry and INI file access, new Internet data conversions, enhanced container classes, and much, much more!

C-Cover 4.0

Are You Testing ALL Of Your C/C++ Applications?

C-Cover shows whether your tests are executing all of the statements in your program by inserting test probes into your source code. You can generate test cases faster by looking only at the untested parts of your application, and find defects you would not otherwise have found. C-Cover is easy to use, has a graphical report viewer and can test DLLs, multi-threaded code and device drivers.

INTERNET TOOLS

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A fistful of dollars isn't always enough



We all know about Y2K. We also know that no one outside the industry takes it seriously. To non-IT people the millennium problem seems ridiculously

overblown and little more than an excuse for computing professionals to demand huge budgets (and salaries).

Here's one easy way the problem can be trivialised. There is a Gartner Group report that says the global cost of Y2K compliance projects might reach six hundred billion dollars. Assuming an average programmer's salary across the world to be twenty thousand dollars (probably a generous estimate), six hundred billion equates to thirty million man-years.

Let's look at the work effort put into software development on this planet so far. The number of programmers in the USA has just hit a million, so let's say that worldwide there are five million programmers (another generous

estimate). Assuming a steady increase in programmer population from zero over the last thirty years this gives the total programming effort in the world to date as seventy five million man-years. Of the applications written over thirty years, let's say that one third of them, twenty five million man-years worth, are still running (yet another generous estimate). This means that to adjust the

Y2K projects may not be merely expensive: they may be impossible.

total global installed base of software for Y2K compliance will take longer than it took to write it in the first place. Can anyone seriously believe this?

Back-of-a-mouse-pad calculations like this, based on unsupportable guesses at figures, are pretty stupid. And in any case, if you actually read the Gartner report you will find that the six hundred billion headline figure includes a lot of stuff apart from programming effort. But it doesn't include litigation and damage – Capers Jones

estimates that these will bring the total to three point six trillion dollars! Nonetheless, we have to find a way of demonstrating the scale of the problem to non-technical managers that cannot be ignored or trivialised. Just quoting astronomical figures isn't good enough: no-one believes them. One point that may get through is that Y2K projects may not be merely expensive: they may be

impossible. Doomed to failure before they begin.

Here's one way it can go. You take an application that has been running satisfactorily, unchanged, for years. What do you have to do before you can start validating it? First problem – you have to find the source code. It may be lost, but let's assume you eventually find a dusty tape cartridge in a safe somewhere. Second problem – you have to read it. This isn't just a matter of finding an old cartridge reader that still works.

Tapes don't last forever. The magnetic oxide flakes off, particularly at the end where the extra thickness of foil distorts the curve round the spool. But let's assume you've managed to read the source code files. Third problem – you have to compile it. Put the source through the compiler (do you still have the version of the compiler from all those years ago?) and hope. Maybe it doesn't compile. But let's say it does. Big sigh of relief – the project can start.

But then you notice that the object file produced is a different size from that which you are running. It must have been the wrong version of the source code...

This is why Y2K projects are so frightening. It isn't just the programming workload and associated costs, it's the fact that whole thing may be impossible. You and I appreciate this – but do our bosses?

John Watson
Freelance consultant
jwatson@bcs.org.uk

References (worth reading):
Gartner Group: www.gartner.com
Capers Jones: www.spr.com

Dangerous laws



Software R&D has traditionally been linked to the army. Many important software

projects have been funded directly or indirectly by armies all over the world. Possibly the most well known source of this type of funding is the US Defense Advanced Research Project Agency (ARPA). Whether you approve or not of the eventual goals of the military, this has been tremendously beneficial to

the industry. These days I'm afraid the situation is not so good: military budgets have been reduced with the end of the cold war, and some industry groups and secret services are doing their best for some very restrictive legislation to be put in place. This can have an adverse effect on software development.

For instance, because of limitations on cryptography in many countries a lot of crypto work is moving to Australia. So far, restrictions on encryption have applied mostly to software; code published in books (without any accompanying disk), such as

the famous *Applied Cryptography*, could be freely exported outside the US. A recent judgement in Ohio ruling that computer programs are not writings protected by the US constitution because they are 'inherently functional' may jeopardise this limited freedom.

But much worse is on the horizon. Still in the US, the House of Representatives is close to passing a law already approved in the Senate, based on the World Intellectual Property Organisation (WIPO) treaty. If passed, this would make illegal the limited reverse-engineering

of software to ensure that programs are inter-operable. It would also be forbidden to trace through a program to discover where a bug lies or if the security is adequate. We would have to rely entirely on information provided by the vendors. Not only that but web users who disable or modify cookies could be declared criminals.

Since the WIPO is an international organisation, if the law passes in the US, we can expect other countries to create similar laws. Watch out, and protest while there is still time.
David Mery

What's code got to do with it?

Nothing! if you're using VideoSoft VS-OCX 6.0

VS-OCX 6.0 is the easiest, fastest way to add elasticity to your forms. Just add the new **ElasticLight** control to your existing applications and set a couple of properties. Your forms immediately and automatically become resolution independent. EGA, VGA, SVGA or whatever your users have, it doesn't matter! When the form is resized the ElasticLight control automatically resizes all of the controls on the form.

With its new grid metaphor, VS-OCX makes easy the design of complex forms. At design time the improved ElasticLight control displays a grid layout, and it is on this that controls are aligned. When the form is resized, all the embedded controls - and their fonts - will be resized proportionately. Splitter bars can also be implemented between controls to allow custom resizing at runtime.

VS-OCX has a small footprint and can be distributed without additional DLLs.

VS-OCX has been the top selling Visual Basic add-on since 1995 and in addition to ElasticLight includes two other controls, a flexible index tab and powerful parsing engine.

IndexTab - This makes it unnecessary to switch between forms! Several screens worth of data can be presented in the space of one by using notebook-style tabs. IndexTab is 3 times faster than the equivalent control in Visual Basic and also provides a much wider range of tab styles, including hidden ones.

Awk - This control is a high-speed string parsing engine. It now allows recursive evaluation of functions. This means that Awk's Val property can be used to calculate the value of a variable, which in turn, can contain expressions. This is ideal for spreadsheet-type calculations and for utilising indexed variables.

What's new in VS-OCX 6.0

- Resizes all controls including lines, shapes and labels
- New grid metaphor for easier resizing
- Smaller footprint ElasticLight control (40k)
- Multi-splitter bars on the same ElasticLight control
- Enhanced font resizing capability
- Easy deployment - no external DLL dependencies
- Enhanced IndexTab control
- Enhanced recursive Awk control

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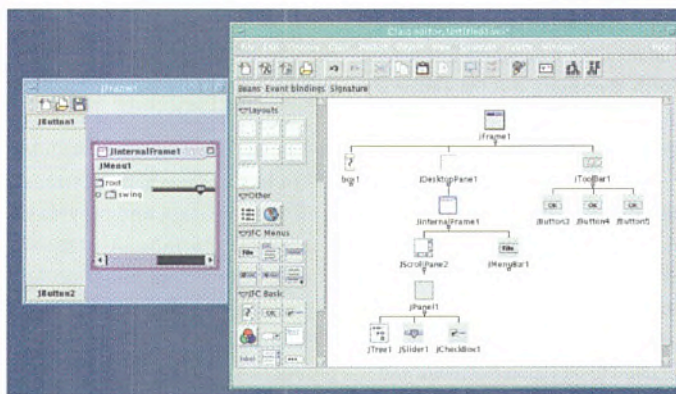


A changing Java visage

Visaj 2.0 for Java is a visual application builder for Java from Imperial Software Technology. It's written entirely in Java to run on Unix, Windows, and Macintosh platforms. This version supports JFC Swing components, a new set of layout editors, an image editor, graphical 'hot wiring' of events, and JavaBean serialisation. It is intended to complement existing Java IDEs by providing extra visual building capabilities.

The JFC/Swing support gives access to the full set of Swing components, with an option to load Swing as the default Visaj palette. This includes access to the built-in children of all Swing composite components.

A Swing Box Layout Editor complements this Swing support by allowing more complex layouts to be constructed visually, including visual representation of 'glue' and 'strut' components (there are layout editors for Gridbag, Border,



Grid, Card, and Flow layouts). The developer is always free to drop down into the code.

An Image Editor is itself implemented entirely using Swing and can read and write JPEG and GIF formats. Along with the standard functionality required for image design and editing there are features such as blur, texture, stylise, and distort filtering options.

Graphical event 'hot-wiring'

means the developer just draws a line between source and destination components in the Visaj containment hierarchy to invoke an event-binding wizard. Visaj also supports multi-argument methods and Bean properties passed as method arguments.

Visaj 2.0 Standard starts at £295 for the first licence and includes a year of support.

w www.ist.co.uk

In Windows or not in Windows

Soft Option for Windows, version 1.5, is a development tool that enables legacy IT systems to run as part of the Windows environment. The latest version improves integration with support for OLE and ActiveX controls.

It provides full 32-bit development and runtime modules, allowing software for a range of operating systems to become integrated within the Windows 95, 98, and NT environments. It enables existing software to assume the look and feel of a Windows package with data sharing capabilities with Microsoft Office.

ActiveX controls are supported by an ActiveX language helper, which provides automatic scripting assistance. The principal benefit of the OLE capabilities is the ability to drag and drop (DDE functionality was supported before).

The custom dialog workspace feature allows any ActiveX control, and most Soft Option for Windows controls, to be placed in a separate dialog box within any area of Soft Option.

URL data is also provided (automatically launching other software packages, such as email and browsers, from highlighted text and addresses within the body of other text). Soft Option for Windows allows the inclusion of URL data and functions within legacy systems.

Data binding is provided, permitting data from various sources to be drawn together into a single area. Data retrieval is normally via ODBC, but data bound controls are independent of the means of retrieving data.

The Soft Options for Windows interface is selectable at runtime: the user can choose between the original application and a Windows option.

w www.softoption.com

Testing by browser

Astra QuickTest is an icon-based functional testing tool for web and e-business applications. The tool, from Mercury Interactive, is designed to make testing as easy as using a browser. It captures business processes into a visual map to automatically generate data driven tests.

The user specifies an URL to start recording and the test is automatically generated as the user navigates through the application using a browser. All actions are represented graphically in a collapsible icon-based test tree. Different icons represent each type of action and the user can view a test map to ensure thorough test coverage. Once a transaction is captured, using any browser, multiple test cases can be created using an Excel-like spreadsheet.

The visual scripts can be used with Mercury Interactive's Load Runner.

w www.merc-int.com

Raima Database Manager for Windows CE (RDM/CE) is an embedded database engine for Microsoft's platform. As well as a C function library (DLL) for database storage, retrieval, and navigation, there is an ActiveX control for database development.

www.raima.com

Two **data compression** products from Algorithmic Research:

SDRZip V1.0, a general purpose data compression library, provides **random** access to compressed data. **SDRKit V1.0** is a data compression development environment featuring **Compressive-C**, a dedicated data compression **modelling** language.

www.algoresarch.com

ActivePicture, from HexaTech, is an ActiveX for constructing and displaying virtual **instrumentation** devices or active pictures such as dashboards, clocks, meters, gauges, and sliders.

www.hexatech.com

The native integration of **NetCrusader** with NetDynamics 4.1, announced by Gradient Technologies, provides a **security** infrastructure to the development and deployment of web-based Java applications. Gradient has developed NetCrusader Java classes that extend the native **NetDynamics** classes.

www.gradient.com

Seagate Software's **Holos 7** is a development environment for scalable applications that can rapidly **analyse** large amounts of data. This version allows users to combine proprietary **OLAP** stores into one application, and manage database growth explosion.

www.seagatesoftware.com

Mobile phone manufacturers call each other

AddFlow V2.0 is an ActiveX control for creating diagrams (**workflows**, process flows, networks, charts, etc.) interactively or programmatically. Each object in a **diagram** can be allocated independent colours, fonts, shapes, pictures, text, and styles. Nodes stay connected when moved or resized.
www.componentsource.com

RogueWave Software's **DBTools.h++ 3.0** gives object-oriented access to relational **databases** through **C++** classes. Array operations support bulk read and write operations, and there's support for the latest databases from Oracle, Microsoft, IBM, Informix, and Sybase.
www.roguewave.co.uk

Analytics.h++, from **Rogue Wave** again, is a suite of components and classes designed to enable a developer to focus on higher-level, conceptual issues in designing and building business **data models**. With a **C++** interface it is configurable for use in multithreaded applications.
www.roguewave.co.uk

MKS Source Integrity Professional Edition 3.1 allows globally distributed software development **teams** to use the Web to collaborate on mission critical software projects. It includes optional support for secure socket layers (**SSL**).
www.mks.com

MFC UI-X, from Quality Componentware, is an MFC class library providing Office 97-style coolbars and cool-menus, Outlook 98-style bars and controls, a generic docking framework, multi-select tree controls.
www.qualitycomponentware.com

Psion has teamed up with phone manufacturers Nokia and Ericsson to form Symbian, a joint venture dedicated to create and license software for the wireless information devices market. Motorola has announced that it will soon join the venture. Initially, Psion will own 40% of Symbian with Ericsson and Nokia each owning 30%. Symbian doesn't start from scratch; it is based on what used to be Psion Software and its EPOC operating system.

The mobile phone market is projected to grow to more than 600 million users by 2002. Symbian will charge \$5 royalty per 'smartphone' (voice-centric device with small display) and \$10 per communicator (information-centric device with quarter to full size VGA-screen). Remember that Nokia, Ericsson and Motorola, today, have the largest share of the mobile phone market and then do your maths! If this alliance is successful it will create a major non-proprietary platform for mobile phones. In unit, if not in value, it could create a bigger market than Windows on PC.

Thin-clients spread

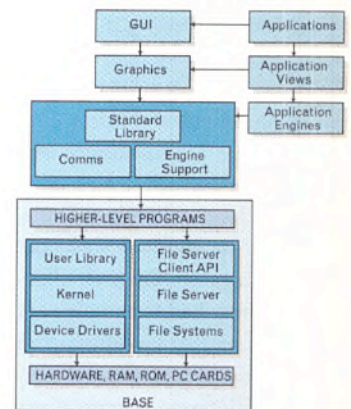
Sybase is the first company to license jBridge, Corel's Java-based thin-client technology. Sybase users will be able to use Java technology to develop and deploy applications over the Internet or Intranet. It is a thin-client/server product that makes it possible to run unmodified Windows applications from any machine with a JVM. Applications running from a Windows NT server can be deployed across networks to a number of different client operating systems.

Corel claims that jBridge does not require modifications to NT and has the ability to process events locally on the client to reduce network traffic and server loads (features delivered using Java and TCP/IP).

www.corel.com/jbridge/index.htm

EPOC is a pure 32-bit OS which runs on ARM, but has been developed to be easily ported to other processors. EPOC has been written in C++ and is completely modular. There is a base, which interfaces with the hardware and provides a Posix-like interface. A standard library, with communication and engine support modules, offers an API which will be identical on all products. Then there's the graphic layer, which should be the same in most devices, and the GUI that will be tailored to each type of device.

The EPOC documentation strongly recommends structuring applications in three parts. First, there should be a main application engine, which addresses the standard library and support modules, should be binary compatible on all devices. Second, an application view will use the graphics APIs and make calls to the application engine. Finally, there should be a top-level application resting on the application view and calling the GUI APIs – this will need most rewriting when porting an applica-



tion from one manufacturer's device to another.

C++ and Psion's OPL SDKs are available from Symbian. Java support to the JDK 1.1 level (with AWT and Unicode support) is currently in beta testing. These are sold as EPOC World Developer memberships, which include the latest SDK, access to a reserved section of the EPOC website, and an upgrade to the SDK on CD-ROM.

The EPOC World C++ Developer subscription costs £175.

www.symbian.com

Mining with an ActiveX

ActiveX Tree Miner is another component in Attar Software's **XpertRule Profiler** data mining software. The control supports all the features of Attar's Profiler tree induction technology and can be deployed in a variety of ways: as a stand-alone mining application or embedded in other vertical applications under Windows. Deployment can also be made over Intranets or the Internet.

The control works with Attar's CAF (Contingency and Frequency) servers to provide multi-tier client/server data mining against very large databases. Mining can be performed either against the data in-situ or using high performance mining against tokenised data tables. In-situ mining works by firing SQL at a database that resides on a dedicated high performance server. This is the ideal for corporate data warehouses, where the organisation does not wish to move or extract data for mining. Using tokenised data tables, the Tree Miner can mine millions of table rows, on a typical NT server, in minutes. This is suited for organisations using departmental 'datamarts'.

The ActiveX Tree Miner is the first in a series of data mining components that Attar Software are developing as part of their new data mining architecture. This will include an ActiveX Associations Miner and an ActiveX Clustering Miner.

Profiler ActiveX Tree Miner is available for Windows 95 and NT and costs £395.

www.attar.com

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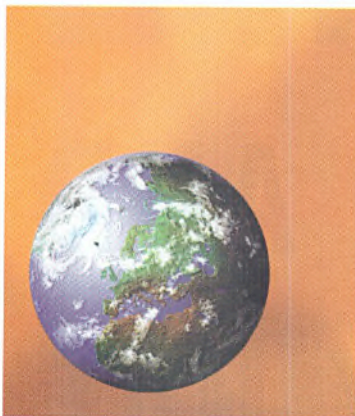


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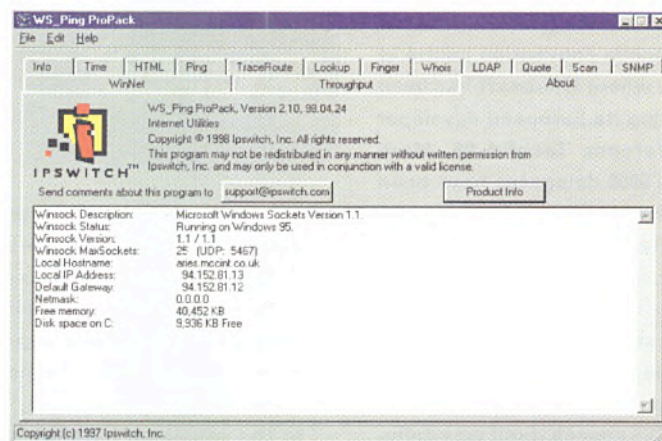
From Ipswitch to the Internet

Version 2.1 of the WS_Ping ProPack suite of network information tools includes four new utilities, improvements in network scanning speed, and enhancements to the existing ten tools. The Windows-based pack is designed to enable users to gain information on hosts, websites, networks, and other users of the Internet.

The four new tools are: HTML, Throughput, Info, and Time.

The primary purpose of the HTML tool is to help in the debugging of websites. It sends a 'get' request to a specified URL and returns full header information (including cookies) along with page data.

The Throughput tool looks at the efficiency of an Internet connection, testing the data speed of a connection with a remote host. It sends a specified number of IP packets to the remote host and calculates the average bits per second sent over the communications link. Throughput is also calculated and displayed



in kilobits or megabits per second.

The Info tool summarises information about a network host or device, including the official host name, IP address, and contact information. An Info request on a host name also polls (pings) the host to verify connectivity.

Other WS_Ping ProPack tools include Ping, Traceroute, Lookup, Finger, Whois, and WinNet.

The suite is designed to run on Intel based processors with Windows 95 or NT. Single-user editions of WS_Ping ProPack are priced at £28. Multi-user network copies are available at £21 per user (based on a 10-49 user site). The suite is distributed in the UK by Unipalm.

A free trial version is available from the Unipalm website.

www.unipalm.co.uk

The Oracle suite formerly known as...

The Oracle Enterprise Developer Suite (formerly known as Oracle Web Developer Suite), a suite of development tools and servers, has been upgraded to release 2.1. It includes Oracle Designer 2.1 (formerly known as Oracle Designer/2000 2.1) and Oracle Developer 2.1 (formerly known as Oracle Developer/2000 2.1).

Oracle claim that the suite blurs traditional lines between Rapid Application Development and modelling, for the building of database applications. Oracle Designer allows developers and business users to visually model business processes. Once the model is fully defined, Oracle Designer can automatically generate Oracle Developer Applications. The Designer is capable of reverse engineering any Developer applications back into the model. This is achieved through the information model inside the Oracle Repository.

Oracle Enterprise Developer Suite 2.1 includes both the Oracle Application Server and Oracle8 database server, for developers to build, debug, and deploy database applications. This version's Oracle Reports has improved reporting features, with more output options and web publishing capabilities.

In full, the Enterprise Developer Suite 2.1 includes the following components: Oracle Designer 2.1, Oracle Developer 2.1, Oracle Application Server 3.0.1, Oracle Database Server version 7.3.4 and 8.0.4, Oracle Enterprise Development Kit 2.1, and one year membership to the Oracle Technology Network. The Enterprise Development Kit contains Oracle partner products such as Symantec Visual Page, Wallop Build-IT, and Web Trends.

Oracle Enterprise Developer Suite is priced at £7810 for Oracle Alliance Partners.

www.oracle.com

A full range of PARTS

Standard and Lite editions of PARTS for Java fill out the product line from ObjectShare. PARTS for Java is an IDE for assembling applets and applications from components, with code browsing and facilities. The new releases add to the original Professional edition.

Parts for Java Lite is the entry-level edition. It includes visual programming tools, support for switching between versions of the JDK, as well as JavaBeans and JFC/Swing. Instantiation's jKit-Grid product is also included.

The Standard edition adds JavaBeans for creating database applications using JDBC. It includes Oracle Lite along with jKit/Grid and Netscape Navigator. The database components include ObjectShare's Form bean, which can automatically generate user interfaces.

PARTS for Java Lite is available for \$149. A free update is available for all existing registered 2.0 customers.

www.objectshare.com

ILOG Views 3.0 has an extended graphics editor for handling business graphic objects and a portable JavaScript implementation to make customising applications easier. ILOG is a provider of C++ and Java components for data visualisation for user interfaces. www.ilog.com

The Atlanta Linux Enthusiasts, in conjunction with Linux International, are planning the second annual Atlanta Linux Showcase. It will be held on October 23-24, immediately following NetWorld+Interop in Atlanta. The keynote address will be given by the CEO of Corel. www.ale.org/showcase

Applied Microsystems has integrated its CodeTEST software verification and analysis tools with the LynxOS version 3.0 real-time operating system. They provide visibility into LynxOS processes and thread switching, as well as heap memory usage and inter-process communication. 01296 625462

Release 3.0 of the Forte Application Environment provides full development and deployment support for Hewlett-Packard's latest Unix release, HP/UX 11. HP 9000 developers can use the environment for distributed object, Internet, and workflow applications. www.forte.com

IT-Map 2000 manages the data generated by the inventory phase of Y2K compliance programs. Within an inventory database the Y2K status of each item is flagged along with an audit trail, enabling the proof of how final compliance was achieved. www.it-map.com

Sun, sea, and SQL Server at TechEd 98

Novell is working with Intel on an improved **JVM** for the NetWare operating system. Code-named 'NetFire', it will be designed to increase the performance and scalability of **Intel** processor-based servers, including symmetrical multiprocessing servers and the upcoming IA-64 architecture machines.

www.novell.com

Virttools, specialist in real-time 3D software development, has launched NeMo Dev in the UK. Targeted at developers, NeMo Dev is a 3D content prototyping and production platform designed to speed up the **game development** cycle.

Recommended pricing is \$45,000.

www.virttools.com

An SDK for Citrix's **WinFrame** and MetaFrame **thin-client**/server software can be downloaded at no charge from their website. It includes documentation on the **Citrix** Server API and sample software. It enables the development of customised administrative tools, such as security and client connection monitoring capabilities.

www.citrix.com/misc/sdk.asp

It's been a busy four days at the Acropolis convention centre in Nice where Microsoft has been holding its European developer conference TechEd 98. More than 5000 delegates have been packed into the already over-stuffed conference rooms this year, so many that the keynote speech had to be 'beamed' live to a second room full of delegates and press because the main hall was overflowing.

The speech itself was delivered by Bob Muglia, applications and tools supremo at Redmond, who talked about the 'Digital Nervous System'. This is Microsoft's new name for its enterprise strategy and takes in traditional development tools like Visual Studio, backoffice products like NT and SQL Server, and Office 2000 - which he announced



would enter public beta in late summer. The message seems to be that developers can expect to be working with all rather than some of these applications to build software the Microsoft way.

In the sessions, highlights included David Solomon's 'Windows NT Internals' where delegates learned some of the more intimate secrets of NT 4.0's kernel API. Sessions on building Internet applications and SQL Server 7.0 were oversubscribed. The conference organisers also tried some fairly radical technology to link the two main conference centre

LANs, setting up a telecommunications laser of the kind normally only seen on the BT Tower. The only real disappointment was the announcement that next year's TechEd will most likely be in the UK rather than sunny Nice.

Unlike previous years, very few new product announcements have been made at the conference. Muglia confirmed that Visual Studio 6.0 is due to ship in September, but declined to give any indication of when NT 5.0 is expected other than 'sometime in 1999'. Delegates queued in the hundreds to get access to the NT 5.0 hands-on demo room where an interim pre-Beta 2 release was on show.

More information on TechEd 98 can be found on Microsoft's European website.

www.eu.microsoft.com/europe/teched

Visual J++ falls behind

Greg DiMichellie, head of the Visual J++ development team at Microsoft, confirmed that unlike the other Visual Studio tools which have already shipped to manufacturing Visual J++ has slipped by around four weeks. Customers who buy copies of Visual Studio in the first four weeks or so of release will get a

'Technology Preview 2' version of the tool and a voucher to get the final product when it is available. According to DiMichellie, the final version will be included in the Visual Studio box a month after the initial release.

In his team's defence, DiMichellie said that work on the WFC, a major component of VJ++ 6.0, only

began in December when Microsoft concluded that a prototype GUI builder based on AWT was not going to be satisfactory. It then took the decision to move ahead with a Windows-native solution. Because of the ongoing lawsuit with Sun, Microsoft has no access to the latest JDK 1.2 enhancements to AWT or JavaBeans.

Books received this month

Publisher	Title	Author	ISBN	RRP
SIGS/ Cambridge	Cognitive Patterns	Gardner, Rush, Crist, Konitzer, Teegarden	0521649986	£22.95
AP Professional	Java Beans for Real Programmers	Peter Wayner	012738670X	£29.95
O'Reilly & Associates	Java Cryptography	Jonathan B Knudsen	1565924029	£21.95
O'Reilly & Associates	Java Security	Scott Oaks	1565924037	£24.50
Sybex Network Press	MCSD: Windows Architecture II - Study Guide	Michael Lee & Kevin Wolford	0782122744	£40.99
Wrox Press	MTS MSMQ with VB and ASP	Alex Homer and David Sussman	1861001460	£46.99
SIGS Reference Library	Open Modeling Language (OML) Ref Manual	Firesmith, Henderson-Sellers & Graham	0521648238	£24.95
O'Reilly & Associates	Oracle Built-in Packages	Steven Feuerstein	1565923758	£34.50
O'Reilly & Associates	Oracle DBA Scripts	Brian Lomasky & David Kreines	156592438X	£21.95
O'Reilly & Associates	Photoshop for the Web	Mikkel Aaland	1565923502	£21.95
O'Reilly & Associates	Protecting Networks with SATAN	Martin Freiss	1565924258	£14.95
O'Reilly & Associates	Windows NT Backup & Restore	Jody Leber	1565922727	£21.95

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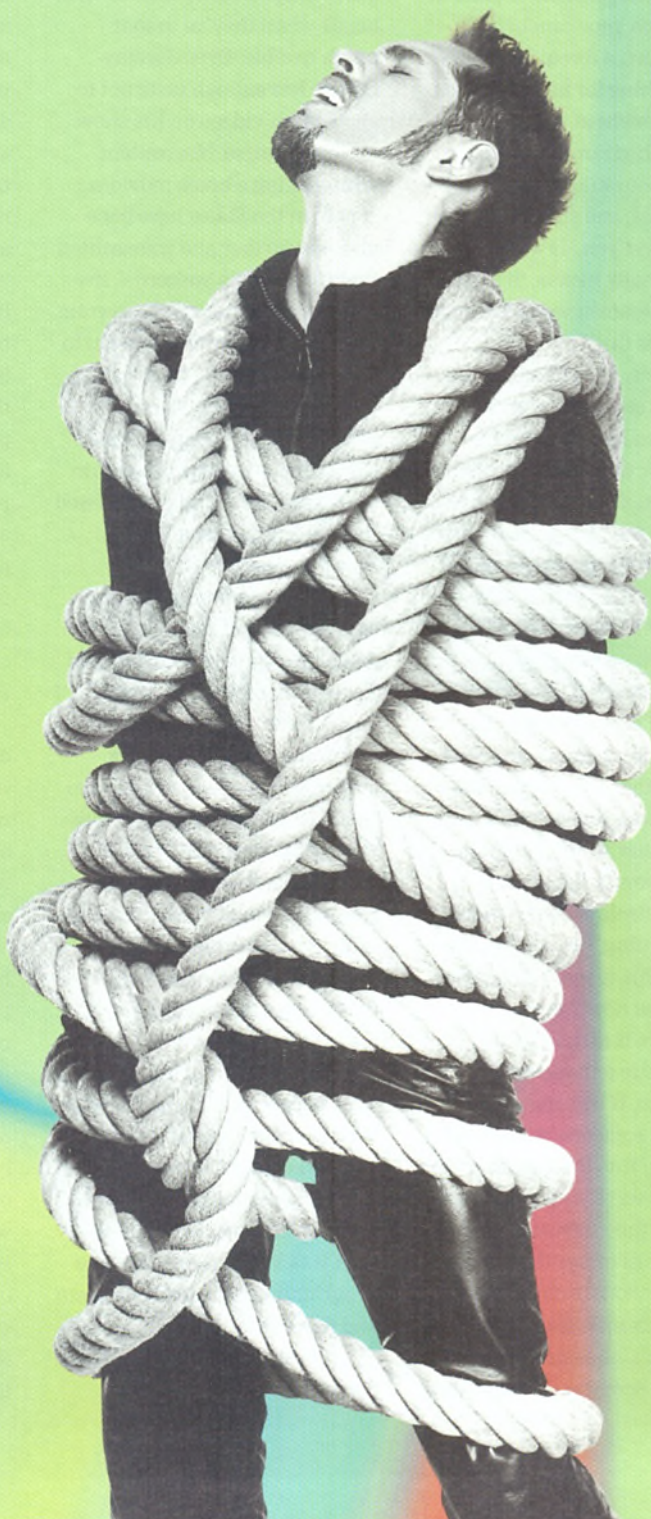
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Born on the Web

It's amazing what you can find on the Internet these days.

And this is Darren just after we <simper> welcomed him into the world.' There's an interesting way of putting it – I'm sure Darren would have something to say about his 'welcome', if only he could talk. There he was, floating around in a bag of goo, nice comfortable temperature, a few quiet noises, doing nothing for himself, when suddenly, without warning, he was squished down this wiggly pipe, spat out into a bright and noisy world, and smacked on the bum. 'I'll get you,' is what that first cry really means, 'if it takes the next eighteen years, I'll make you pay for this!'

The baby is cleaned up, the mother is cleaned up, and the father goes in close with his Instamatic (only slightly dented with the mother's teeth marks) and takes the picture that, out of politeness, we are now looking at. Why do they bother with the picture? All babies look alike – a cross between Winston Churchill and a King Edward; you could fake a much better picture with a decent mugshot of the mother from before the birth, and an Image Magic.

The other thing the photo doesn't show is the process of the birth itself. It doesn't show the screaming, the yelling, the 'You did this to me, you bastard! Don't come near me again!', which, too, is all part of the glorious, life-enhancing experience. It was inevitable, then, that someone would take a handycam into the hospital, tape the whole terrifying event, and then play the video at their friends until either the friends are all previously engaged for the next six months or the neighbours, on hearing the continual screams day after day,

summon the police. At least you can ignore a photo – a video is so much more direct. What must Darren think? In addition to being evicted from his home, there's a film crew recording the whole event. At least grown-ups get to drape a raincoat over their heads when they're in that much trouble. Even Jeremy Beadle has enough taste not to show birth videos on his show.

It gets worse. Not content with making a home movie, a couple in the States have gone one step further and transmitted their firstborn's 'welcome', live on the Internet. It takes a certain kind of exhibitionism to want to do this in the first place – or perhaps the father was so attached to his computer that, unless the birth was piped onto his screen, he would have missed the whole thing, and the broadcast was only a fringe benefit. It couldn't have been easy for the mother; a live transmission would have stilted her style somewhat; 'Argh, fff ... I mean, ouch'. On the other hand, with a worldwide broadcast, sufficient onlookers would have been moved by the event to have made a contribution of their own; the mother must have received enough baby clothes to dress Shea Stadium.

Jon Snow, on Channel 4 news, reported the broadcast and sadly explained: 'Of course, the site was completely jammed with people looking in'. That's hardly surprising; it's the first transmission of its kind, and many people would have been curious. But what happened next was very interesting; the programme ran a piece on taste and decency on the net.

At first, I thought this was the pornography issue all over

again, but it's not. A birth can't be pornography; it won't corrupt or deprave, and I can imagine very few people were excited by the pictures. In fact, Channel 4, as well as all the other channels, have all shown film of births, but those films were edited carefully and placed in the context of medical programmes, and the internet transmission was devoid of any editing or context at all. Not only that, the transmission was arguing nothing, dictating nothing; it was a simple piece of what is called 'actuality' by the newsmen who like to believe in objectivity. The transmission was disturbing because it depicted something that would otherwise be very private – only the father and a few dozen anonymous medical professionals would be present – and is very stressful both physically and emotionally. It was, in fact, very good actuality – far better than broadcast media could achieve – precisely because it was completely free of context.

Overall, what was being depicted was really not important, because those revolting home videos are easily accessible, and everybody knows what birth is. But something significant has happened.

First, the site jammed. That's because all Internet comms is point to point; this site had to communicate with each viewer individually. A self-adjusting broadcast system – a 'dynamic mirror' – should be set up, because I can imagine many other events will be transmitted whose live-ness is important. However, the self-limiting nature of the medium seems evident. If sites refused to rebroadcast feeds they considered unwholesome, the influence of those feeds

would be limited by bandwidth restrictions. Decency would be determined by consensus rather than legislation, as (I believe) it should.

Second, the idea of decency is changing. Though little legislation acknowledges this, it is obvious to everyone that there are more disturbing things in the world than people with no clothes on, and for all its naturalness, an unedited and uncommentaried birth is one of those things. If the husband were to broadcast his vasectomy, or his appendectomy, how would that be accepted? What if the couple broadcast their marriage guidance sessions? How about live feeds from war zones? These are things that, for all our sophistication as inhabitants of the information age, we're not – yet – equipped to deal with, yet they're very hard to restrict.

Finally, there's the idea of performance. Like the Jennycam site before it (a camera fixed in a woman's bedroom, showing her life almost unedited) this birth was a piece of performance just as surely as any other act designed for public consumption, but it's hard to think of it in the same way as acting. Perhaps that's because performances are supposed to be fictional or communicative. But, the idea of the performer as being no more than a placeholder for a piece of experience that is documented, that strikes me as a very powerful means of communication – 'Look at this, feel what I'm feeling, then make up your own mind'. No wonder TV news finds this disturbing! I think we're seeing the beginning of a new form of expression.

Something really big happened when that birth was transmitted, and a new human was welcomed into the world. ■

Jules became an uncle for the second time last month. You can send your congratulations to mayhem@jules.cix.co.uk, or phone him on 01707 662698.





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

The end is nigh

Dear Sir,

Unless my calculations are wrong, the end of Moore's law is much nearer than Jules May realises (EXE, June 1998). The first absolute constraint on computer power will be the speed of light. My reference books tell me this speed (and of electricity) is 300,000 kilometres per second. That is 300 kilometres per millisecond, 300 metres per microsecond. In a cycle of a 300 megahertz Pentium processor, an electrical signal travels just one metre. When two devices running at 300 MHz can only operate 75 cm apart. This is not much more than the length of the copper strips on a motherboard.

We are not talking twenty years to the end of Moore's law. Unconditional benefits of faster clock speeds have already reached their limits.

Jules is right. Development will have to follow entirely new paths. In the first instance, it will be possible to mitigate speed problems by clever designs. Motherboards will be laid out to minimise critical electrical paths. More use can be made of caching, but its clever design will be more important than raw power. Very soon we will have to start thinking smart again. I see that as a great opportunity for the British.

The American approach to problem solving tends to be to throw resources at the situation. They have a culture of wide open spaces. The British are used to coping with resource shortages and finding clever solutions. Microsoft, Borland, et al only seem to be able to exist by developing

massive, and increasing complexity. Their lifeblood is a doubling of resources every couple of years. Pretty soon the challenge will be to do more with what we have. Jules seems to share my distaste for the sheer complexity of everything about a modern PC. (How can the operating system for a personal computer possibly take over 100 MB of disk space?) Perhaps our time is coming. Yours faithfully
 John McMillan
McMillan.Technology@BTInternet.com

Credit where it's due

Dear Sir,

I was most interested to read Bob Rimmington's article and, as I read, found my excitement building. Here was somebody whose ideas exactly matched my own and he has so clearly put into words those half formed thoughts on the subject. Alas, the bubble was ever so slightly pricked when I came to the final paragraph where I sense he has allowed a hint of prejudice to spoil his otherwise well reasoned argument.

Now I am no Microsoft sycophant, they have many faults and much of what Mr Rimmington had to say applies to them as it does to others in the industry. However, we must give credit where it's due or our criticisms will not be considered. His final paragraph, regretfully, ignores this. For many years I was an unswerving QuattroPro devotee until a request to teach spreadsheets at a local night school forced me to look at Excel. I had to admit that the world had moved on and

QuattroPro was not in it. For quite independent reasons, I also adopted Word and Access and, while they are not perfect, I have never regretted it. None of these decisions were because, as Mr Rimmington has it, 'In case **** is not around in a few years time'. The software was chosen in each case because it was the best for me and then only after research and consideration of many factors; a situation which I suspect is more common than Mr Rimmington may concede. It just so happens that Excel, Word, and Access all come from the same software house. If each had come from a different supplier then that would have been fine by me too. Such decisions are, of course, today made more complicated because it is usual to buy these applications as part of a suite rather than individual components but, I think the principles still apply.

Finally, may I congratulate you and Mr Rimmington on your courage in publishing the article. It needed saying and, apart from the final paragraph, admirably sets out the unsatisfactory manner in which the industry treats its customers.

David Stevenson
 Lindfield, RH16

Old compilers still active

Dear Sir,

Great *Mayhem* article in EXE (May). Couldn't agree more.

Since Jules (and I) could easily be accused of 'luddite-ness', I thought I would write to express my support.

I too still have my old development tools going right

back to the early '80s. And, of course, they still work just like they always did - only now about 40 times faster due to hardware improvements.

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Changing the subject slightly, it niggles me to see secretaries asking for Pentium-II machines in order to run wordprocessors.

Of course, we all like having computers work faster and faster each year (regardless of whether we still use the same software), but I wonder if the chip manufacturers would still be racing for higher performance quite so hard if Microsoft wasn't right behind them using up all the spare RAM and CPU cycles.

Thanks for keeping the candle of sanity lit.

Andrew Lydon
 Software Manager
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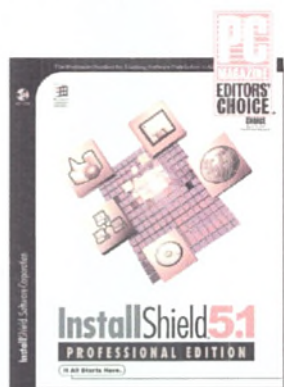
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Delphi

Code explorer, class completion, new language extensions, and a raft of additional features – Dave Jewell reviews the latest Delphi offering.

The next generation

Borland recently caused something of a furore in the development community by changing its much-loved company name to Inprise, yet another example of America's sad infatuation with the over-worked and utterly meaningless word 'Enterprise'. In the inevitable Internet flame-wars that followed, Charlie Calvert, a Developer Relations representative, emphasised that developers should support the change or risk losing their favourite development system. It probably wasn't intended as a veiled threat, but unfortunately it sounded like

one, and turned out to be even more of a disaster than the original name change itself...

IDE enhancements

Be that as it may, the good news is that Delphi is still very much with us and has recently been upgraded to version 4. In this review I look at a 'gamma' version of the system. On launching the new IDE, you'll immediately find that some significant changes have been made to

the user interface. For example, the main IDE window has been given an Office/Internet Explorer 'look', with moveable toolbars. In all, there are five different toolbars (Standard, Debug, View, Custom, and Component Palette) each of which can be detached from the main window and left floating. In addition, a special toolbar contains the IDE menu. This can be repositioned, but unlike the others it can't be resized or detached.

In addition to dockable toolbars, the version 4.0 IDE incorporates the concept of dockable *tool windows*. The aforementioned toolbars will dock only with the main window, but tool windows can dock with each other and with the Code Editor window. Examples of dockable tool windows include the Modules View, the Message View, Threads, Local Variables, Project Manager, the Code Explorer window, and the Object Inspector itself.

Code Explorer – what's that, I hear you cry? By default, when you first start the IDE, you'll see a Code Explorer window docked alongside the Code Editor. (As with other tool windows, it can be moved elsewhere.) The Code Explorer gives you a hierarchical view into the current source file, its contents changing automatically whenever a new source file becomes the active edit view. Code Explorer shows you the types, variables, constants, and classes defined in a particular unit, along with a hierarchical 'drill-down' facility for exploring the individual members of a class. If you double-click on a member field or property, then Code Explorer will take you to the appropriate declaration in the source file. However, if you click on a member routine, then you'll go straight to the code body for that member. This is obviously very useful when navigating around inside large source files. The concept reminds me of a sort of poor-man's CodeRush! (See my review of Eagle Software's CodeRush in the June issue of EXE.)

Code Explorer maintains a list of the units referenced by a source file and, if you click on one of the unit names, the code editor will take you to the place where the unit is referenced in the `uses` clause. This particular facility is about as useful as the proverbial chocolate teapot. Why on earth didn't Inprise take a leaf from CodeRush's book and arrange things such that double-clicking a unit name would open the unit in the code editor? That would have been infinitely more useful...

That said, Code Explorer is more than just a browser – but not much more. There's a right-click context menu with **New** and **Rename** options. Depending on what part of the unit's hierarchy you're viewing, you can add/rename both class methods and members, unit variables, and so forth. When adding a method to a class, Code Explorer will auto-generate the empty function body for you, but my suspicion is that most developers will just type what they want into the Code Editor. Other than the ability to find your way around quickly in large files, Code Explorer brings little to the party.

Incidentally, before leaving the subject of dockable tool windows, it's interesting to point out that Inprise has added an interesting new twist to the docking paradigm. If you drag a tool window into the middle of another window (as opposed to an edge) both windows will 'collapse' into a single window with a tabbed dialog to switch between the two constituent views. Quite a nice touch. I should also emphasize that much of the new docking functionality has been incorporated into the VCL framework, making it easy to build dockable windows into your own application.

Eat your heart out, CodeRush...

Okay, I was underwhelmed by the Code Explorer, but there are lots of other goodies to be had. Particularly nice is the new Class Completion facility. You're probably familiar with Delphi's Code Completion features whereby small pop-up windows display available properties of

typed-in object names, argument lists for methods, and so forth. By contrast, the Class Completion system is quite different. Suppose you're adding a new property to some custom control and you type in a property declaration like this:

```
property Size: Integer;
```

With the cursor on the same line of the Code Editor, you can invoke Class Completion by typing **Ctrl-Shift-C**. This will instantly cause Delphi to add a private member variable, `fSize`, to the class as well as a private access method, `SetSize`. The necessary `read` and `write` clauses will be added to the property declaration and the code for a skeletal `SetSize` method will be added to the unit. This is a nice facility and can potentially save a lot of 'grunt work' if you're not using something like the CDK (Control Development Kit) from Eagle.

Class Completion isn't restricted to working with properties either. If you add any new procedure or function declaration to a class and then type **Ctrl-Shift-C**, a skeletal function body for the routine will be added to the unit. In fact, it cuts both ways. If you're

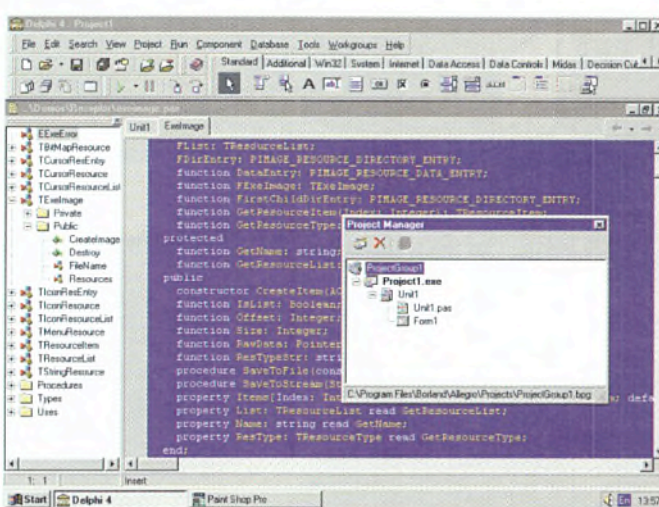


Figure 1 – The Delphi 4 IDE complete with assorted dockable, 'tear-off' toolbars in the main window. You can see the new hierarchical Project Manager floating above the Code Editor, with the new Code Explorer docked to the left-hand side.

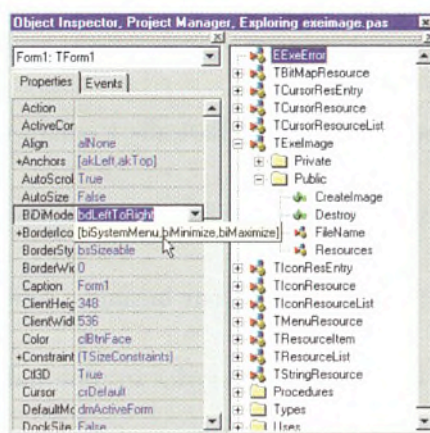


Figure 2 – The Code Explorer again, this time docked to the right hand side of the Object Inspector. Although convenient, doing this will often reduce the usable width of the Object Inspector and Inprise has therefore added a hint feature (illustrated) to the right-hand side of the Inspector window.



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Solutions for a small planet

The help files

A year ago I contributed a why-oh-why article to EXE Magazine, bemoaning the ongoing deterioration in the quality of Delphi's Help files in each version. I have persuaded the Editor to let me follow it up here.

Here are some specific complaints against the previous versions of help, together with a note of how version 4 compares.

Lost VCL editorial. In the main entry describing the VCL control `TTreeView`, the Delphi 2 help file uses 311 words and 20 odd clickable links. Delphi 3 help uses 95 words and contains no clickable links. This is typical. Delphi 1 and 2 VCL help includes a main page for each control summarising the main properties/methods/events you need to get your head around, and provides convenient jump-off points so that you can investigate them. Delphi 3, inexplicably, doesn't.

From the entries I've checked, Delphi 4 VCL help appears to be the same as Delphi 3 in this respect.

Crude API files. For 32-bit versions of Delphi, the help files for the Windows APIs are in C not Pascal, and are not fully integrated.

Same in Delphi 4.

Threadbare. Coverage of threads in 32-bit Delphi has been minimal, even though thread support was trumpeted as a selling feature.

Hurrah! Fixed. Delphi 4 introduces a new chapter-like unit of organisation into the help file called a 'Topic Group'. There's no 'official' explanation of these Topic Groups but from all the ones I browsed, they seem to contain content traditionally put into the paper manuals *User's Guide* and *Developer's Guide*. So the Threads Topic Group begins with an overview of why threads are useful, then has a page on how to define thread objects, and then a page on initialisation – all of which can be read sequentially. The bad news is that, as I understand it, the paper *Developer's Guide* is now only included with the expensive Client/Server edition of Delphi.

Poor organisation of function descriptions. Another baffling instance of removal of good material. Delphi 1 and Delphi 2 help included a hierarchy of pages which listed functions by category. The title of the much-used help page 'String-handling routines (Pascal-style)' may bring this back to old Delphi hands. Delphi 3 dropped this structure, and instead grouped the functions so that they all appear in the same 'Topics Found' popup window. No opportunity to explore the library, or serendipitously stumble upon an unfamiliar function. Useless.

It's still broken in Delphi 4.

'Shy' help bug. A minor but very, very long standing irritation. When clicking a link, the help window sometimes places itself behind all the other windows on the desktop, but retains focus. Clicking on the help window fails to bring it back on top – you need to switch to another application and back again to get the window back on top.

Delphi 4 retains this bug.

I suppose I should mention a new Delphi 4 feature called 'OpenHelp', which smoothes away the messing around one used to have to do to integrate third party help files into Delphi help. It's okay, but I'd much rather they had fixed one of the things above.

I'm afraid I think that Delphi 4 help is very disappointing and rather surprising. There is a depth of feeling in the Delphi user community about this issue. For example, a Greek Delphi user recently posted on the Web a home-made help file containing the function descriptions organised in the way I describe, plus a vulgar and pointed exposition of his irritation at needing to do it. If Borland/Inprise would like to field a spokesperson to explain the ongoing poor quality of its help, I am sure I am not the only person who would be most interested in what they had to say.

Will Watts

down near the bottom of a lengthy unit, you can type in the body of a new function or procedure, hit the Class Completion hot key, and the matching declaration will then be added to the class. In this particular case, the declaration will be added, by default, to the `private` part of the class.

It would be rather nice if you could use Class Completion more than once. Suppose, for example, that you wanted to change the type of an existing property from `Integer` to `String`. Wouldn't it be great if you could change the property declaration, hit Ctrl-Shift-C, and have the various access routines change too? Unfortunately, the current Class Completion implementation is very much a 'one shot' facility. The internal parser simply satisfies itself that there's a private field and access method for the property, and then bows out. Maybe in version 5?

A feature called Module Navigation is another help for navigating large source files. Placing the cursor on any class method and hitting Ctrl-Shift-Arrow (where Arrow is either the up or down arrow key) will toggle you between the function prototype in the class declaration and the actual function body of the method in the implementation section.

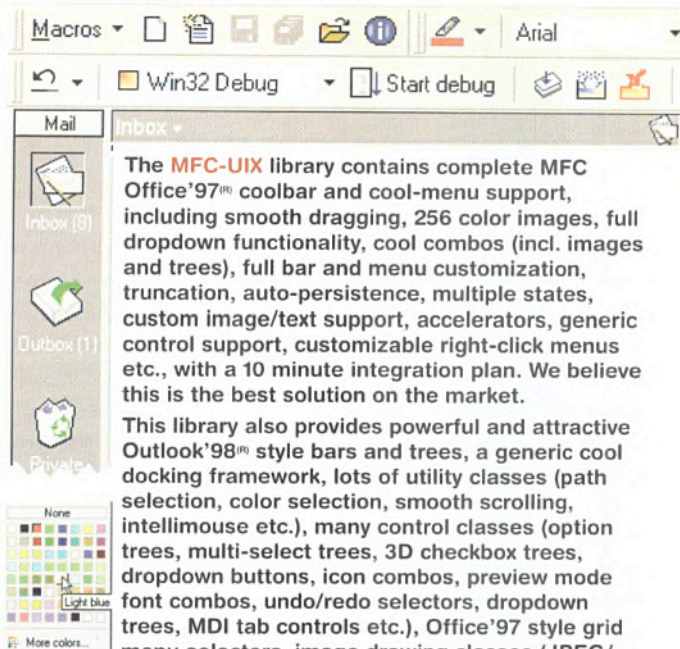
Another nice goodie is the addition of hint windows to the Object Inspector. This particular window is rarely wide enough to show everything in it (the right-hand 'value' part of some properties can be very long), and now that other windows can be docked alongside, this is likely to be exacerbated. In Delphi 4, as you move the cursor over the right-hand part of the Object Inspector, any partially-obscured property values are momentarily displayed in a pop-up hint window.

Hint windows have been added to the form designer. As you move the cursor over a populated form, a small hint window pops up to show the name and type of each component. You'll also see a small hint window displayed whenever you move a component on the form designer or alter its size. So to precisely align and size components you won't need the alignment palette or to check the Object Inspector.

In keeping with other development systems, Delphi 4 allows you to combine several different projects into one high-level project group. As the Inprise documentation states, this is useful in those cases where you're working with multi-tiered database applications. I suspect that it will be equally applicable in those situations where you're developing an application in parallel with one or more packages, creating a program in conjunction with COM-based controls, or whatever. The new Project Manager window displays a hierarchical tree of projects, targets, forms, and units. You can add new and existing projects either from a right-click context menu in the Project Manager window, or from the main Project menu. There are new options to compile and/or build all projects, and you can designate a specific project in the group as the 'active' project using the context menu.

New language features

As I've observed in the past, Delphi's designers seem to have an ongoing philosophy of pinching the best ideas from C/C++ while avoiding the C++ syntactic blunders such as those awful templates-from-hell. In keeping with this philosophy, Delphi now has method overloading and default parameters.



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Suppose, for example, that you want to create multiple constructors for a class, each of which takes a different type of argument. Although this was possible in previous versions of Delphi, you had to give each constructor a different name, which was rather messy. In Delphi 4, each constructor can be called `Create` just as nature intended. For obvious reasons, every overloaded method must have a 'type signature' (number and type of arguments) different from other methods of the same name, so that the compiler can distinguish between them. Additionally, overloaded methods must be introduced to the compiler using the new `overload` keyword.

Delphi 4 supports default parameter values. The rules are pretty much as for C++: default parameters must appear at the end of the argument list, the default value must evaluate to a constant expression, and must be assignment compatible with the type of the default parameter.

There are other language changes too. The rather odd-sounding, Modula-2-style `Cardinal` type has a soul mate, `Longword`, which is also a 32-bit unsigned integer with the range 0..4294967295. Both `Cardinal` and `Longword` are directly equivalent, but the latter is to be preferred in new code. Presumably Inprise felt that `Cardinal` wasn't a very descriptive name – it was right!

For those who like to think big, there's a new `Int64` type. Again, this is an integer type, but signed. As the name suggests, it uses 64 bits of storage and can represent values in the range -2^{63} through to $2^{63} - 1$, which should be sufficient even for keeping track of Bill Gates' bank account. Still on the subject of basic types, Inprise has modified its implementation of `real` to make it compatible with the 64-bit `double` type. This means that properties of type `real` can now be published. There's a compiler switch for those who need old-style `reals`.

Speaking as someone with an interest in scientific number crunching, I was interested to see that Inprise has added dynamic array support to the language. You define a dynamic array like this:

```
// One-dimensional integer array
type TIntegerArray = array of Integer;
// Two-dimensional float array
type TAdmittanceMatrix = array of array of Double;
var
  NumList: TIntegerArray;
  AdmitOne: TAdmittanceMatrix;
```

As you can see, multi-dimensional arrays are supported. In the example code shown here, two dynamic arrays are declared, but they aren't actually instantiated. In order to instantiate a dynamic array you have to use the `SetLength` routine – previously relevant only to long strings. Thus, to instantiate the above two variables, you might do something like this:

```
SetLength (NumList, 1000);
SetLength (AdmitOne, 50, 100);
```

I know what you're dying to ask, and the answer is no! I don't believe that Delphi 4's implementation of dynamic arrays uses a sparse-array implementation. At the time you call `SetLength`, there must be enough memory to satisfy the request. If there isn't, then an exception is generated.

There is a couple of other interesting points about Delphi 4's dynamic array implementation. You can use `SetLength` to enlarge an existing dynamic array. When you do so, the existing content of the array is preserved, and only the newly created elements are undefined. This is obviously a very handy feature. It's much like (dare I say it?) Basic's `REDIM` command. Another, less obvious point concerns the allocation of multi-dimensional arrays. When you call

`SetLength` on a multi-dimensional array, you're not limited to the creation of rectangular arrays. You can begin by specifying the size of one dimension only, and you can then resize each column (or row, depending on how you want to look at it) with a different limit. This paves the way for the implementation of, for example, triangular matrices, which crop up a lot in scientific computing. Of course, the ultimate usefulness of all this remains to be seen – it's going to be dependent on the efficiency of the underlying runtime library code.



Service with a smile...

Inprise has responded to the current level of paranoia/hysteria regarding the dreaded 'Millennium Bug' by adding a Y2K compliance

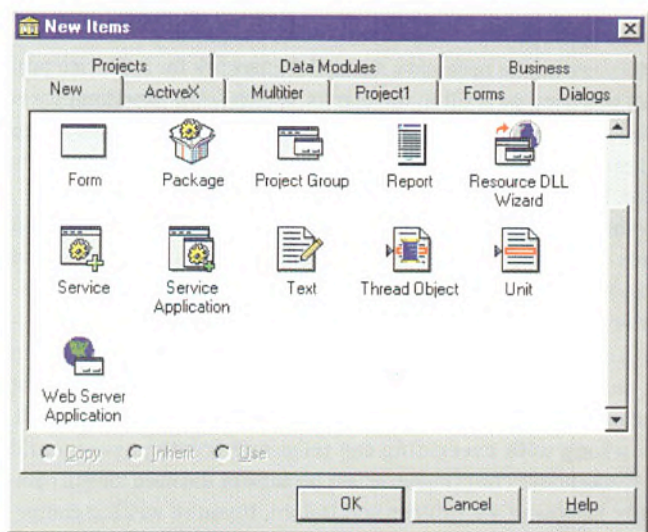


Figure 3 – Assorted new goodies have been added to the New Items repository dialog. Here, you can see two new wizards have been added that relate to NT Services. There's also a 'Multitier' page, which provides access to the Corba and MTS wizards.

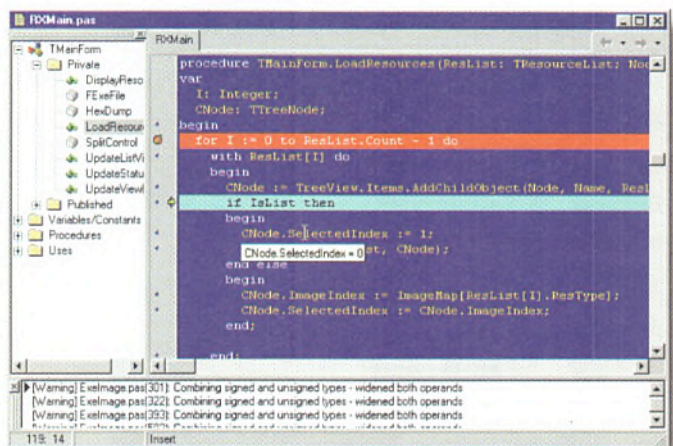


Figure 4 – The integrated debugger has had some enhancements, and supports both multi-process debugging and remote debugging. The eagle-eyed may noticed that some new warning messages have been added to the language compiler.



facility to the Delphi runtime library. A snap-pily-named global variable controls how string to date conversion routines interpret two-digit year numbers entered by the user. However, Inprise emphasises that this solution is intended only for the recompilation of legacy code in order to make it Y2K compliant.

The best approach is to insist upon four-digit year entry fields from the word go.

I love the way that Inprise keeps extending the VCL architecture in ways that were never originally envisaged by Anders Hejlsberg, and yet remain true to his vision – integrating with the application framework in a seamless, ‘Delphi-like’ manner and making full use of the power of Object Pascal. A good example of this is the DAX library, which gave Delphi programmers the ability to create ActiveX controls. As a more recent example, NT aficionados can now use Delphi 4 to create NT Services. This is handled through a couple of new classes called *TService* and *TServiceApplication*. A couple of wizards in the repository create the necessary skeletal framework for a Service project – all you need do is fill in the blanks. A rich set of functionality is provided through the two service classes. For example, you can set up event handlers to be called immediately before or after a service is installed, before or after it's uninstalled, on shutdown, and so forth.

Another VCL addition concerns the introduction of two protected methods into *TObject*. These are called *AfterConstruction* and *BeforeDestruction*. Because these methods are implemented in *TObject*, they're available to all objects in the VCL hierarchy. *AfterConstruction* is called immediately *after* the final constructor for an object, and *BeforeDestruction* is called immediately *before* the first destructor. At first sight, this might sound distinctly bizarre. After all, what's wrong with overriding the tried and trusted *Create* and *Destroy* methods? The problem arises because of the need for full compatibility between C++ Builder and Delphi. If you're writing components to work in both environments, you will sometimes need to guarantee that some code executes before any destructors (or after all constructors) have been called. This facility enables you to do just that.

Speaking of full compatibility with C++ Builder, have I mentioned that Delphi 4 produces package files with the extension BPL? Back in the April issue, when reviewing C++ Builder 3.0, I guessed that the

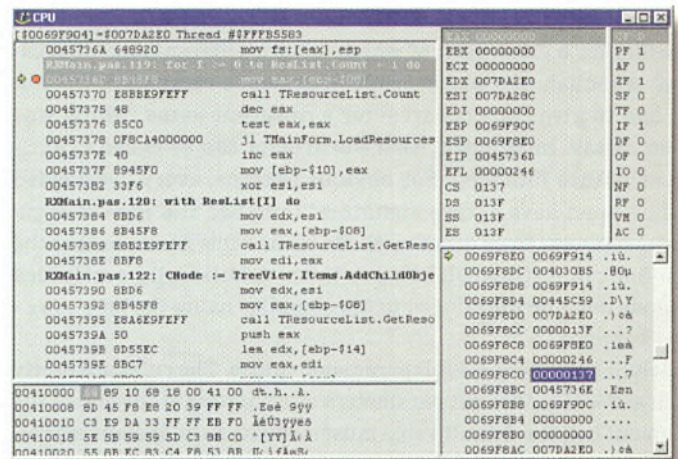


Figure 5 – The ‘unofficial’ CPU disassembly view is officially supported for low-level programmers who want to see what sort of code is being generated by the Delphi compiler.

new BPL extension would be used to create package files that could be used from both C++ Builder and Delphi. This guess seems to have been proven correct. When you create a Delphi 4 package, not only will you get a BPL file but Delphi will also create C++ compatible name-mangled exports, which are compatible with C++ Builder.

Interestingly, the internal implementation of Delphi 4 represents something of a departure from previous versions, and one that will be of interest to the terminally inquisitive – like me! In Delphi 3, the IDE was really a single large EXE file that used substantially the same set of runtime packages that were used by ordinary applications. In Delphi 4, the IDE has shrunk down to just a few hundred KB in size, and it uses a number of custom packages that are exclusively for use of the IDE. What this means is that the vast majority of IDE code is contained in packages, and it's therefore much easier to ...umm... examine than it was before. As you probably appreciate, by default Delphi will export all methods of a class and with the new name-mangling, this means that name, argument counts, and argument types are all available. Yum – hacker heaven!

But wait...there's more

There is a whole raft of additional features that I haven't got the space to discuss in detail. The integrated debugger has come in for some tweaking and now supports multi-process and remote debugging. The ‘unofficial’ CPU debugger window has become official (everybody knew it was there in previous versions of Delphi, but you had to know what registry setting to change in order to make it appear).

Inprise has added the *TMemIniFile* class to the VCL hierarchy. This class is particularly useful when using .INI files under Windows NT. NT doesn't cache .INI file changes but writes the modifications to disk immediately, which can seriously impair the performance of applications that make heavy use of such files. This class, which caches changes in memory, was originally written for internal use within the IDE, but has now gone ‘public’.

VCL controls have a new property, *Constraints*, which can be used to set up runtime limits on the way in which a form or control is resized. A new *TActionList* component has been introduced that can be used to centralise response to user commands in a single place on a complex form. The much-maligned online help documentation has been completely revamped and even in the pre-release code I was using it looked reassuringly complete.

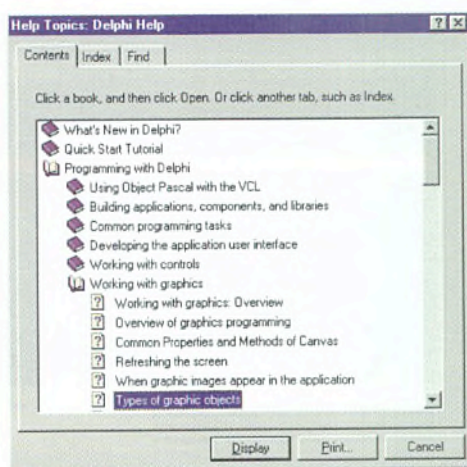


Figure 6 – Delphi's notoriously bad online help documentation has received a major face-lift. It includes tutorial information, a nice easy introduction to Delphi programming, and a strongly task-oriented approach.

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Borland Delphi 4

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And for the droids...

But what about 'Enterprise' computing, I hear you cry? What new goodies are there for dedicated database droids? Well, as you should know by now, this isn't my strong point. However, it's reassuring to see that Inprise is continuing the time-honoured Bor-

land tradition of emphasising the database-twiddling aspects of Delphi to the virtual exclusion of everything else. In my reviews of what is – after all – an excellent general-purpose development system, I merely try to redress the balance!

The Client/Server and Enterprise editions of Delphi 4 have full support for creating Corba (Common Object Request Broker Architecture) servers and clients through a couple more code-generator wizards in the repository. Delphi's Corba support is based around the Inprise VisiBroker ORB (Object Request Broker) technology that determines how Corba clients communicate with the server. Because Corba is an industry standard, you can use Delphi 4 to create clients that communicate with non-Windows servers and servers that communicate with non-Windows clients.

Support for Microsoft's MTS (Microsoft Transaction Server) technology has also been included in Delphi. More wizards (yes, you guessed!) are used to create MTS servers and data modules. Additionally, a number of BDE enhancements allow you to access new server types such as Access 97, Abstract Data Types, and Oracle8 extensions to the SQL language. Hmm... when is the BDE going to be renamed as the IDE – Inprise Database Engine? Now that *will* be confusing!

Evolution

Delphi 4 is very much an evolutionary release rather than a revolutionary one. It builds on Delphi 3 and adds a number of significant improvements such as C++ Builder compatibility, support for docking windows, NT Service creation, and so on. For me, Delphi 3 was a 'must-have', primarily because of the introduction of packages and the ability to deploy tiny executables to customers who already have the runtime packages. In the case of Delphi 4, I feel that things are less clear-cut. Whether or not you feel the need to upgrade will depend very much on what you perceive as 'must-have' features, and of course, on the price of the upgrade. For me, the ability to create dynamically-resizable array variables in my applications is very attractive, and compatibility with C++ Builder is great for linking old legacy C++ code into your Delphi applications. ■

Dave Jewell is a freelance consultant, programmer, and technical author specialising in low-level systems programming, development systems, and compiler design. He is the author of 'Instant Delphi' published by Wrox Press. You can contact Dave as Dave@HexManiac.com.

Delphi 4 Client/Server Suite has an estimated street price (ESP) of £1,699 for new users. Delphi 4 Professional has a new-user ESP of £449 and Standard will have a new-user ESP of £84.26.

Current owners of any Borland Client/Server product can purchase Delphi 4 Client/Server Suite for an ESP of £1,199. Current owners of other Borland products can purchase Delphi 4 Client/Server Suite for an ESP of £1,399. Current owners of any Borland or Inprise product can purchase Delphi 4 Professional for an ESP of £249.

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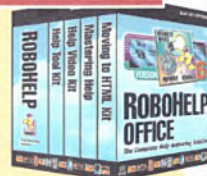
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ADVANCED TECHNIQUES

Mark Harman continues his look at software testing by describing three more techniques that focus on semantics, rather than syntax, to weed out those 'hard to find' bugs.

Coverage analysis, which we looked at last month, is the most common way of ensuring that testing really does *test* the software. But it is not the only approach. Notions of coverage are all based upon the syntactic structure of the program, rather than upon the semantic properties of the program. For example, we could try to ensure that all the statements of the program are executed, or we could try to see that every branch of the program is executed. However, errors are by their very nature *semantic* beasts, and so a purely syntactic approach to testing is not ideal; we are more likely to find bugs if we put some semantic requirement on our test cases.

The first technique we will look at, dataflow testing, seeks to address this problem by introducing some semantic aspects of the program into the notion of coverage. To start with, we need to find a path within the program that begins with the definition of a variable. Sup-

pose that the variable's name is x . The path we choose must end up with a use of x , and along the way must not go through any statement that defines a new value for x .

By 'a definition of x ', we mean that x appears on the left-hand side of an assignment statement. A 'use of x ' means that x is used in some computation, but not altered by it. For example, a use might consist of printing out the value of x , testing its value, or using its value on the right-hand side of an assignment statement.

Definition-use paths

The path we choose is called a definition-use path (or *du* path for short). The idea behind *du* paths is that the value defined at the start will pass unaffected along the path until it reaches the end where it is used. A *du* path therefore represents the *channel* along which data

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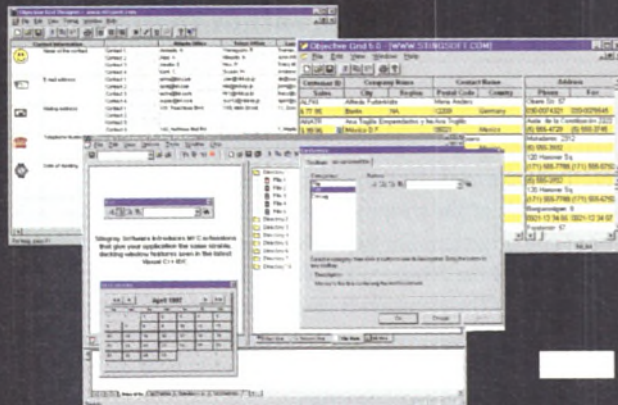
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The relationship of mutants and coverage analysis

Suppose that we want to assess the level of statement coverage that our test set achieves. We can perform this assessment using mutation testing. To do this, we create one (non-equivalent) mutant for each statement. The percentage of mutants killed will be the same as the percentage of statements covered. We can use a similar trick to get mutation testing to emulate branch coverage, in which all the branches in the program under test must be exercised. This is not a particularly efficient way of assessing statement and branch coverage, but it does highlight the connection between mutation testing and coverage analysis.

flows through the program. Dataflow testing is concerned with ensuring that our test cases exercise all of these *du* paths.

Any statement that defines a value for a variable can be the start of a *du* path. There may be several *du* paths from a single statement, because the value of the variable might be used at several points in the program. For example, consider the example program in Listing 1. In order to think about *du* paths we need to draw a graph of the program showing all the paths down which the execution can go. This graph is depicted in Figure 1. It is called a Control Flow Graph, because it shows how the flow of control moves from one point in the program to the next. Each point is called a node. To find a *du* path we look for a node where some variable is defined. Having found this, we then trace forward through the graph to find a point where the variable is used, being careful to ensure that the variable is not *redefined* along the way.

Suppose we take the assignment to *y* at node 1. This is an easy one to deal with because there is only one point at which *y* is used (node 2) and there cannot be any other definition of *y* along the way from node 1 to node 2, because there are no other nodes along the way. Therefore, there is a *du* path from node 1 to node 2 and, because there are no other uses of the variable defined at node 1, there are no other *du* paths that start at node 1. Our test cases should ensure that this *du* path is followed. This will be easy because any execution of the program will go down this path.

Suppose we start with the assignment at node 2. This node defines a new value for the variable *x* and so it can be the start of a *du* path concerned with the flow of the value of *x*. Node 8 uses the value of *x* and so we might look for a path from node 2 to node 8. There are three possibilities, each depending upon the outcome of the evaluation of the predicates in the program. These paths are $\langle 2,3,4,8 \rangle$, $\langle 2,3,5,6,8 \rangle$, and $\langle 2,3,5,7,8 \rangle$. It turns out that all of these paths contain a definition of the variable *x*, and so none of them is a *du* path. From this, we know that the value of *x* defined at node 2 cannot get through to node 8.

Although there are no *du* paths from node 2 to node 8, there is a *du* path starting at node 2. That is, the path $\langle 2,3,5,7 \rangle$. Down this path, the value defined for *x* at node 2 passes unaltered to the final node at which the value is used. It does not matter that the value of *x* is also defined at the end nodes of this *du* path, because it is defined in terms of the value given to it at node 2. In addition, you can see that there is no *du* path from node 2 to node 4, or from node 2 to node 6, because the value of *x* is used neither at node 4 nor at node 6. In fact, we can go further than that: no *du* path could possibly end at either node 4 or node 6, because no variable is used at either of these nodes.

Three *du* paths end up at node 8.

These are $\langle 4,8 \rangle$, $\langle 6,8 \rangle$, and $\langle 7,8 \rangle$.

We have now considered all the *du* paths in the program and we can turn to the problem of finding test cases that cover all of them. For this program, there



is only one determining value: the initial value of the variable *z*. It decides which branch is taken at each of the predicate nodes in the program. In this case, we can see that when *z* is compared to *x*, the value of *x* will be 4. We require three values for *z*: one less than 4, one equal to 4, and one greater than 4. This will ensure that we have exercised all of the *du* paths in the program.

In this case, covering all the statements of the program amounts to the same thing as covering all of the *du* paths in the program. However, there are programs where we can cover all the statements without having covered all the *du* paths. For example, consider the program in Listing 2. We can cover all the statements in this program using only one test case, namely where the initial value of *p* is greater than zero. However, this would not cover all the *du* paths, because there is a *du* path from node 1 to node 4, which is exercised only when the predicate evaluates to false.

There are programs where we can cover all the *du* paths without covering all of the statements. Such programs involve statements that either define a value which is never used, use a value which is never defined, or neither use nor define any value. The first two cases are rather anomalous and should be reported as errors, but the third is quite common. For example, consider the program fragment in Listing 3. Assume that the value of *p* is defined somewhere earlier in the program. Dataflow testing will not require us to execute nodes 2, 3, and 4 at all, as these cannot be the start or end of a *du* chain. On the other hand, to cover all the statements of the program we must ensure that both statements are executed.

The finding of all *du* paths can be automated (following a similar dependence-tracking type of approach that is used in program slicing, see *A piece of cake*, EXE, October 1996). This automated computation will produce a conservative approximation to the real answer.

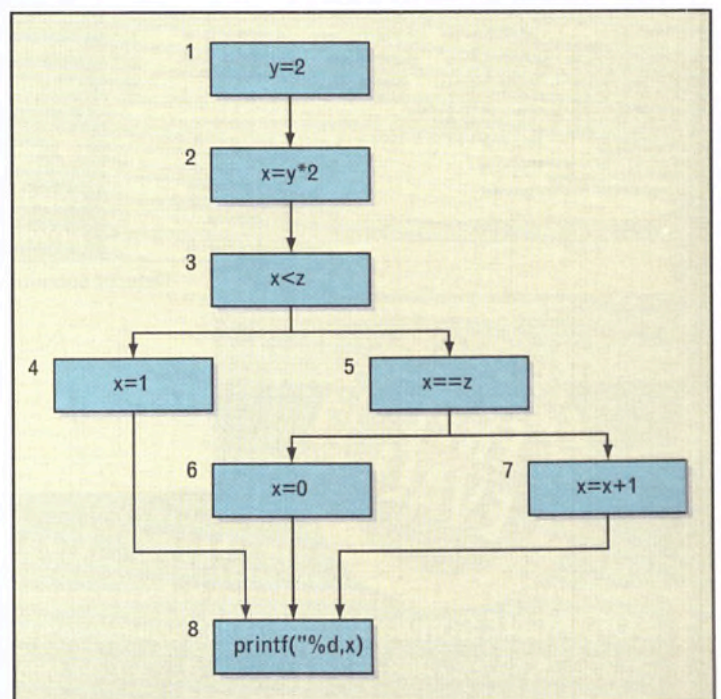


Figure 1 – The Control Flow Graph of Listing 1.

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File Edit Record View Mail Query Report Setup Window Help

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

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

Synopsis: Overlapping viewports can't be displayed

Detailed Description:

To reproduce:

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

Comments:

Attached Files: demo.log

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That is, the algorithm will correctly identify all *du* paths, but it may add in a few non-*du* paths too. This has the effect of making us do slightly more testing than necessary, but it's a 'safe approximation' because we do guarantee to cover all *du* paths. For instance, dataflow coverage, as well as the more commonly found statement and branch coverage, is handled automatically by some testing tools such as LDRA Testbed (Liverpool Data Research Associates).

Mutation testing

In dataflow testing what we are trying to do is monitor the flow of traffic (data) through the program, so that we ensure that some traffic has been down every little country lane as well as all the major motorways. We hope that the passage of traffic will show up the need for any repair work (fixing the bugs). There is a far more radical solution, which is tantamount to *deliberately* wrecking the road with pot holes and watching to see how many accidents occur – this bizarre approach to testing is called 'mutation testing'.

Mutation testing turns the whole problem on its head. Instead of testing the program to find faults, we test the test data by *introducing* faults to see how good our test data is at finding the faults. The idea is to create many copies of the program, each of which has been altered in some minor way. Each copy resembles the original, but deviates from it. Having done this, we see how many of these different variations of the program behave differently from the original, for our set of test cases.

Each copy of the program is called a mutant, because it is created by 'mutating' the program in some way. When a mutant behaves differently from the original program for some test case *t*, we say that *t kills* the mutant. For example, suppose we mutate the program in Listing 1, so that the assignment $x=y*2$ at node 2 is replaced by the assignment $x=y*4$. This creates a mutant version of the original program. To kill this mutant we need a test case that makes the mutant produce a different value to the original program. Suppose we try the test case $z=10$. In this case, the mutant will follow the same path and will end up with the same value in x at node 8 as the original program would have done. We say that the test case $z=10$ *fails* to kill the mutant. However, had we chosen the test case $z=5$, we would have killed the mutant. In this way, mutants allow us to assess how good our test cases are.

In mutation testing, we are not directly concerned with testing the program. Rather we are trying to assess the quality of the test data we intend to use to test the program. We want to see how many

of the mutants are killed by a set of test data. The more mutants we can kill the better.



Such testing is based on two assumptions about the nature of errors in programs. The first of these is called the 'competent programmer hypothesis'. According to this hypothesis, programmers write programs that are almost perfect. The competent programmer hypothesis says that program faults are syntactically small and can be corrected with a few keystrokes. The upshot of this is that the mutants simulate the likely effect of real faults. Therefore, if the test set is good at catching the artificial mutants, it will also be good at catching the *real* mutants – the faults in our program.

The second assumption, called the 'coupling hypothesis', states that should there be any big and dramatic effects that arise from bugs in the software then these will be closely coupled to small and simple bugs. The net effect of these assumptions is that we take on faith the basic principle of mutation testing: making small mutations to the program code emulates the real bugs in the software.

Strong and weak mutation testing

In the previous example, we considered that a mutant was killed if a test case made it produce a different output value at the end of the program. This is called 'strong mutation testing' because it places a 'strong' requirement on the test case. To see why the requirement is strong, consider the opposite: weak mutation testing. In weak mutation testing, we require only that the value produced at the *point we introduce the mutation* is different from the corresponding value in the original program. This is less demanding on the test cases because it is always easier to force a program to have a different value at the mutation point than it is to force it to have a different value at the end of the program.

For example, in the program in Listing 1, suppose we mutate node 2 by replacing the assignment $x=y*2$ with $x=y*4$. If we test the program with the test case $z=10$, then the value of x just after node 2 has been executed is 8, whereas its value was 4 in the original program. Had we looked only at the value of x at node 2 then we could have tested the program with any test case except $z=0$, and we would have killed the mutant. However, if we had required the value of x to be different at the *end* of the program, then only the test cases where z has a value between 4 and 9 would have caught the error and therefore killed the mutant.

Strong mutation testing is tougher (or stronger) on the test set because we can be sure that when a test case strongly kills a mutant, it must definitely weakly kill it. Mutation testing is all about assessing the quality of test cases; it would be natural to prefer strong mutation testing to weak mutation testing. Unfortunately, strong mutation testing proves much more time-consuming when it comes to automating the testing process. As with other testing strategies, mutation testing is a non-starter without automation.

A weak mutation testing tool can store the state just before the mutation point, and then test each mutated version of the statement in isolation, using the previously saved state as the starting state. This is not possible with strong mutation testing, because we have to see if the mutation creates a mutant value that survives all the way through to the end of the program. This entails running the program to the end for each mutated version of each mutation point. There are usually a great many mutations to be considered and so the strong version is simply too expensive. Fortunately, analytic and experimental investi-

```
1 y=2;
2 x=y*2;
3 if (x<z)
4     x=1;
5     else if (x==z)
6         x=0;
7     else x=x+1;
8 printf("%d",x);
```

Listing 1 – The original program to be tested.

```
1 x=1;
2 if (p>0)
3     y=x*2;
4     y=x+1;
```

Listing 2 – Covering all statements does not cover all *du* paths.



gation has shown that strong and weak mutation often turn out to be very close in practice. Many testing experts therefore believe that weak mutation testing is 'strong enough'.

The problem of equivalent mutants

Suppose we mutate the program in Listing 1, by replacing the assignment at node 2 with $x=y+2$. This mutation produces a program that behaves in *exactly the same way* as the original. We say that the mutant is 'equivalent' to the original. How can we expect a test case to kill an equivalent mutant?

Equivalent mutants are more of a problem for mutation testing approaches than one might think. There is no automatic way to decide whether a mutant is equivalent to the original program, so in automated mutant generation tools it is likely that some of the generated mutants will be equivalent (and therefore unkillable). Clearly, it is unfair to penalise a test case for failing to kill an equivalent mutant. Suppose a test case fails to kill a mutant. How can we tell whether this is because it is a poor test case or because the mutant is unkillable?

Mutation testing has been implemented in a few commercial CASE tools (three I'm aware of are: Mothra, SafetyNet, and Insure++). The latter uses mutation, but not in the way described in this article. It deliberately creates equivalent mutants. If the programmer believes that any of these produce a wrong answer then there must either be a bug in the original program, or the programmer's understanding of the specification must be at fault – or the specification itself). Studies have shown that this technique would have been good at detecting some of the famous bugs, such as the Pentium bug and the Therac-25 bugs. However, a solution to the problem of equivalent mutants needs to be found if the technique is to find wider acceptance.

Boundary value analysis

The techniques we have looked at so far are known as 'white box' techniques, because they require knowledge of the internal structure of the program. By contrast, boundary value analysis is a black box technique. It is based on the observation that faults tend to cluster around 'boundaries' in programs. The boundaries partition the input domain.

We assume that the program partitions the input into a set of domains in which the program's behaviour is similar. Because of this, we assume that if an element from some input domain produces an error then a similar error will be produced for *all* elements of that input domain. We also assume that if a particular test case fails to produce an error then all other elements in the domain will fail to produce an error.

According to these assumptions, we attempt to cover the structure of the program's input, not the program's structure. This requires no knowledge of the program's syntax – only knowledge of its specification. This allows us to start thinking about test cases as soon as we have agreed upon a specification. By contrast, the white box techniques require the system to be implemented before we can start to define test cases.

Listing 4 contains a very simple example. Suppose the specification says that the program should give the square root of non-negative inputs. If the input is negative, then the program should print a message to say that only non-negative input is handled. The program in Listing 4 is not quite right; it contains a boundary value error.

There is only one input to the program, so the boundary is simply a point on a line (the point $x=0$). Had there been two inputs then the

```
1 if (p>0)
2   printf("Hello ");
3 else printf("Goodbye cruel ");
4   printf("world.");
```

Listing 3 – Covering all du paths does not cover all statements.

```
1 scanf("%d",&x) ;
2 if (x<=0)
3   printf("Input should be non-negative") ;
4 else printf("The square root is %d",sqrt(x)) ;
```

Listing 4 – Boundary value analysis.

boundary would have been a line in a plane. With three inputs, it would have been a plane in three dimensional space, and so on. Whatever the boundary, the testing process seeks to test values on and around the boundary. If there is a boundary value error, then the boundary will shift, so we try to find test cases that will detect the shift.

In the case of the square root program, we would try one case where $x=-1$. This would test the negative input domain and one case where $x=0$, this would test the non-negative input domain. The second test case will reveal the fault: the $<=$ operator in the conditional should have been a $<$ operator.

As a testing technique, boundary value analysis is still in an embryonic state. While dataflow testing and mutation testing have been implemented in commercial CASE tools – and some form of coverage analysis is found in most tools – boundary value analysis is currently the subject of ongoing research and has yet to find its way into commercial CASE tools.

No guarantees

When we test software, we want to maximise the chance that our test cases will find bugs. No system is ever going to be able to *guarantee* that it will find every bug, but we can use some theory to improve our chances. The basis of this theory revolves around the idea that we should exercise some property of the program. The property is either a structural (white box) aspect of the syntax of the program (such as its statements or its definition-use paths), or it is a behavioural (black box) property (such as the output it produces for each input sub-domain).

A more radical approach is provided by mutation testing, where we corrupt the program to see how good our test cases are at detecting the corruption.

Finding effective ways of testing software remains a big problem. The approaches described in this article help, but no technique is perfect. Testing is likely to continue to become increasingly significant in the software development process and we can expect many developments in this field. ■

Mark Harman is a lecturer in computer science at Goldsmiths' College, where he works on program manipulation and testing using slicing and transformation. Goldsmiths' college can provide bursaries for suitably qualified students wishing to study for a masters or doctoral degree. He can be contacted by email at m.harman@gold.ac.uk.

Mark Harman would like to thank Robert Hierons, who helped greatly in the production of this article.

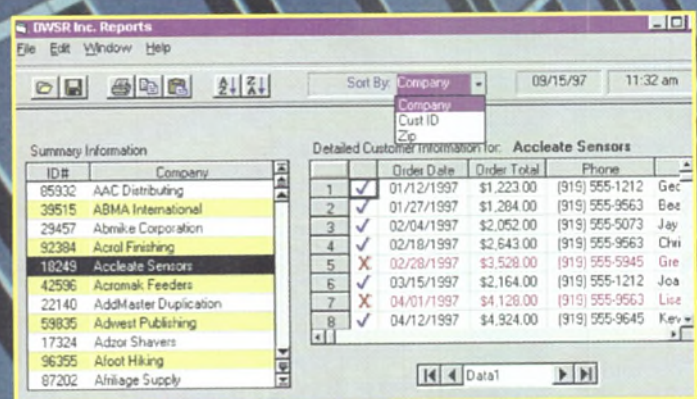
Correction: In last month's *Testing in black & white* there should have been an edge drawn from node 3 to node 4, in Figure 1 on p19.

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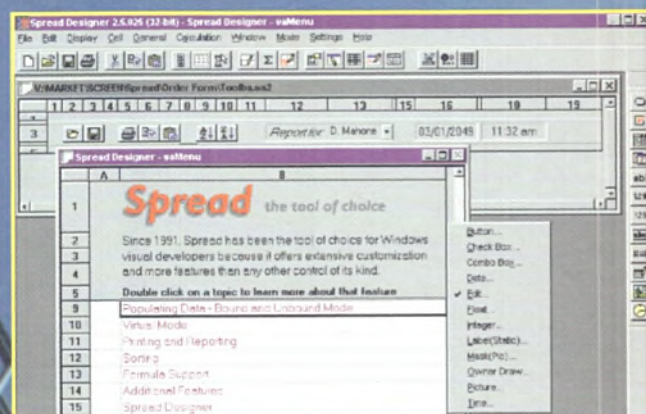
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Making Mozilla

Want to play your part in the building of a community browser? While waiting to compile the Mozilla source for Windows and Unix, Peter Collinson checked out the latest developments.

It was back in late March that our esteemed editor suggested that I might like to take a look at what Netscape was up to with the free software release of its browser. In what many people thought was a surprising move, Netscape had decided to make Version 5.0 of its original staple product into free software for developers to play with. It also started to make existing binary editions of its browser family free for anyone. The reasons for this move are well known. Mr. Gates' organisation has essentially been 'dumping' Internet Explorer onto consumers for nothing, and using it as a further lever to entrap the user solidly in the One Microsoft Way. People were taking the bait and transferring in droves. Beware of Greeks bearing gifts.

Whatever you think about Microsoft, and I am aware there are many people who observe the sun by crouching low behind Mr. Gates, I suspect that you will concede it's a bad idea for one company to control anything completely. There are different ways of doing things, different ways of looking at the world, and difference is healthy.

When the IE browser appeared, Netscape's pre-eminent position as browser supremo was challenged, and that was healthy originally, forcing Netscape to develop things quickly. Of course, you may also dislike Netscape, although I haven't found any good reason for doing so. I expect that if you bought a browser just before Netscape decided that it should be free, then you may have a solid reason for the dislike.

Incidentally, there's now a really viable third-choice browser called Opera. Sadly its available only for Mr Gates' 16- and 32-bit operating systems, and costs \$35. (It is in the process of being ported to OS/2, Amiga, and Psion, with plans for Mac, Unix, and BeOS.) Opera tries to be the speedy alternative to the heavyweights of IE and Netscape, and succeeds. However, it doesn't support some of the features that the Web is beginning to rely on, like Java or cascading style sheets.

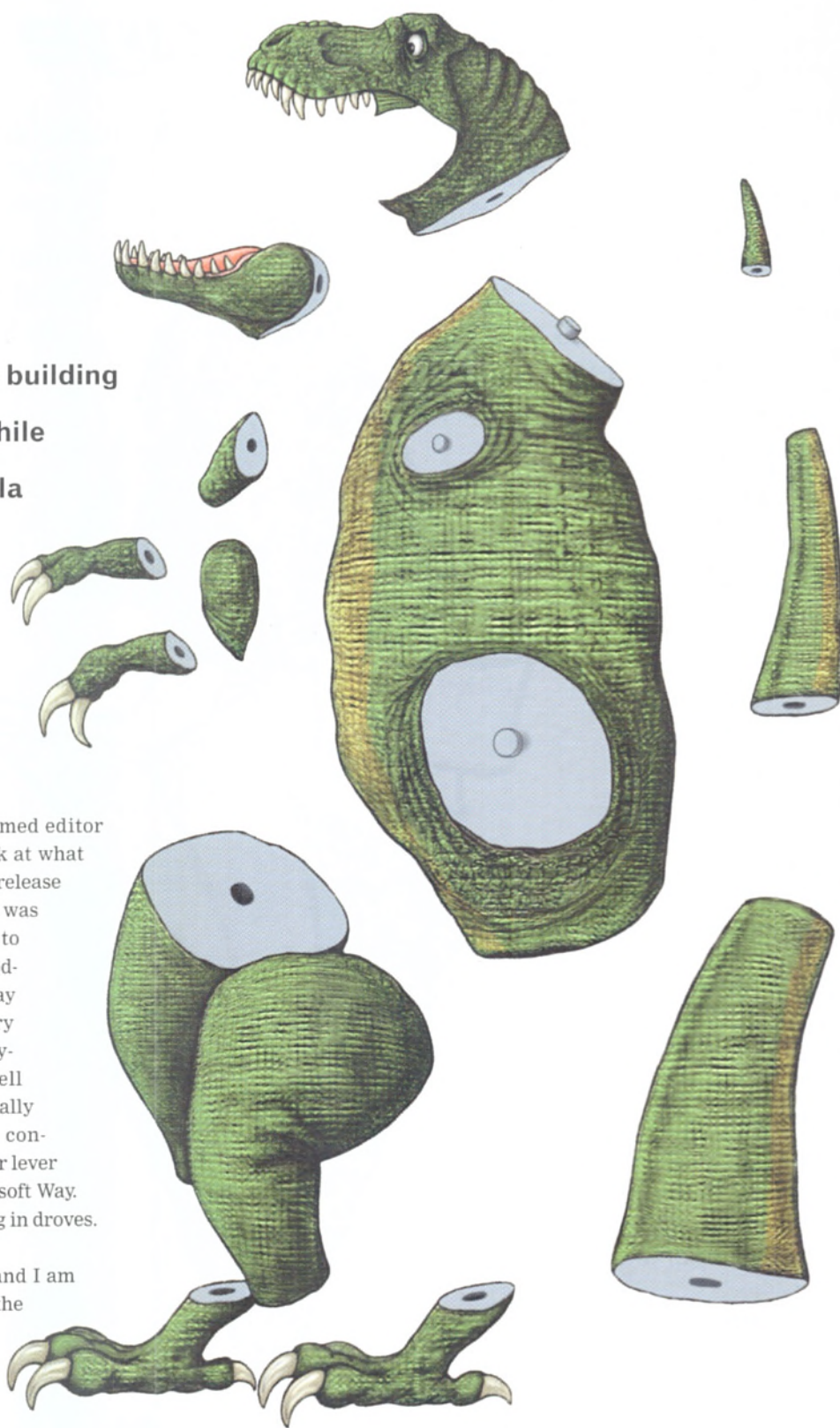


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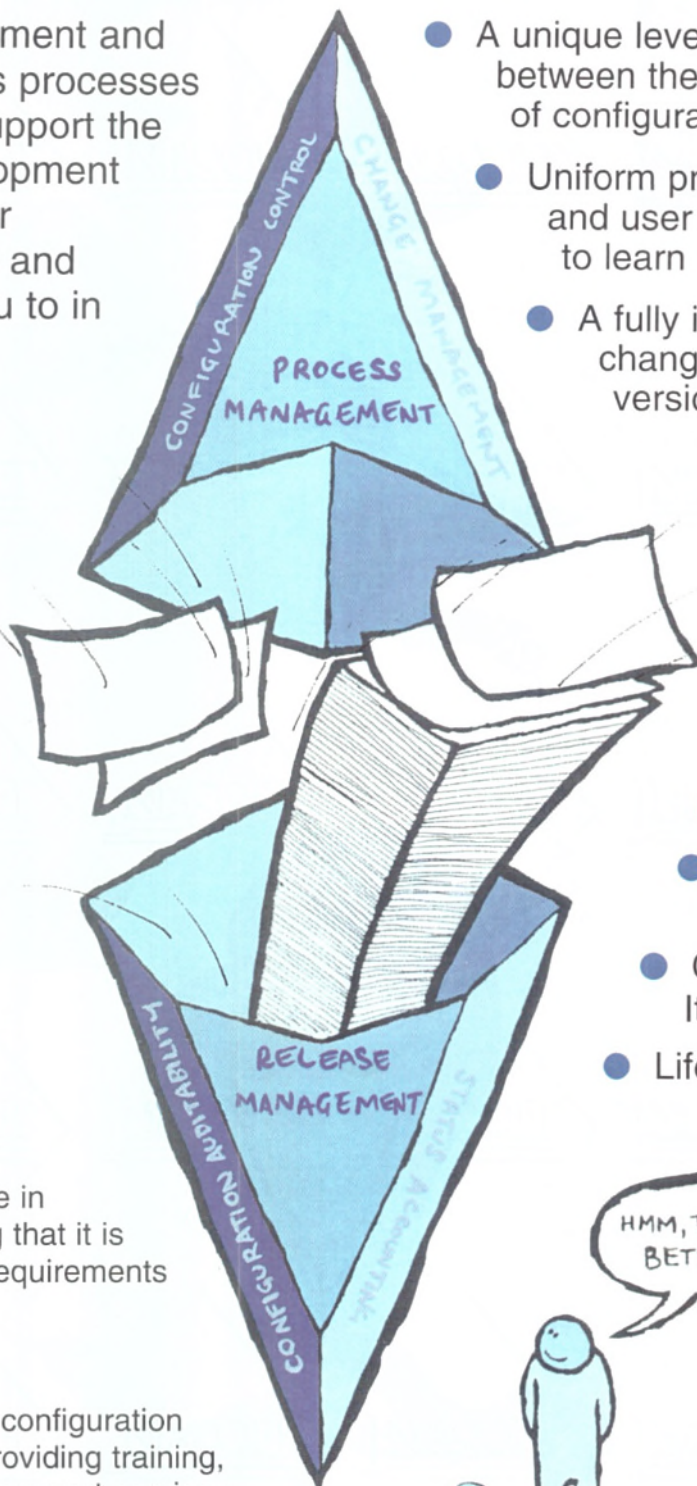
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Mozilla

Netscape has started a website (www.mozilla.org) and has released all its browser software in source form into the charge of a small team of integrators and developers. The browser base is known as Mozilla. The job of the Mozilla team is perceived to be similar to the group at Berkeley way back when BSD Unix was new. The notion is that developers in the wider community will take whatever liberties they like with the extant code. The team will accept the changes, fix bugs, manage the master source tree, perform quality control, arbitrate over design decisions, and provide a 'steer'. Netscape is providing infrastructure and paying the salary of the integrators, who, by the way, are some of Netscape's choicest staff. Many of whom contributed in a big way to the development of the browser in the first place.

Well, I pulled the released source of Mozilla on the 1st of April. At that time, the gzipped tar file was 11 MB. There have been three releases since then, so things are moving quickly. The most recent June 3rd release is 16 MB, which is probably not something that you want to pull over a slow modem Internet connection. You can get the folks at Netscape to send you a CD with the source, if you find this a better alternative.

There are actually two source distributions: one for Windows and Unix and the other for the Macintosh. One change between April and June has been the merging of the Unix and Windows code into a single code tree. While I was pulling the code, I began to wonder which machine I should use to compile it. My fastest machine runs Windows NT 4.0, and that looked favourite. The requirements for a Windows platform are (and I quote): 'a Pentium with at least a 133 MHz processor and at least 250 megs (NTFS partition) or 500 megs (FAT partition) of hard drive space. You need to have a minimum of 64 megs of memory in order to build this tree. Having at least 128 megs of memory will make your debugging experience noticeably less agonising. The preferred platform is NT 4.0. NT 3.51 will also work, and Win95 might work if you're lucky. Maybe.' There are reports of successful Win95 builds in the mailing lists and newgroups, so the 'Maybe' has become a little less iffy. My NT machine looked quite a good match but it has insufficient disk space to hold the files, and I didn't really want to compile into a Samba file system – it would swamp my network.

I looked at my Unix systems. Here Netscape advises '32 MB of RAM, 64 MB of RAM recommended, 128 MB of swap', which is no problem on any of my Unix machines. The build needs the GNU C/C++ compiler 2.7.2 or better, and GNU make 3.74 or better. I am running the compiler and it's no problem to install gmake. However, the browser is an X Window System client and uses Motif 1.2. You need to buy this if it doesn't come with your machine. I've not bought a copy for my BSDI systems, which meant I had to use my Sun. It's a SPARCstation II, once a fast machine but now creaking at the seams with modern software that interprets bytecodes. I really need to upgrade this machine.

I unpacked the code, installed GNU's make, typed in the necessary runes, and sat back. Sitting back is necessary: it's compiling 77 MB of source, and there are loads and loads of include files. This first version compiled and ran. I then deleted it because I didn't want to expend the disk space. The compilation of the June code took about

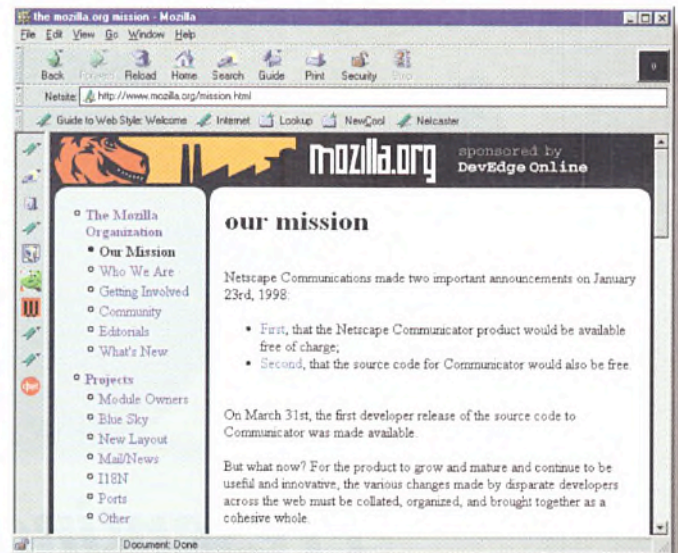


Figure 1 – Cryptozilla on Windows NT.

5½ hours on my machine, and then things didn't work; there is a problem in setting up the X environment. I have a precompiled binary of Mozilla that runs on my Windows NT machine and have contented myself with playing with that while reporting my Unix bug to Netscape. However, while I was waiting for the compilation, I decided to peruse the documents on the Web.

What you do and don't get

The Mozilla website takes great pains to point out that although you get a running program, you don't necessarily get a stable browser that doesn't crash. The code is pre-alpha and they don't want people sending in user-level bug reports. They really want developers to use the program so that when they detect a bug they will investigate it and send in pre-digested reports.

What you get is a working browser that feels a little faster than a regular Netscape binary on the same machine. The browser has all the features of a stand-alone release of Navigator, a pure web display engine plus the Composer HTML editor. It seems to work. It displays web pages, anyway. It also has bugs. My pages contain many images centred in tables, and these don't appear in the middle of the page in Mozilla.

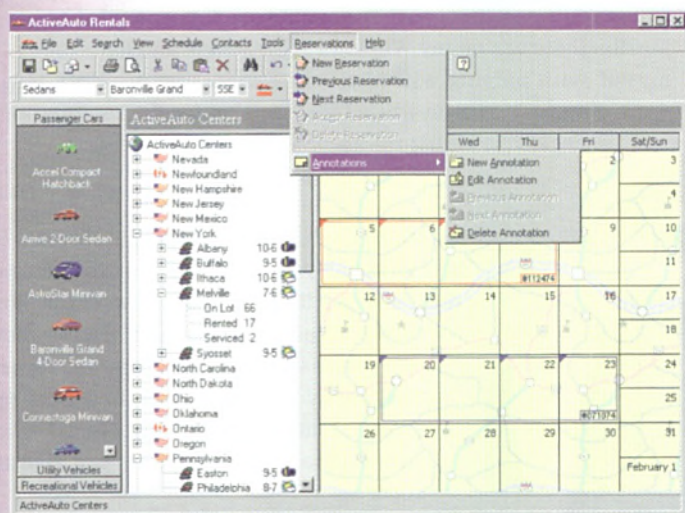
The program contains a full implementation of JavaScript and this appears to be operational. However, the JavaScript code in my pages will need to change. When deciding if a browser can do image replacement – I currently test for 'Netscape' and 'Microsoft Internet Explorer' – I need to add 'Mozilla' to the test list.

The Mozilla code is a mixture of C and C++. It's split into well-defined modules and is intended to be administered by CVS, a system that lives on top of the RCS file version control system. CVS provides version control and file management so that many people can share the same source tree, make changes, and integrate them back into the master source. Both CVS and RCS are free software available under the GNU umbrella. You do not need either on your machine to build the release.

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URLs to note

The main website for Mozilla is, of course, <http://www.mozilla.org>. You'll find more links on the site in the FAQ, which you'll find in the Documentation section and in the Download section. I've mentioned the roadmap site run by Nathan Torkington, which you'll find at <http://prometheus.frii.com/~gnat/mrm>. The source code can be browsed with hyperlinks from LXR –

<http://cannibal.mi.org/mozilla/source>. There is talk on the Mozilla pages about doing this task in-house, so the situation may change. Opera is available from www.operasoftware.com.

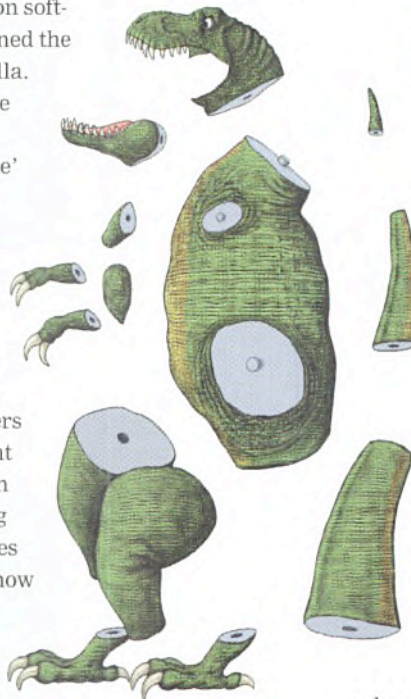
What you don't get is mostly dictated by licensing or US export law. You don't get any Java because this code depends on a licence from Sun. There is no encryption software, because this would inhibit the release of the software outside the USA. So there is no SSL support, no certificates, and the like. If you need this, then you can go to the home site of the Mozilla Crypto Group (see *URLs to note*) who ported the SSLeay version of the encryption code to the Mozilla release some 15 hours after it became available. Of course, this is in Australia, fast becoming the world's home of encryption software. Incidentally, it was from this site that I obtained the pre-compiled version of Mozilla, called Cryptozilla. You can see this in action in Figure 1. Note the absence of the Netscape browser animated logo, which is being retained in order to mark 'true' Netscape browsers.

Documentation

There's loads and loads and loads of code. How does it all fit together? Well, that's a good question. Sadly, there is no really good overview to the code supplied by Netscape. There's a desperate need for a roadmap to the code, so that new developers can quickly lay their hands on the bits that they want to change, do that job, and move on. Certainly, I learn code only on a 'need to know' basis. If I am changing something in some code, then I'll identify its interfaces and make the change. If it works, then I need to know no more. Of course, I'll curse and learn some more if the change breaks things.

There is a roadmap on the net that is linked to by various sites. However, I don't have a lot of confidence in this roadmap because it doesn't seem to have had much input from Netscape. It certainly started life from a piece of mail that was inspired guesswork (the mail is still in the archives on mozilla.org).

For example, in common with other Netscape browsers, Mozilla uses the Berkeley DB library to store (keyword, value) pairs. The source for this code lives in a directory called `dbm` and so people have leapt to the conclusion that the code is the Unix `dbm` library. Well, it ain't. The actual `dbm` library is owned by the current owners of Unix, SCO, and is proprietary. The code here does contain the DBM API but is derived from version 1.85 of the Berkeley DB library. I've corrected the roadmap. You can edit it and make changes in real time. The guy that runs the site is a very trusting soul. Nevertheless, given this basic error, I am unsure that I have a great level of confidence in the remaining information in the roadmap. It's probably better than nothing.



The documentation on the mozilla.org is growing; it's changed a lot since mid May. It is a little patchy, with detailed information on some aspects of the browser and sketchy pages on others. Quite a bit of the full information that exists is of the form 'this is how it works', and tends to ignore the question 'why is the code there in the first place?' There seem to be whole tranches of missing information. Netscape is actually looking to the wider developer community to produce documentation, and it runs a newsgroup to foster this effort. It's not clear to me that this will actually be helpful. I feel sure that you need to get the code developers to brain dump in the final analysis.

However, should you be wondering where to start, you should probably look at the FAQ available on the Mozilla site. It points at several places on the Web where you might find interesting things. Sadly, several of these seem to have been started in a burst of great enthusiasm that has come to naught. The Crypto FAQ gives a bunch of answers to questions about the ins and outs of shipping encryption technology out of the USA, and why Netscape couldn't ship things.

My next step was to skim through the extant documents on the website, just speed reading what was there. This gave me a basic grounding in the possible acronym set, if nothing else, and it does explain what some of the modules do. I was still waiting for the compilation to finish.

The code

Finally, you just have to look at the code. Accessing the code over the Web using a system called LXR is one way to inspect it. If you are just vaguely interested, looking at LXR will save you from pulling the immense gzipped tar image. The great thing about LXR is that it provides hyperlink cross references for variables, constants, and routines, so you can use links to navigate the code. One bad thing is that it treats some of the HTML documentation files like source, indexing and displaying line numbers, rather than showing the contents.

As I said, the code is very modular. At the heart of the module organisation is `xpcom`, a homegrown version of COM used to provide basic communication between modules. An internal version was written to ensure cross-platform support and to avoid licensing Microsoft's version. Because modules are written with C++ interfaces, the code doesn't

need to have COM's extensive support for function pointer tables and stack calling conventions.

The `xpcom` source is to be found at the top of the source tree, along with other major sections of the code. Some sections have small amounts of attached documentation, and some do not. There are sporadic README files too, and these can help to understand what the code in that section of the tree is doing. For example, the `js` directory contains JavaScript, which is also shipped with the reference implementation, providing a stand-alone interpreter that can be used to test source files written in JavaScript.

There's been significant work to divorce the code from platform dependencies, even though it's evident that there has been three distinct lines of development: for Unix under X, for Windows, and for Macintosh platform. You'll find three possible 'front-ends' in the `cmd` section of the tree: `xfe` for X11, `winfe` for Windows, and `macfe` for



the Macintosh. There is a 'stub' front-end for creating new platform interfaces.

The key to making the code portable is to provide abstractions of various facilities, to generate an internal API, and write conversion libraries. The NetScape Portable Runtime library (NPSR) is one part of this idea. The facilities that this code supplies includes threads, thread synchronisation, normal file and network I/O, interval timing and calendar time,

basic memory management, and shared library linkage. A primary purpose of the library is to provide support for the Java VM.

The Mozilla code contains basic functionality for several of the new ideas and systems being introduced on the Web. For example, there is limited support for XML, the next generation mark-up language. There is extensive support for the Resource Description Framework (RDF).

RDF has been defined by the Web Standards body (W3C) and is designed to provide an infrastructure to support metadata across many web-based activities. The browser supports many different pieces of structured data: bookmarks, history of pages that have been accessed, file systems, document structures, sitemaps, etc. The creation and access code for the objects are independent: each object has its own storage system, editing and viewing tools, and query or manipulation APIs. RDF addresses the observation that there is considerable overlap in the data models used by these different structures; they are all directed labelled graphs. The basic idea is to hide all the localisation behind the RDF data model and present a single API to the browser, unifying all these structures into a common service set.

Support and bugs

Netscape are providing several publicly available newsgroups from the Mozilla site. These should be your first points of contact for help. As with many newsgroups, the signal to noise ratio can leave things to be desired, but the folks on the Mozilla team do monitor and post to these groups, so the worst inaccuracies are sorted out in the end.

There is now an official bug reporting and tracking system that runs from the Web, it's a little slow and some of the menu choices are out of date, but it's still usable. You need to register for this section of the site.

On the 'Getting it' (the software, the software) page, there are links to *Bonsai* (cute names 'R' US) which gives you details on the changes that have been made to the CVS tree. And there's *Tinderbox*, which is interesting from an engineering standpoint. They are continuously building the code on several hosts and track errors to see what has broken and who was responsible.

Raptor

Well, this is an interesting effort and will no doubt grow with time. I haven't managed to mention (or look at) the other slab of code that's available from the Mozilla site. Raptor is the next generation layout engine that's intended to provide the basis for future Netscape browsers; its code is also freely available.

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The object of STL containers

Francis Glassborow considers why containers will struggle to hold objects.



Last month I wrote about attributes and objects. A clear understanding of these is required if you are to get full benefit from the Standard Template Library (STL). Let me try to explain why.

Several years ago a visitor to an exhibition commented to me that he was disappointed to find that the STL was at such a low level that it handled only value types. At the time I thought very little about it, perhaps I should have given it more thought. At first sight, you would expect that the contents of a container would be objects. I hope you will soon realise why that cannot be.

Whatever mechanism you use for placing elements into a container there are several things that you will expect to be able to do with them. There would be very little purpose served by a container that could not be sorted. Think carefully about the minimum requirement for such an activity: you need to be able to move the contents around. I am sorry if you have ever been taught otherwise, but a fundamental property of a true object in computing is location. You cannot move an object (and that is just as true in Java where you can swap names around but not the objects they reference). If you could move an object, you would invalidate all iterators and references to it.

In order to sort the contents of a container we need to move things around. That means we need to be dealing with values. Remember that location is not a fundamental property of a value. In general, values have public copy constructors (and copy assignments) and well-behaved destructors. Normally we require default constructors to create bulk containers of elements though we can sometimes avoid this in the case of STL containers (rather than raw C-style arrays) by pushing the elements into the container one by one.

Do not confuse the requirement that `deque<>` shall not move with any requirement on the individual elements of a `deque<>`. A `vector<>` container may have to relocate its elements when it is expanded (the C++ version of `realloc`) and so invalidate existing pointers and iterators to its elements. A `deque<>` never relocates itself, but the elements can take new values.

We have to be very careful when it comes to calling STL algorithms on STL containers as some of these may unexpectedly use extra copies of elements. For example, sort algorithms that use a pivot element may well create a local copy of the pivot element. If there is any aspect of the copy constructor of an element that does not abide by the semantics of strict copying, we are heading for trouble.

How do we produce containers of objects? Most programmers try using pointers. Fairly soon they realise that this does not work because there are no destructors for pointers. Pointers get over-written, with the result that the destructor is never called for some objects. To see why this might be, consider an algorithm such as `erase()`. This can simply over-write the erased element (having called any required destructor – remember, there aren't any for built in types and pointers).

We can use containers of pointers but we must be very careful which algorithms are called. That kind of care is far from safe in software that lasts for more than a couple of days. Sometime someone is going to forget. Unfortunately, most of the early practice programs of those learning the joys of STL will survive this abuse.

Having discovered that plain pointers do not work reliably, the new programmer realises that s/he needs something like a pointer that

will have a destructor to take care of the object it points to. As this is something that all programmers will want at some time, you could reasonably expect to find what you want in the Standard C++ Library. Indeed, when you start looking you come across `auto_ptr<>`. All but the most careful inspection of this 'smart pointer' will suggest that it is what you need. Unfortunately, `auto_ptr<>` has what is called ownership semantics. This means that the act of copying it transfers ownership to the copy. We do not have strict copy semantics: the copy and the original are different. Indeed, the act of copying mutates the original. Though the version of `auto_ptr<>` in the Final Draft International Standard (FDIS) makes it just about impossible to use containers of `auto_ptr<>`, the versions shipped with most current compilers lack this magic protection. A container of `auto_ptr<>` that is never re-arranged will probably survive. If you do anything to your container other than read it, your code will finish up doing something very nasty and totally unexpected at the worst possible moment.

You should never try to use a container of `auto_ptr<>`.

Handles

What we need is some form of handle for our objects with value semantics. As soon as we start providing any form of ownership semantics we are in trouble. We do not need all the complexity of a full-blown pointer. We need something that can be created, copied, and destroyed while tracking an object. Ideally, we would like something that tracks both static and dynamic objects, but if we cannot have both we will have to make do with just using dynamically created objects. We need some simple value type that can contain one of two situations: a null pointer or a pointer to a dynamically created instance, together with a count. Furthermore, we want it as a template so that ordinary programmers do not have to constantly invent it for themselves.

What makes this particularly vicious is that we almost certainly want to be able to handle polymorphic types. In other words, we need to be able to provide 'derived to base' conversions for our handle class, so that `Handle<Base> = Handle<Derived>` will work but `Handle<Derived> = Handle<Base>` will fail. Even without this extra level of complexity we still need to be careful.

To begin, we need a mechanism for counting non-intrusively. In other words, whatever we do must work even for classes that we do not own and that do not support copy-counting. As we are going to provide some form of generic facility this strongly suggests that we should use some form of template. Something like:

```
// predeclare the main working template class
template <typename Object> class Handle;
// now define the count support (privately)
template <typename Object>
class Counter {
    Object * ptr;
    int count;
// prevent copy semantics
    Counter(Counter const &);
    Counter& operator = (Counter const &);
// provide constructor from Object instance,
```



```

Counter(Object const & obj, int cnt):
    ptr(&obj), count(cnt) {}
// default Constructor and destructor
Counter():ptr(0), count(0) {}
~Counter();
// provide access for handle type
friend class Handle<Object>;
};

```

Now only the related template class can create Counter<Object> instances.

```

template <typename Object>
class Handle {
    Counter<Object> * item;
public:
    // construct from existing object
    Handle(Object & obj):
        item(new Counter<Object>(obj,1)) {}
    // construct from pointer to existing object
    Handle(Object * ptr):
        item(new Counter<Object>(*ptr, 0)){}
    // default constructor
    Handle(): item(new Counter<Object>) {}
    // lazy copy
    Handle(Handle const & hnd):
        item(hnd.item) { (item->count)++; }
    // assignments
    Handle & operator=(Handle const & rhs);
    Handle & operator=(Object const &);
    Handle & operator=(Object *);
    // destructor
    ~Handle(){
        if((item->count)==0) delete (item-> ptr);
        else (item->count--);
    }
};

```

Please note that this is far from finished code and it needs a lot of work to finish it. If it were otherwise, the C++ Standard Committees would have found time to deliver something in the library.

The Handle class contains both constructors and assignments to acquire management of existing objects (passed by reference) and dynamic instances (passed by pointer). If it is an existing object, the count is started at one so that the Handle will not destroy the object. If it was newly created, the Handle assumes responsibility for its ultimate destruction. The following specimen statements should work:

```

MyType mt, mtx;
Handle<MyType> hnd1(mt); // use but do not destroy
Handle<MyType> hnd2(new MyType); // destroy when finished
Handle<MyType> hnd3; // create an empty handle
hnd3 = mtx; // acquire mtx but don't destroy it
hnd3 = new MyType; // acquire a dynamic instance

```

Notice that the usage of pointers for dynamic instances relies on programmer discipline. I am leaving the implementation of the assignment operators as an exercise for the reader, though note that you must handle the left-hand side carefully.

I guess expert readers will have great fun ripping into the above scheme. I will be more than happy if they then provide an effective and robust mechanism to handle objects in containers. To do that we will have to add other functionality such as comparison operators.

The great advantage of template libraries is that once someone gets the design and implementation right the rest of us get a cheap ride.

Last month's problem

Look at the following minimalist source code and decide what the output should be.

```

#include <iostream>
using std::cout;
using std::endl;
char const * fn(int, int)
    {return "Two parameters";}
char const * fn(int) {return "One parameter";}
int main(){
    int i, j;
    cout << fn((i, j)) << endl;
    return 0; }

```

Skip over the anonymous parameters, they are perfectly legal in C++ though not in C. Ignore the return of the addresses of string literals, which is plain ugly but perfectly legal, particularly as they are returned with const qualification. Note the use of using declarations to inject names selectively from the standard library namespace (std) into global space. That is the way it was intended for use rather than potentially dumping all the library names into global space.

What do you think the output should be? If you decided that it should be 'One parameter', you missed the nasty bug lurking behind bizarre code. It is true that the inner brackets in fn((i, j)) means that i, j is a list and that the comma is a sequence operator. The value of a list is the last item in the list but the individual items must be evaluated. Being right up to date you correctly identified that the lhs of the comma operator evaluates as a reference to i. You also worked out that the rhs might evaluate the same way (as a reference to j). So far so good. However, that last must now be passed by value to the anonymous parameter of fn(int). All the anonymity does is inhibit warnings generated because the parameter is not used. However, the value must still be passed. It must be that way because the definition of fn() might have been in a different file. There is no requirement for parameters in prototypes to have names, only types. Reading storage before it has been initialised is undefined behaviour. In other words, while most compilers will generate code that outputs the expected message, absolutely anything could happen. Just change those ints to int * throughout and many compilers for protected memory systems will generate an executable that will sometimes exit with a memory violation fault.

This month's problem

With the increasing availability of C++ compilers that support exceptions, we are seeing adventurous programmers experimenting with veritable hierarchies of exception types. Look at the following typical exception hierarchy and decide what the flaw is:

```

class Exception {};
class Out_Of_Bounds : public Exception {};
class Too_Small : public Out_Of_Bounds {
    string message;
public:
    Too_Small(string m = "No Data"): message(m) {}
};

```

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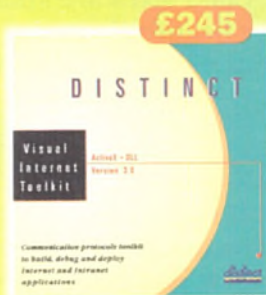
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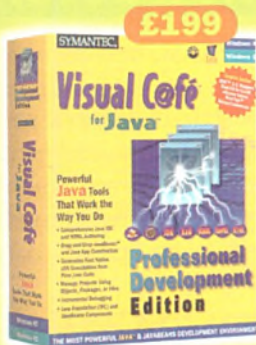
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Working in the object factory

Mark Smith shows how, with the help of a design pattern to centralise the creation of objects, programming work can be significantly simplified.



Following on from last month's look at the Observer pattern, I want to stay with the theme of how design patterns can make your Delphi programs simpler and more flexible. Once again, the inspiration is *Design Patterns* by Gamma, Helm, Johnson, and Vlissides (aka the Gang of Four or GOF). One of the most useful sections of this book, 'Creational Patterns', deals with the creation of objects and presents a family of design patterns that add flexibility in how, when, and by whom an object is created. I'll focus on a variant of the Factory Method pattern that I have found to be very useful with Delphi.

Design patterns are usually presented as a problem in a context with a solution. For Factory Method the problem is an application framework needing to instantiate domain-specific objects, the context being that the framework knows nothing of the domain-specific objects it is responsible for. Factory Method describes a Creator object that creates objects using the overridable `FactoryMethod` function. To use Creator, you subclass it and override `FactoryMethod` to create the objects you require. The GOF version of Factory Method (shown in Figure 1) describes an inheritance tree of Creators with each Creator responsible for making a single kind of object. Each Creator is relatively permanent. Once the program has been linked, the Creators cannot easily be changed.

Object creation

We will be using these ideas to provide a solution to a pair of common object-creation scenarios, which I will call in-house and vertical. In-house systems evolve over time to cope with entirely new types of functionality when the business requirements change. This functionality is delivered as additional classes that co-exist with the ones the system was originally built with. Vertical systems are written for specific vertical markets and often require modification for specific clients. Instead of adding new kinds of business classes the developer is required to add new derived classes that override their ancestor's behaviour. The challenge for in-house systems is an increase in the number of business object classes, while the challenge for vertical systems is in increasing the depth of the inheritance tree.

I will use an example from the area of television and radio program budgets. As presented, the example is closer to the in-house model,

though the system described could also be packaged and sold as a vertical system. Both television and radio budgets can be assumed to derive from a standard 'broadcast' budget and in addition there is an extended television budget, giving the inheritance hierarchy shown in Figure 2. For every kind of budget we have specific editor forms, reports, and import/export routines. These are arranged in their own class hierarchy, which reflects the class hierarchy of the business objects. For example, there is a `TelevisionBudgetEditor` form for editing `TelevisionBudget` objects and a `RadioBudgetReporter` for printing the details of a `RadioBudget`.

When working with Delphi in RAD mode it seems obvious to use direct creation of objects. For example, it would be easy to write code that directly instantiates a `TelevisionBudget` object and a `TelevisionBudgetEditor`. However, when the system is extended to include new classes, we would need to add code to create the new budget objects, as well as code to create all of the editor, reporter, and import/export classes needed to support the new business function-

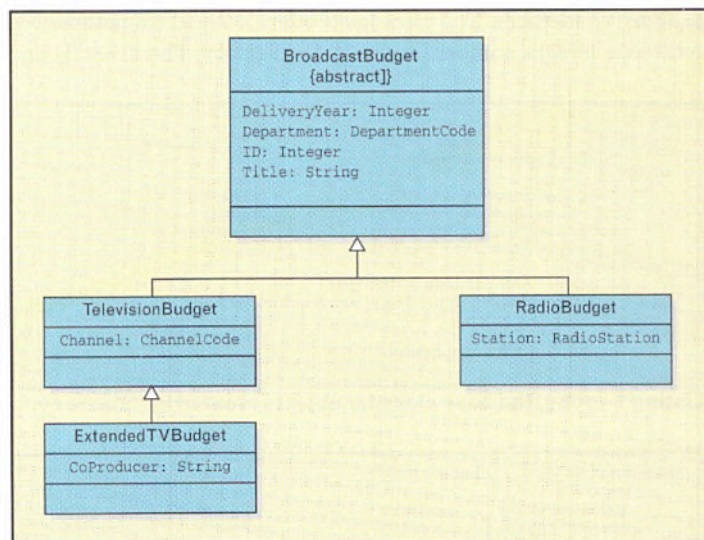


Figure 2 – Example business object class hierarchy.

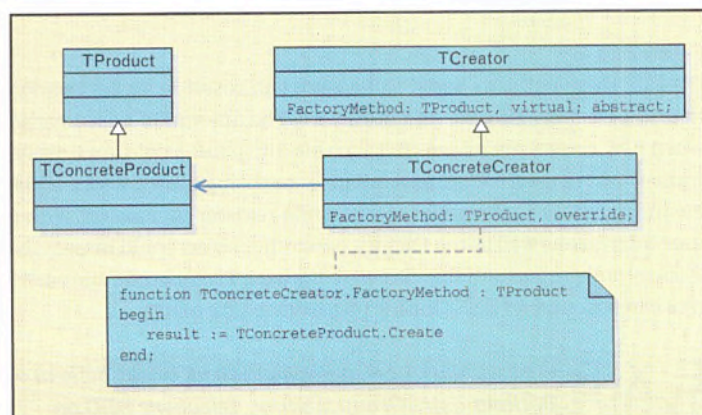


Figure 1 – Factory Method.

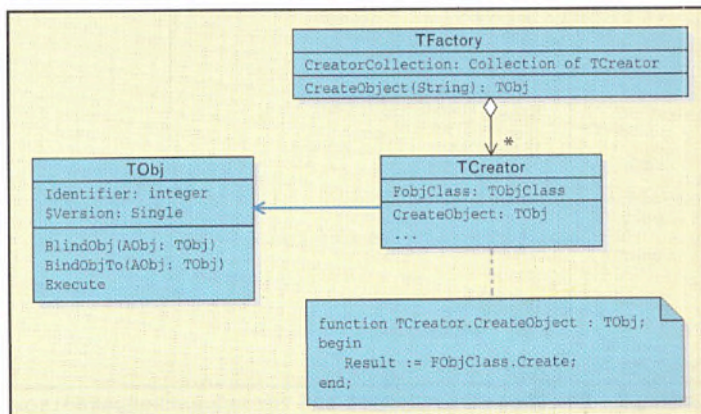


Figure 3 – Delphi implementation.

ality. In a vertical application, we would need to replace the code that created the base objects with code that creates new objects from the derived classes. Either way, this adds up to a lot of work since we need to check the entire program to make sure we have made the appropriate changes systematically. By centralising the creation of objects, we can simplify our programming work significantly.

Implementing the Factory Method pattern

As I mentioned earlier, the basic Factory Method describes Creators arranged in an inheritance hierarchy, with each Creator knowing the class of the objects they are creating, as shown in the code snippet for `TConcreteCreator.FactoryMethod` in Figure 1. That is not quite the solution I am proposing. Instead, I maintain a list of Creators in a Factory as shown in Figure 3.

The application requests a new object from the Factory, which locates the appropriate Creator and calls it to do the work. This is very similar to the Parametric Factory Method, which is a variant of the Factory Method pattern. The advantage of this approach is that the list of Creator objects can be changed by adding new Creators to the Factory in an `initialize` block or even at runtime by adding Creators from a DLL or package. Internally, `TFactory` maintains its Creators in a collection, rather than the more common `StringList` with objects. This is more convenient as it means that the Factory manages the lifetime of the Creators.

The Factory and the Creator classes understand the base class that we are using, `TObj`. This class (see Listing 1) is a very simple descendent of `TObject`, offering `Identifier`, `Execute`, `BindObj`, and `BindObjTo` methods. The class itself offers a `Version` method that returns a version number for use by the Factory. The `BindObj` and

`BindObjTo` methods are for linking objects together, more of which later.



A Factory object is visible to any module that includes the Factory unit. The `TFactory.Add` method creates a new Creator. The `TFactory` class also exposes two methods for creating objects – `CreateObject` and `CreateObjectForObject`. In general, the programmer calls `CreateObject` to create objects that model the business, while `CreateObjectForObject` is used to create user interface objects such as forms and reports.

When requested to create a new object, the Factory needs to decide which Creator to use. The Factory searches the `CreatorCollection` for appropriate Creators. If there is only one Creator available to create a given class name, there is no problem – the Factory just asks that Creator to create a new object. If there is more than one Creator able to do the job, the Factory needs to determine the best choice. In this example, the best choice is deemed to be the latest version of an object. This choice is arbitrary, but it works for me. Another design pattern, called Strategy, suggests that the logic could be delegated into another class, but I choose not to do so here for the sake of clarity.

Building the application

Having a framework for managing the creation of objects, we can return to the broadcast budgeting program. We can model budgets using `TObj` as the ancestor for the `TBroadcastBudget` from which the other budget classes descend. The editor `TBroadcastBudgetEditor` also descends from `TObj`, thus putting all objects in the system within the framework offered by using Creators. See Listing 2.

The issue is then one of actually linking the editor (or reporter, import, or export) objects to the objects from the business domain. This is where the `TObj.BindObj` and `BindObjTo` methods come in. You override `BindObj` to accept an object to link to, and `BindObjTo` to link yourself to another object. Delphi provides superb runtime type information and you can use this to determine if you are willing to accept a binding to another object. If `TObj` has not been overridden in a descendent class or a class cannot determine how to bind to another class, `BindObj` calls the `BindObjTo` method of the other object, passing itself as a parameter. In other words, if object *A* does not understand how to bind to object *B*, then *A* asks *B* 'can you bind to me?'. This allows classes introduced later in the system lifecycle to add functionality to the application without the need to modify existing classes.

In the example program, the `TBroadcastBudgetEditor` class overrides `BindObj` to check if the parameter is an object of class `TBroadcastBudget`. If so, it accepts the binding and stores the object as a `TBroadcastBudget` in its private property. Otherwise, it calls the default inherited behaviour. The editor class overrides its `Execute` method to create a form and present the budget for editing.

Flexibility

Overall, these patterns-based techniques can result in an application that is a lot more flexible and minimises the amount of code needed when new classes are added. To turn this into a full-blown application framework we need some mechanism for exposing the existence of the business classes to the user. Classes could register themselves with a user interface as well as the Factory, or another object could inspect the Factory and present suitable classes to the user. The full code and examples can be found on EXE OnLine (<http://www.exe.co.uk>). ■

EXE Contact Mark at msmitha@cix.co.uk or say hello at a Borland Users Group meeting. Telephone BUG on 01980 630032 for details.

```
TObj = class
private
    FIdentifier : integer;
public
    class function Version : single; virtual;
    procedure BindObj (Aobj : TObj); virtual;
    procedure BindObjTo (Aobj : TObj); virtual;
    procedure Execute; virtual; abstract;
published
    property Identifier : integer
        read FIdentifier write FIdentifier;
end;

TObjClass = class of TObj;
```

Listing 1 – `TObj`, the base class for objects created by `TFactory`.

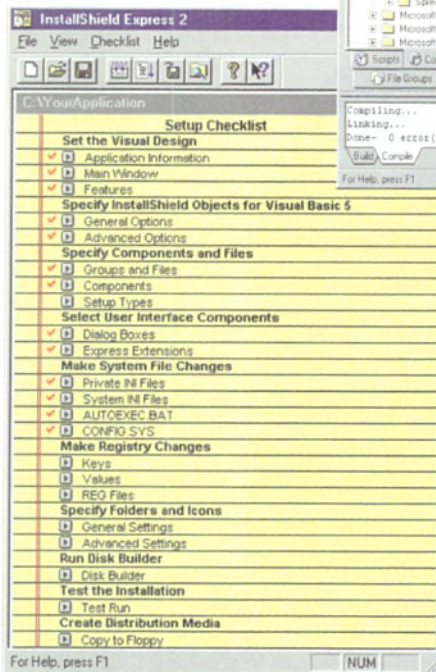
```
TBroadcastBudget = class (TObj)
private
    FDeliveryYear : integer;
    FDepartmentCode : string;
    FTitle : string;
public
    class function Version : single; override;

    property DeliveryYear : integer
        read FDeliveryYear
        write FDeliveryYear;
    property DepartmentCode : string
        read FDepartmentCode
        write FDepartmentCode;
    property Title : string
        read FTitle write FTitle;
end;

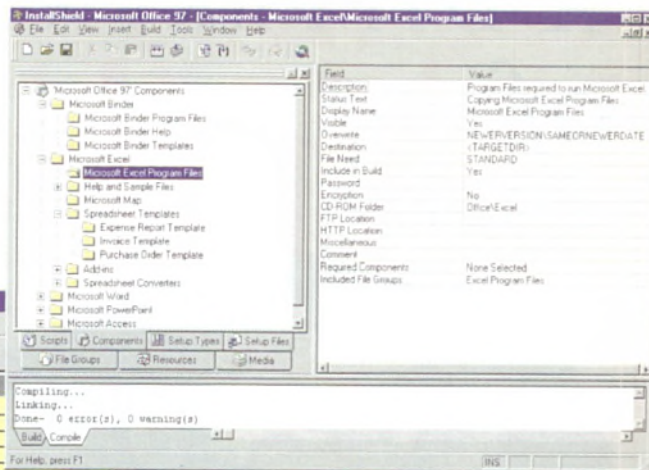
TBroadcastBudgetEditor = class (TObj)
private
    FBroadcastBudget : TBroadcastBudget;
public
    class function Version : single; override;
    procedure Execute; override;
    procedure BindObjTo (
        Aobj : TObj); override;
end;
```

Listing 2 – The `TBroadcastBudget` and `TBroadcastBudgetEditor` classes.

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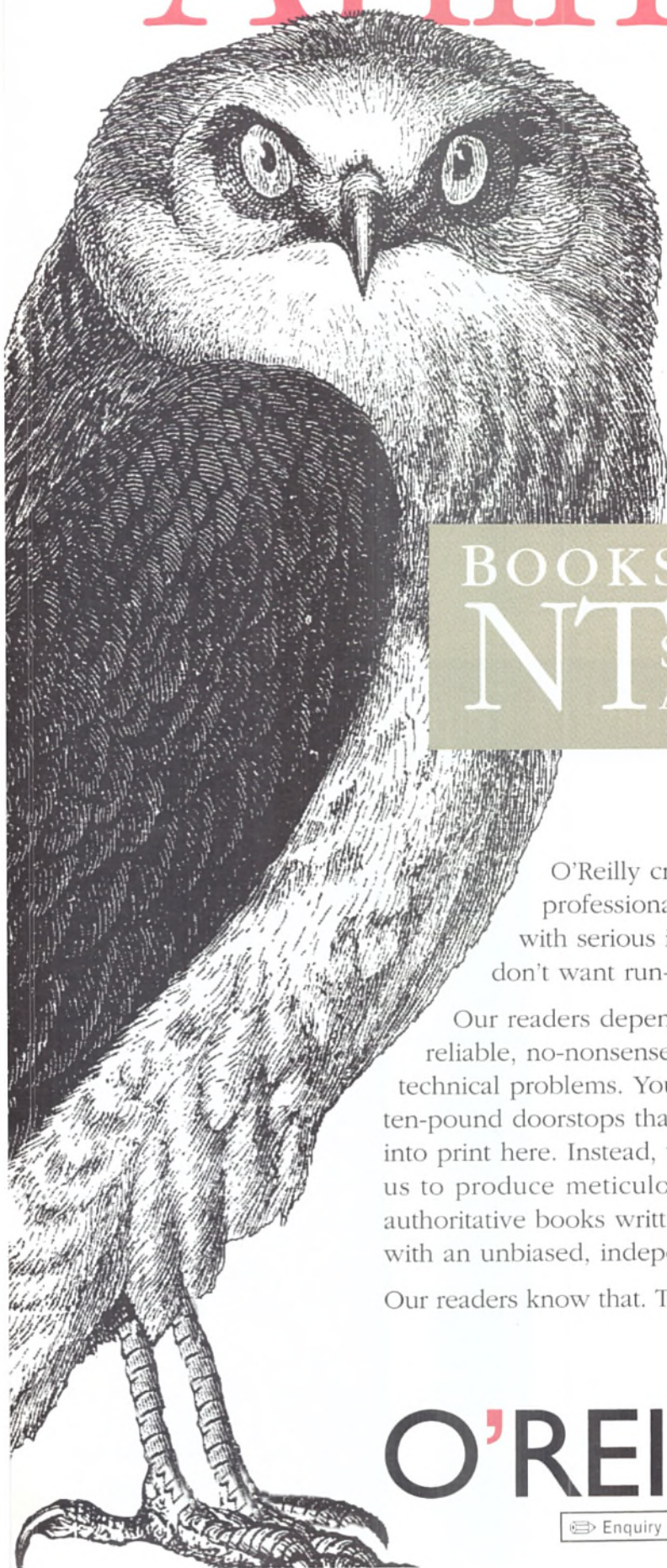
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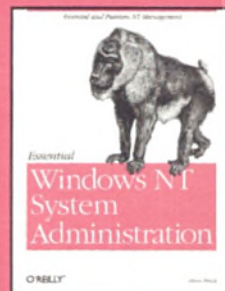
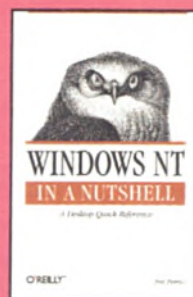
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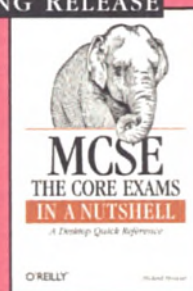
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The TradeX project evolves

Tom Guinther continues his examination of the fundamentals of the Java language and how best to apply them to a complex and demanding project.



Last month I was talking about understanding the fundamentals of the Java language and environment with an emphasis on class and interface design. This was to explore some of the typical design problems and trade-offs one would normally encounter during the development of a complex Java application. In order to facilitate the discussion I proposed writing a stock market trading system in Java and presented a few base interfaces as a starting point for further thought and development.

The interfaces presented were `IBasicQuote`, `IQuoteData`, and `IQuoteServer`. Since last month I have added a new interface:

```
interface IQuoteIterator extends IBasicQuote
{
    public abstract IBasicQuote getNext() ;
    public abstract IBasicQuote getPrev() ;
    public abstract void restart(int interval) ;
    public abstract boolean hasMoreElements() ;
}
```

The code that accompanies this column (available on EXE OnLine) contains a basic implementation of each of these interfaces, and includes quite a few new interfaces and classes that use them to perform real calculations and analysis.

As I pointed out previously, interfaces are used because we are specifying a set of functionality without specifying the implementation. The interface definition is often referred to as a contract because anyone who implements the interface must abide by the rules and guidelines set forth by the designer(s). The methods of the interface specify a portion of the contract but, in general, do not contain enough information for a complete implementation. This is because many times an interface requires intrinsic functionality that cannot be specified directly using programming notation. That is the difficult way of saying that the interface designer may need to provide implementation guidelines in comments or separate documentation. A good example is what error codes can be returned and under what conditions.

Exceptions

Speaking of errors one of the first things I decided was that the primary methods of each interface would throw a checked exception of type `QuoteException` (or one of its derived classes).

```
// generic exception
class QuoteException extends Exception
{
    public QuoteException() {}
    public QuoteException(String s) { super(s) ; }
} ;
```

I am a big believer of designing error handling in from the start because halfway through a design or implementation it is nearly impossible to wedge it in. In Java, the design of signalling and handling errors should usually evolve around throwing exceptions. From my experience, Java truly has the correct exception model. This is

specifically in contrast to C++ exceptions, which I think suffer from lack of a `finally` clause and the complexity and performance problems associated with implementing the RTL object tracking and unwinding.

The class `QuoteException` is derived from class `Exception`, which means that it is classified as a checked exception. A checked exception must be declared in the `throw` clause of any method that throws it. In addition, any code using a method that throws a checked exception must catch, or 'check' for an occurrence of that exception. If you define an exception that is derived from class `RuntimeException` then the exception is not checked, and calling code does not need to explicitly check for the exception although it may do so if it wishes. The only really annoying thing about check exceptions is that you do have to check for them. If the design of an application's error handling gets over-bearing, the code starts to look and feel clumsy. Finding a balance is usually pretty easy. If you examine the sample code, you will notice that I use non-checked exceptions in a few places where it seems more sensible.

Note that class `QuoteException` is not very complex. That is intentional since `QuoteException` is intended to serve as a super class for other exceptions, which might be defined in the future. The example code defines quite a few exceptions most of which derive from `QuoteException`.

The most important question to ask about `QuoteException` is why bother to define it at all, and why do the base interfaces need to throw it? The reason is that an implementation of an interface method is limited to throwing only the types of checked exceptions (including subclasses) explicitly specified by the interface definition. By creating a base exception class and throwing it from interface methods, implementors are free to create subclasses as necessary and can legally throw them. One word of caution: method implementations or sub-interfaces are not required to declare the exception in their `throws` clause and can effectively subvert the checked exception logic for their users or subclasses.

The TradeX sample

The sample code, available on EXE OnLine, illustrates a basic implementation of the interfaces defined above and branches out into a whole new set of interfaces and classes that use the base interfaces to perform various momentum and direction analyses. The new classes implement 'indicators' (they indicate the strength or weakness of momentum as well as the direction of momentum).

Most of the indicator classes revolve around an abstract class called `MovingAverage`, which implements the `IMovingAverage` interface. Although `MovingAverage` is an abstract class, it provides about 95% of the overall implementation with only two methods being abstract. A non-abstract subclass `SimpleMovingAverage` is derived from `MovingAverage`. A simple moving average may be useful in some cases, but it can show unusual deviations when large or small values fall in and out of the window used to calculate the average. An exponential moving average is less affected by swings in data



because it smoothes the values by a specific constant, which is calculated based on the size of the window. The `ExponentialMovingAverage` class is a subclass of `MovingAverage` and is without a doubt the core class for the other indicator classes provided.

Here's how it all works. Run the TradeX from the command line, passing it the name of a symbol such as 'NSCP' (Netscape). TradeX will create an instance of `BasicQuoteServer` (which implements `IQuoteServer`) that will look up the requested symbol in its historical quote database and if found will create an instance of `BasicQuoteData` (which implements `IQuoteData`). Using the `BasicQuoteData`, TradeX creates one instance of each type of indicator (`SimpleMovingAverage`, `ExponentialMovingAverage`, `ForceIndex`, `TrueStrengthIndex`, `RateOfChange`, and `SmoothedRateOfChange`) and subsequently iterates through the calculated values displaying them to standard output (columns are comma delimited).

The abbreviated output might look as follows:

Close	EMA(13)	FI(13)	TSI(20,5)	ROC(10)	SROC(13,10)
8.313,	7.649,	114478.586,	22.89,	115.65,	108.29
8.625,	7.789,	145388.045,	27.88,	113.114,	109.03

The purpose of outputting the indicator results to the console in comma delimited format is so that I can easily validate the algorithms by redirecting output to a file and importing the results into Excel. Once I am in Excel, I can graph the data with a few simple mouse clicks. That saves me the time of having to worry about writing an interface from the beginning.

Implementing the design

The individual algorithms for the indicators are not very important so I am not going to discuss them here. What is important is the combination of interfaces and classes that evolved. I started with the class `MovingAverage` so that I could exercise the `IBasicQuote` and related interfaces (in search of design flaws). Because I knew I was going to have the classes `SimpleMovingAverage` and `ExponentialMovingAverage` I decided that an abstract base class would be the optimal way to implement the core functionality. Ultimately, only two methods need to be provided by the subclasses. One, `RecalculateAverages()`, is used to iterate through each stored value and re-calculate the averages. The second, `internal_addValue(double value)`, is used to add incrementally a new value and adjust the running average accordingly.

As the design and implementation evolved (and continues to evolve) I saw quite a few opportunities to create new interfaces that encapsulated a common set of functionality. The first, `IQueryValues`, is a concise interface for obtaining values from a collection (ultimately, all the indicator classes are collections of data).

```
// a generic interface for accessing values
interface IQueryValues
{
    // return an array of doubles that
    // represent the "primary values"
    public abstract double[] getValues();
    // return a specific value, ie values[interval]
    public abstract double getValue(int interval);
    // return the total number of values,
    // ie values.length;
}
```

```
public abstract int getNumberOfValues();
};
```

The purpose of this interface is to allow any class to expose its data set in a straightforward, generic way. This type of generic functionality is likely to be used heavily in UI graphing code, which doesn't need to know what the data means, just 'What are the values, and how many of them are there?'

A second major interface that evolved from class `MovingAverage` is `IMovingAverage`:

```
// interface to provide moving average functionality
interface IMovingAverage extends IQueryValues {
    // get the current width of the MA
    public abstract int getWindowWidth();
    // set the current width of the MA
    public abstract void setWindowWidth(int windowWidth)
        throws RuntimeException;
    // average the averages using newWindow
    public abstract void doubleSmooth(int newWindow);
    // average the averages of the averages using
    // newWindow and newWindow2
    public abstract void tripleSmooth(int newWindow1,
        int newWindow2);
    // have the original values been smoothed
    // (ie, destroyed?)
    public abstract boolean isSmoothed();
    // add a value to the moving average
    // (unless smoothing has been applied)
    public abstract double addValue(double value)
        throws SmoothedAverageException;
}
```

I created this interface because most of the indicators perform some type of moving average calculations on the data. I thought it would be convenient (and necessary) for the indicators to be smoothed (smoothing means to take an average of the average). It is also likely that someone would want to adjust the window the average was calculated with. Rather than having each indicator provide its own custom methods, I extracted the general functionality of class `MovingAverage` to interface `IMovingAverage`.

After doing that I thought that I would have each indicator class implement interface `IMovingAverage`. But it dawned on me that it would be a lot simpler, and in most cases more optimal, to derive the indicator class directly from the appropriate moving average class. In most cases this means that the indicator class won't have to do anything special to support smoothing and resetting the window average width.

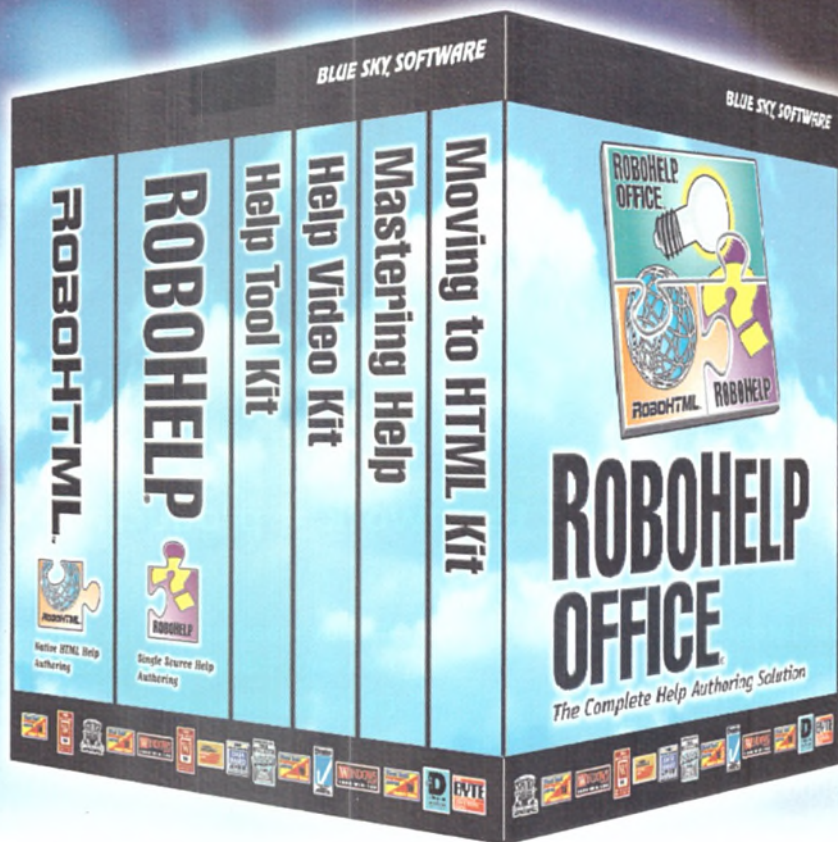
Volunteers needed

I think the biggest design problems I encountered were implementing the cloning logic (Microsoft VM bugs?) and deciding how to write the initialisation code of each class. I'll talk more about those kinds of issues in a future column and in a few months I'll update you on how I have evolved the TradeX system. It is already a lot more sophisticated than the current sample.

Send me your comments, ideas, questions, and if there are any volunteers for writing a UI, I could definitely use your help! ■

Tom Guinther is working for Vireo, a company developing device-driver tools. He can be reached via email at tomg@vireo.com.

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Raising and handling events



As well as Events, Visual Basic 5 introduced the AddressOf operator to provide support for procedure callbacks. Jon Perkins considers the

important differences in the way the two mechanisms work.

Windows is an event-driven environment. This means that a fair proportion of the code that is written for an application needs to be responsive to messages sent from various sources. In the CUI (Common User Interface) days before Windows, applications written in such languages as Clipper typically needed only to be on the lookout for straightforward keyboard input. These days, of course, code is written much more as tiers of functionality using object components. Different mechanisms exist to cater for communication between these components, so in this month's column I shall discuss the use of events to this end.

An event is a means of informing an application that something interesting has happened. In all versions of Visual Basic up to and including number 4 the only events that you could program with were those provided by Visual Basic itself. Because Visual Basic was originally intended to simplify Windows programming, the events that were catered for were presented as Subs rather than Events. In these cases, the name of the Sub was made up of the control name and the event name. Consequently, if you draw a command button onto a form and double click it from the development environment then you are presented with `Private Sub Command1_Click()`. For each Windows control that is offered as standard with Visual Basic, you are given the means to provide code for the events that are most likely to be of interest to you.

RaiseEvent and WithEvents

After many requests from the development community Visual Basic 5 finally offered the ability to add custom events to forms, classes, and controls. From the design point of view events are called *outgoing interfaces* because they originate from within the object and are handled elsewhere. Conversely, properties and methods are called *incoming interfaces* because they are invoked from outside the object. The object that generates events is called the *event source* while the receiving object is called the *event sink*.

For a class to generate an event, it must first be introduced in the declarations section in the following form: `[Public] Event procedure-name [(arglist)]`. The keyword `Public` is cosmetic: events are always public. The event can actually be raised in code using the `RaiseEvent` command. Listing 1 demonstrates the bare bones of a simple class, `CFile`, which performs some kind of processing on a file. An event, called `BatchNotify`, is fired for every 1000 records that are processed to give the front-end application the opportunity to provide some form of visual feedback. A further event, `Completion`, is fired when the task finishes. Note that the `BatchNotify` event also passes a piece of data with it. Event arguments mainly follow the same rules as procedure arguments, except they cannot have named arguments, optional arguments, or `ParamArray` arguments. As in all other cases, arguments can be declared as `ByVal` or `ByRef` (the default), the latter giving the client the option to modify the contents of the variable for later use by the event source.

In order that the calling piece of code can trap these events as they occur it is necessary to declare the class in the declarations section of the calling code module. This declaration must be of the form: `Private WithEvents`

Under the hood

Events are conveyed to an application via the primary internal communication within Windows: messaging. This mechanism has been in use since Windows 1 although inevitably it has been refined, especially with the advent of the Win32 model. Events such as window resizing, movement, and the need to repaint are all handled in this way. Each window is treated as a separate entity, and most types of visible controls (eg buttons, edit boxes, toolbars) are 'special cases' of windows. When a user presses a toolbar button the window event is grabbed by the Windows system and then passed up to the relevant application thread to provide notification of what's just happened.

Under all current versions of Windows (NT, 95, and 98 if you've got it) messages are received into the raw input queue. A system thread regularly inspects this queue and passes the messages on to a private per-thread queue for Win32 applications. When a process is created, it is allocated a primary thread of execution. If subsequent threads of execution are created by the application then they are also allocated a thread message queue if necessary. If the target is a Win16 application then all messages are placed into a single common message queue, which is resident within the Win16 subsystem. The Win32 model uses this technique of splitting messages out to each thread message queue – a technique known as *input desynchronisation*. The reason for this approach is to prevent the whole system from hanging when a single application crashes and stops accepting messages from the queue. This was a common problem under Windows 3.x.

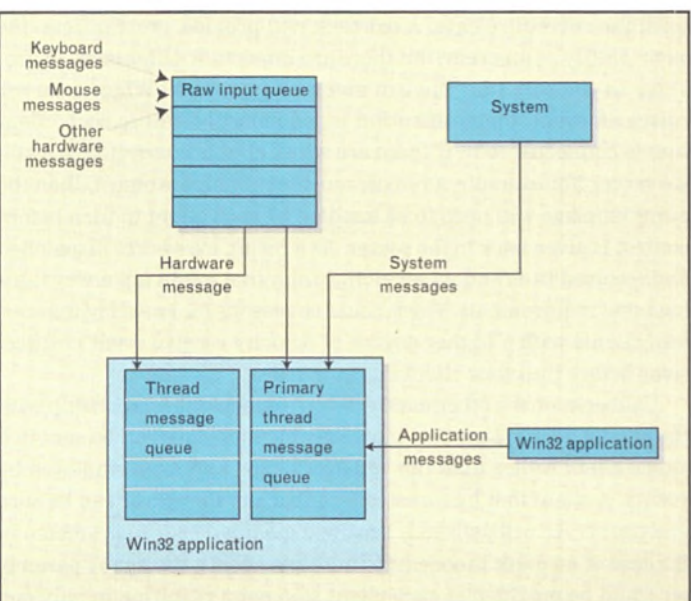


Figure 1 – Win32 message queue system.



ivate WithEvents varname As type. The requirement here is to create an instance of the class object at the declaration level rather than, for example, from within a single Sub or Function. The visibility scope of the class might now be wider than you would ideally want it to be, but that's the trade off for getting this functionality. First, the event handler is installed via the WithEvents declaration. Then the IDE will automatically add entries to the object list box (the control immediately above, and on the left-hand side, of the main edit window) for each event that it finds registered for the class in question. Listing 2 provides another piece of simple code that receives the events and acts accordingly. It's worth noting that the class declaration didn't include an actual instantiation. The current implementation doesn't allow the New keyword together with the WithEvents keyword. Therefore, I've provided the creation and destruction in the form load and unload handlers respectively.

A further requirement that WithEvents imposes is that the variable cannot be a generic object. You cannot declare it As Object. This is because the IDE needs to instantly accommodate a WithEvents declaration by adding the appropriate event handler entries to the code editor window. If the variable is declared As Object then the IDE will not be able to scan the relevant type library to extract the provided events. You also cannot create arrays of WithEvents variables.

Events provide a simple way of supplying a one-way form of communication between two code objects. Although the potential uses for an event are theoretically limitless, they are often used to provide feedback on long running processing tasks, as the examples in Listings 1 and 2 demonstrate. However, the ability to pass parameters ByRef gives the event sink the ability to return useful information back to the event source. For example, a boolean Cancel parameter could be set to false by default, but could be altered to true by the event sink if the user had requested the current operation to be aborted.

Events or callbacks?

As well as Events, Visual Basic 5 introduced the AddressOf operator to provide support for procedure callbacks. This mechanism entails passing the address in memory of a piece of client code that the server should run at a point in time deemed appropriate by the server. Historically speaking, even the most simple C-based Windows applications used callbacks but these were absent from Visual Basic until the current release. A callback will provide, more or less, the same ability as an event, but there are important differences to consider in the way that the two mechanisms work. When a server raises an event, the notification is sequentially sent to each client that is connected to it. If there are many clients connected to a single server (for example, a remote multi-use business object) then the event message will need to be handled by each client in turn before control is given back to the server. As a result, events are dispatched and received in a random servicing order that might not always suit business requirements. There could be reasons for ensuring that certain clients with a higher degree of priority receive event notifications before the other clients.

Callbacks on the other hand exist on a one-to-one relationship with the server. This means that more specific messages can be sent to a single client rather than the 'tell everybody' approach employed by events. A client that has created a callback to the server can be sure that the server will definitely receive a modified ByRef parameter. In the case of an event broadcast to multiple clients, the ByRef parameter could be modified at each client stop point resulting in only one modification – the last one – arriving at the server.

```
' cfile.cls
' Declare the events that this class will raise
Public Event BatchNotify(ByVal lNumber As Long)
Public Event Completion()

Public Sub ProcessFile
    ' Open input and output files
    iReadFileNum = FreeFile
    Open 'c:\demo.txt' For Random Access Read Lock _
        Read As #iReadFileNum
    iWriteFileNum = FreeFile
    Open 'output.txt' For Output As #iWriteFileNum
    Do While Not EOF(iReadFileNum)
        If lRecordCount Mod 1000 = 0 Then
            RaiseEvent BatchNotify(lRecordCount)
        End If
    Loop
    ' Raise a message to flag completion
    RaiseEvent Completion
    Close #iReadFileNum
    Close #iWriteFileNum
End Sub
```

Listing 1 – Simple CFile class showing events declarations.

```
' form1.frm
Private WithEvents moFile As CFile
Private Sub Form_Load()
    Set moFile = New File
    Me.Show
    moFile.ProcessFile
End Sub

Private Sub Form_Unload(Cancel As Integer)
    Set moFile = Nothing
End Sub

Private Sub moFile_BatchNotify(ByVal lNumber As Long)
    ' Update label on form
    lblWriteCount.Caption = CStr(lNumber)
    lblWriteCount.Refresh
End Sub

Private Sub moFile_Completion()
    MsgBox 'File conversion completed!'
End Sub
```

Listing 2 – Simple form showing WithEvents declarations.

Programming considerations

There are three main considerations. First, it is not possible for two objects to each have a WithEvents reference to each other. The compiler will reject such an intention with a 'circular references' warning.

Second, attempting to pass events over a DCOM implementation doesn't work very well. If you're building for this kind of delivery platform then you are better off going to the extra effort of writing a callback routine.

Third, if an error occurs in the client application (event sink), then the event source is not notified of the problem. Depending upon the nature of the application, this might be a problem. If it will cause a problem then a callback server is a better solution because it will automatically receive the error when it is passed up the call chain. This is standard behaviour within Visual Basic.

In summary, custom events are not always the best method for passing messages between one object and another, but when they are appropriate then they are very straightforward to program. They should probably be the first consideration when designing a method of one-way communication between objects, but discarded if the disadvantages would be an issue.

Jon Perkins is a freelance Visual Basic developer and a Microsoft Certified Solution Developer. He is a contributing author of Advanced Microsoft Visual Basic 5 by The Mandelbrot Set, published by Microsoft Press. Contact him at www.jonperkins.com.

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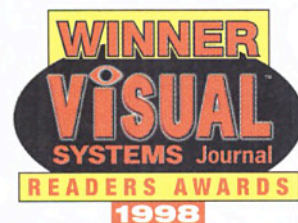
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Ninety four per cent of candidates using Connections, in response to a recent survey, have successfully been found a position which promised greater career prospects and, furthermore, higher salaries.

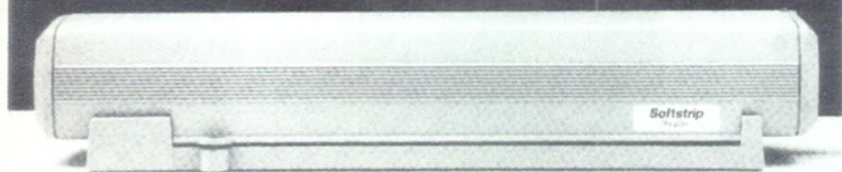
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— The Windows —
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The .EXE Offer



In this month's .EXE Offer, we are pleased to be able to offer 20% discount on a fascinating new product from the US: the Softstrip system.

The Softstrip system is a revolutionary method of encoding software, data, programs, graphics or sound into a highly condensed form which can be printed on plain paper with ordinary dot-matrix, laser or thermal printers.

Printed data strips like the ones shown here, can be read by a Softstrip reader, directly into the computer. Strips can hold up to 5,500 bytes of data and are produced in varying densities according to the quantity of information and the printer or process being used. A single high-density strip printed by laser, for example, can hold up to 3,500 bytes of encoded data. Multiple strips are produced when the information is greater.



Here are some of the benefits of the Softstrip system:

- * A convenient way to send programs. Cheap to send, and no risk of damage in the post.
- * Documents or files recorded in Softstrip format can be stored in a normal filing cabinet
- * Allows easy communication between computers - data can be printed in ASCII from an IBM PC and the Softstrip read by an Apple equipped with its own Softstrip reader.
- * Softstrip data is secure against damage. Draw on it in coloured ink, fold or crease the paper, use magnets, yet the system will still be readable. You can also forget damage by x-rays, magnets or electricity.
- * Because Softstrip is on paper, it's easy to find the precise data strip required - you don't have to spend valuable time searching through multiple directories as with diskettes.
- * It's very simple to produce: and can even be reprinted in large volumes.

Blast from the past

.EXE February 1987

An exciting new alternative to SneakerNet™ is born, as reported in .EXE, February 1987. How did we ever live before the Internet?



An end to grey Jolt?



News reaches us that the favourite drink of US programmers for a generation, Jolt Cola, is finally to be introduced into the UK. Not that the lack of official distribution has stopped enterprising developers from getting their hands on this ultra-caffeinated drink. Certain newsagents - the locations of which were generally kept secret to avoid any illicit sources drying up - have been stocking imported cans and bottles of Jolt for years. So does this spell the end for the grey imports? Unlikely. The UK distributors, a company by the unlikely name of Soif, intend to introduce the drink to a selected area 'within the M25' at first, concentrating on a few privileged outlets in W1. Luckily, the EXE offices are handily located in W1V. Sorted.

Freebie of the month And finally...

Hard day? Too much code and not enough entertainment? You need... the Intel 'Create and Share' Rubber Camera. This digital marvel doesn't generate a clear, crisp video feed for all your videoconferencing and corporate spying needs. It doesn't autofocus. It doesn't have an RS-232 port. Or a USB port. Or even a Firewire port. But it is real squeezey. It might even float in the bath (we didn't try to find out). And this was just one of the goodies we got in our very own Windows 98 launch bag. We draw the line at printing pictures of the Evesham Vale 'We've Got You Covered' condoms. So you'll just have to make do with this.



Thanks to the good folks at militant geekzine Need to Know (www.ntk.net - check it out today!) for the following extract:

'One of the few end-of-the-world gigs that you can pre-register for: the SUB-GENIUS RELIGION times out spectacularly when X-Day finally arrives on Sunday 05/07/98. Devotees will gather at "Ground Zero", Brushwood, Sherman, NY, ready to beam aboard the escape vessels of the Sex Goddesses, a bit like Heaven's Gate, but this time for real. Apparently many will be leaving behind "Last Starfighter"-style android clones - leaving the "pinks" to wrongly assume that the whole thing didn't happen.'

<http://www.subgenius.com/bigfist/fun/devivals/X-Day98/X-Day98.html>



Try the girl

With the Y2K panic hotting up, there are government schemes afoot to train up all and sundry as programmers. But of course, not quite everyone is suitable...

It was a blue-white Wednesday midsummer morning, and hot with it: the kind of morning that makes a water company executive wonder if it isn't time to announce a surprise hose-pipe ban just for the hell of it. White beams of eleven o'clock sunshine fell directly on my screen, so that I would have had to have drawn the blinds if I wanted to see the little coloured pipes of the screensaver draw their perpendicular patterns. I left the blinds undrawn, and lay back in the warmth, and watched the dust particles dance around in the airstream from the PC's cooling fan. I'd seen the little pipes before. They were nothing special.

The phone rang, and it was Violets M'gee. Violets is a great guy with a beer gut and a collection of T-shirts with the logos of defunct software houses and the bad habit of calling me up with contracts that pay worse than a shareware DOS text editor on a Macintosh-user website. They call him Violets because he ain't shrinking.

He said, 'Hey, Marlowe. Have you got anything on?'

'You mean you hadn't heard? I'm substituting for Ginger in the girls' US tour. I fly to Chicago in half an hour.'

'Sure. I look forward to seeing the outfit. Quit jawing and get the dust covers off that love-wagon of yours. There's a distressed party out in E11 who is crying out for some of your jolliest database design.'

'Uh-huh. And pray how do they intend paying for all this frivolity? I don't fire up the Sierra for less than twenty-five lonely dollars an hour, plus ex's.'

'Twenty-five lonely Euros, Marlowe. This is a class outfit; pre-printed business cards, own domain name, a web site that gets updated more than once a year, everything. Get on over there before you drop below their price range.' And he gave me an address and hung up.

I rescued my blue Ford from Sainsbury's Strictly Patrons-Only car park and crawled east through the midday heat and the Capital City integrated transport system. Ninety minutes and ten miles further on I pulled off the A12 into the filthy shadow of a filthy pub. Some writing on the walls of the pub suggested that the place was built within the catchment area of Soylent Orient football club. A memory stirred. I said 'Mmmm... Soylent Green...' but it didn't mean anything. It was just something to say.

'Hey you!' A slim, blonde woman in her mid-thirties was standing in the entrance of the office next door, chewing gum, watching me. She wore jeans, sneakers, a white polo shirt, and a face which wasn't exactly beautiful, but was comfortable and kind. A nice face to have around. 'What are you doing standing there, muttering to yourself?'

'The name's Marlowe. Database guy. Oracle, Visual Basic, and Crystal Reports. I heard you needed help.' I leered at her politely.



Her eyes narrowed suspiciously. 'Maybe you heard wrong.' She thought it over for a few seconds. 'Come in anyway, and Jack'll give you the test.'

We went into the building. I followed her through a glass-doored ante-room into the programming room. It was 25 foot square, and it was full of little shoulder-high cubicles with a programmer working in each one, like a *Dilbert* cartoon. It was quite hot, but no hotter than a hot sauna heated by a runaway broken boiler, and it smelled quite bad, but no worse than downwind of a sewage treatment works in National Diarrhoea Week.

The woman said, 'I have a Mr Marlowe here, Jack. He wants to take the test.'

A balding man with a grey beard, socks, sandals, and a permanently wistful look appeared, and touched my arm.

'Come over here Mr Marlowe, there's a spare desk in the corner.'

He guided me across the floor space to an empty cubicle where the PC was turned off, and invited me to sit down. I sat. He produced a piece of paper with a flourish.

'This is a little programming test. Everybody takes it. It's nothing to be afraid of. You don't mind, do you?'

I said I thought I would probably live.

'Good, good. Off you go then, and I'll be back in 10 minutes to see how you got on.' He hustled off.

I looked at the piece of paper. The test was the old 'Design a table suitable for holding a corporate personnel record' test. That was really original - in 1943.

True to his word, the little bearded man returned after a few minutes. 'How did you get on?'

Silently, I handed him my answer sheet with the table schema. He held the paper close to his face. Probably trying to stop me from seeing him move his lips. It didn't work.

'Um. One thing, Mr Marlowe.'

'Yeah?'

'You haven't provided a field for, um, sex.' His voice twittered with embarrassment. 'You know, gender. It's very important in most applications.'

'Oh yeah? What about that?' I pointed.

'But that says "hair colour".'

'So you put "Blond" or "Blonde". What do you guys use for brains around here?'

'Yes, but... Oh never mind. What does this field "Pocket" mean?'

'It's an enumerated type: Shirt, Jacket, or Hip.'

'Mr Marlowe, I do know what both a pocket and an enumerated type are. I don't see the relevance to a personnel database.'

'If it's a blonde, you'll want to know which pocket you feel her smile in.'

'And the boolean field "Conspicuous"?'

'Call me cute if you like, but I don't see how you can describe someone properly if you don't know whether he is as conspicuous as a tarantula on a slice of angel food.'

He looked at me and sighed. 'Thanks very much for your time, Mr Marlowe...'

On the way home I pulled off the A12 at a Threshers in Whitechapel and downed a brace of Two Dogs. It didn't do any good. It only made me think of the blonde woman, and I never saw her again. ■

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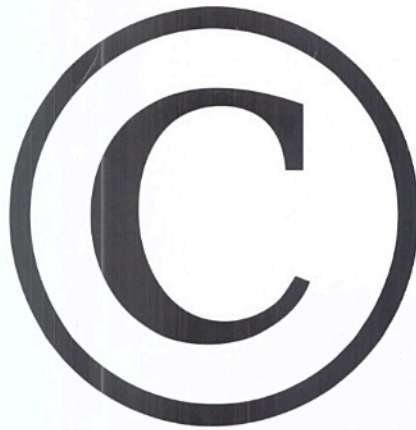


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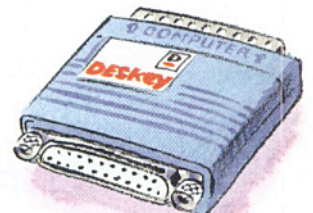
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