THE SOFTWARE DEVELOPERS' MAGAZINE

EXE

JULY 1999

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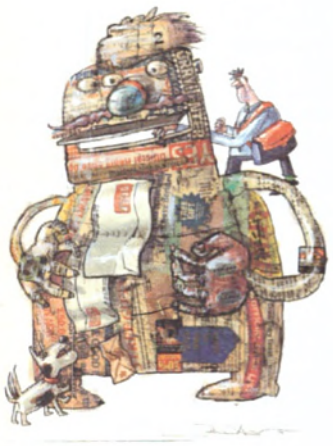

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EXE: The Software Developers' Magazine is independent and not affiliated to any vendor of hardware, software, or services. It is published by: **Centaur Communications Ltd, St Giles House, 50 Poland Street, London W1V 4AX. EXE Telephone:** 0171 970 6541 **Fax:** 0171 970 6741 **Advertising email** *advertising@exe.co.uk* **Subscriptions** Tel: 0171 292 3706 Fax: 0171 970 4099 email: *execirc@centaur.co.uk*. EXE is available by subscription at £35 per annum (12 issues) in the UK: see subs card between pages 2 & 3. The magazine is published around the 1st of the month. To subscribe or if you have a subscription query, please call 0171 292 3706 or write to Anna Martin, EXE (address above). We can invoice your company if an official company order is provided. Back issues £5.00 each, if available. **Editorial.** Address all editorial enquiries and comments to The Editor, EXE (address above) or email to *editorial@exe.co.uk* (press releases by fax or mail only). We welcome letters, opinions, suggestions, and articles from readers. These may be edited. Information contained in EXE is believed to be correct. If errors are found, we will endeavour to publish a clarification in the next issue. **Copyright** Material published in EXE is copyright © Centaur Communications Ltd. Articles (or parts of articles) may not be copied, distributed, or republished without written permission from the publisher. All trademarks are acknowledged as the property of their respective owners. **Repro & Typesetting:** Atelier Dataset Ltd **Printer:** St Ives (Roche) Ltd. **Front Cover Picture:** Patricia Deardorff **ISSN:**0268-6872

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news

Speech Components from Chant Inc.

An easy way to integrate speech recognition and synthesis to your applications. The speech components work with both Microsoft's Speech API and IBM's Speech Manager API so your applications will work with a wide range of speech engines and enjoy the benefits of new speech engine enhancements without reprogramming.

JProbe Suite from KL Group

A fully integrated set of tools that can help you to debug thread, memory and performance problems in Java applications. It includes JProbe Profiler and Memory Debugger for improving application performance and plugging memory leaks, JProbe Threadalyzer for hunting down deadlocks, stalls and race conditions and JProbe Coverage to make sure all your code is tested.

BugCollector 3.0 from Nesbitt Software

Helps you organise software bugs and feature requests by status, priority, severity and more. In addition, it lets you organise programs in a logical hierarchy, while keeping a record of user statistics as well as problem investigation, resolution and verification. New features include a built-in Report Designer, customisable charts, user-definable filters, a multi-level project tree and export/import so that mobile users can take subsets of data "on the road" and merge the changes later.

SQL Tools from Perfect Sync

A library of functions that lets you access ODBC databases from your PowerBASIC (DLL and Console) programs. Open a database with a single line of code, and use standard SQL statements to build powerful, sophisticated, multi-user database programs!

Console Tools from Perfect Sync

A set of functions that were specifically designed to enhance the PowerBASIC Console Compiler and other compilers that can produce Win32 console applications. Add GUI elements such as message boxes, progress boxes, pulldown menus, splash boxes and input boxes.

CodeAssist from Sheridan Software

CodeAssist is a programmer's power tool that eliminates the tedious chore of writing repetitive database access code. CodeAssist uses a flexible, template-driven approach to code generation that gives the programmer complete control over the quality of the resulting database code. CodeAssist wraps it's high-performance code generation engine in a set of intuitive GUI tools that make the whole process straightforward and simple.

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"How will software take advantage of hardware advances in the next few years"

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For the sake of simplicity

Software development is about many things, one of which is the management of complexity. It is a lesson that has been oft repeated, but apparently not as often heeded. The inherent complexity of a software system is something that we can do little about. We cannot eliminate it, but we can hide and abstract it. We can also create complexity.

The fact that software systems are getting bigger and more pervasive is testimony to the fact that we can at times muster the wherewithal to manage the inherent complexity of constructing large systems. At other times, it supports the view that creating complexity is easier than hiding it: the creeping featurism, physical size, and bugginess of certain operating systems and wordprocessing packages is tantamount to a public admission of software engineering failure. 'The software to solve your problem is larger and more complex than necessary, because we did not have the ability or resources to make it smaller and simpler,' to misquote liberally Blaise Pascal.

The *inherent* complexity of a software system is related to the problem it is trying to solve. The *actual* complexity is related to the size and structure of the software system as built. The difference is a measure of our inability to match the solution to the problem.

This deficit (or surplus, depending on your perspective) is caused by, and manifested in, many aspects of the software and its development process. This reflects the structure and culture of the organisation and people that created it. It is reflected in its interface, by which I broadly mean GUI, configuration, public API, and so on. And it is reflected in its reliability and adaptability, ie a more complex system will inevitably have more bugs and be harder to change – all other things being equal – than an equivalent simple system.

Note that there is a major, but nonetheless subtle, distinction between 'simple' and 'simplistic'. Dumbing things down, and sweeping complexity under the carpet, is an example of 'simplistic'; the complexity still leaks out. Far from eliminating the need for skills, when simplistic tools (and mindsets) are applied to non-simple problems they highlight that technology alone cannot solve the problem, and that skills for managing complexity (okay, call it programming) are needed as much as ever. Zero- and minimal-programming models solve particular categories of problem for particular categories of people. Beyond that scope they are simplistic rather than simple, and create rather than solve problems – just remember that the majority of spreadsheets have bugs.

Patricia Deardorff

This leads to an interesting marketing possibility: that a subsequent release of a product will be smaller and have fewer features.

In this context, what is simplicity? Simplicity is related to minimalism, as defined by John Pawson in his book *Minimum* (published by Phaidon, ISBN 0 7148 3817 9): 'The minimum could be defined as the perfection that an artefact achieves when it is no longer possible to improve it by subtraction. This is the quality that an object has when every component, every detail, and every junction has been reduced or condensed to the essentials. It is the result of the omission of the inessentials.'

In other words, leaving or taking things out by constantly examining the difference between inherent and actual complexity: questioning and reducing the number of features, and questioning and reducing the amount of code (for benighted management that still measures productivity in terms of KLOCs, this is scary: it appears to represent negative productivity). Less code, less bugs; fewer features, greater ease of use; etc.

This leads to an interesting marketing possibility, and one that I have seen in action only a few times: the idea that a subsequent release of a product will be smaller and/or have fewer features than the previous version, and that this property is actually considered to be a selling point. Perhaps the market is not mature enough to accept it yet, but it remains a promising ideal: less is more.

In software development we have already had these principles enshrined in our vocabulary for nearly three decades: low coupling and high cohesion. As David Parnas said, 'Partition to minimize interfaces.' The wisdom has been captured, but most developers today either do not know what these terms mean or they do not understand their significance. The practice of aggressively managing dependencies between parts of a software system applies at every level: function to function; class to class; component to component. A separation of concerns leads to separation in software architecture.

A software system reflects the principles used to build it. Personally, I find it quite disturbing to see some of the files being copied or replaced when an application is installed on Windows: 'Hey, isn't that file part of the operating system? Why is the application layer messing around with the operating system layer? And why do I need to install this completely unrelated piece of software to make this other one work? ... Hey, why don't some of my other applications work any more?'

It is not technology that solves problems, it is understanding: simplicity and minimalism are not criteria to apply to our understanding, but criteria that should be applied to the products of our understanding. We are often in the situation of having technology before understanding, and without principles to guide us we can end up with logical absurdities. To illustrate this, and reinforce the message of inherent versus actual complexity, I will leave you with the following thought: why is it that when I install new software on a Windows machine it typically requires me to reboot (or, as is often the case, rereboot) the operating system, and yet plugging in a new piece of hardware does not? ■

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Server-side Java from Oracle

Oracle JDeveloper 2.0 has been released with the design of providing complete support for server-side Java standards. Components for UIs, business logic, and data access can be built and deployed on the three tiers of Oracle's Internet platform.

Combined with Oracle8*i* JServer (the Java server inside 8*i*), JDeveloper enables the building, debugging, and deployment of Enterprise JavaBeans, which can also be deployed on the Oracle Application Server. With the addition of a DB ServletsWizard, Oracle claims JDeveloper is the first tool to automate the building of database servlets. As well as building Internet apps (for example, servlets generating HTML as part of presentation logic), Java Stored Procedures can be created for Oracle8*i*. Other database programming support includes built-in JDBC drivers and an SQLJ translator and debugger. There is an integrated EJB server and Corba ORB.

On the IDE side of things, there is a range of visual features, including an MDI-style interface with floating or docking windows and a configurable multi-tier project workspace. Full access to source code is combined with two-way technology, and code generation wizards are supplemented by CodeInsight syntax help. There is a Unicode-enabled compiler (with 'integrated dependency-checking and obfuscation support') and a visual debugger.

For the building of HTML web applications with server-side Java,

Oracle has provided a number of wizards. There is a Servlet ClassWizard, an HTML Servlet FormWizard (with support for Cascading Style Sheets), and an HTML-to-Java Wizard.

The Java 2 platform is supported to provide switchable Java User Interfaces. This has been extended by Oracle with the provision of a set of JFC-based controls that implement the InfoBus standard, for control applications. There is JDK switching with JDK 1.1.7.

The full JDeveloper Suite 2.0 includes the following products: JDeveloper 2.0, Oracle8*i*, Oracle Application Server 4.0.7, Oracle Procedure Builder 6.0, Oracle Lite 3.6, and the online book *Thinking In Java* by Bruce Eckels.

For Windows NT 4.0, JDeveloper is available via download from the Oracle Technology Network (OTN) at *http://technet.oracle.com*.

Oracle has also announced the beta release of Oracle Business Components for Java, a set of Java framework classes and wizards that function as add-ins to JDeveloper. The wizards are designed to allow developers to focus on business logic rather than low-level database interactions, which are automatically optimised by the framework.

Business Components for Java uses XML's ability to describe data in a structured way for the management of an application's metadata. Customising an application should be as easy as editing XML information.

w www.oracle.com/tools/jdeveloper

Critical first aid?

Microsoft has purchased $25 million of non-voting Inprise stock and has given a further $100 million of cash. Inprise insists that there are no strings attached to this investment and that it will allow them to move ahead faster with, for instance, their Linux development. Inprise is committed, though, to support Windows 2000, ship MFC with C++Builder, and license the latest version of the Windows SDK.

The payment is part of a patent cross-licensing agreement. Both companies will be able to adopt features they like from each other's products. Jeremy McGee, European Product Manager, Borland Tools, comments: 'What we're talking about here are innovations [...] which can benefit both sides'. For instance Borland wouldn't be surprised if Microsoft showed some interest in its COM object wrappers in C++Builder or the support for DCOM IDL. One argument that is now resolved is the use of tabbed sheets in Excel, which was covered by a patent dating back from the Quattro days.

Some analysts are pondering if Microsoft might be interested in JBuilder in case the outcome of its trial with Sun doesn't meet its expectations. Others consider the experience of Inprise regarding DCOM and Corba as being of prime interest. Time will tell of the unspoken interests involved, if any, and of the positive effect of this sudden infusion of cash.

Delphi 5 will be announced at Borcon and should ship in August.

w www.inprise.com/about/press/1999/inprise_ms.html

XML in XMetaL

SoftQuad claims for XMetaL the title of 'first native XML/SGML authoring tool'. It is not a website development tool, but is aimed at existing SGML content authors or those migrating to XML. Designed to be an easy way to create documents in native XML format, whatever the user's level of expertise, the environment of a word processing package is intended to help streamline publishing workflows.

Authoring support includes multiple-document editing views, inline table editing, access to all attributes and elements, and validation. The tool can access ODBC data sources, save and reuse queries, and automatically convert database content to XML. For Windows 9x and NT 4.0, it also requires IE 5.0. Pricing starts at £300

w www.softquad.co.uk

Continuus/WebPT is an integrated module of the Continuus **CM** suite, providing simplified, browser-based change request management. Its querying, browsing, and reporting capabilities enable the control of all updates to **web-based** applications and websites. For IE 4.0+ and Navigator 4.x.

www.continuus.com

Pervasive.SQL 2000 has three new database engines for use with smart cards, **Windows CE** devices, and embedded systems and mobile devices. For example, the Pervasive.SQL 2000 for **Smart Cards** is a sub-8 KB engine designed to integrate with the Java Card environment. A platform-neutral Row Set Interface provides a common API to all three database sizes.

www.pervasive.com/developerzone/

Rational Purify and Rational Quantify, the **Unix** error detection and performance-profiling tools, now support the 64-bit environment of Hewlett Packard's **HP-UX** 11.00. Versions 4.13.99 of Purify and Quantify have an RRP of £1,575.

www.ratonal.com

X.Org, a non-profit organisation of **The Open Group**, has become an official steward of the X Window System and its standards. It's dedicated to maintaining the existing **X Window** code base, managing enhancements, and increasing general awareness of X Window.

www.X.org

WebWhacker 2000 is the Internet utility for those wishing to store, print, and organise **web** pages for offline viewing or archiving. With an Explorer-style interface, its features include site tree previewing and site tree post-viewing. A link-checking facility generates reports on broken **links**.

www.bluesquirrel.com

Version 5.5 of **MapInfo Professional** sees it enhanced as a business intelligence tool for analysing patterns and trends. As well as new graphing and charting features for the **mapping** tool, including thematic relief shading, there is full connectivity with the **Oracle8i** database. The RRP is £1,095.
www.mapinfo.com

INSTAbase 4.0 Web Ready is a **database** design tool that can instantly publish databases to the Web. Through the GUI you can rename fields and import graphics or text, and there are searching and reporting tools. The 'publish to the **Web**' feature is configurable. For Windows 9x or NT 4.0, it costs £49.95.
www.guildsoft.co.uk

LeadTools (the imaging toolkit) Version 11.0 adds **annotation** features (over 30 new objects including points, protractors, push pin text, and freehand hotspots), increased file format support (including TIFF, CALS, JBIG, and DICOM), and **multimedia** additions including support for MS DirectShow 6 and the creation of MPEG 1 and 2 files. It costs £325.
www.contemporary.co.uk

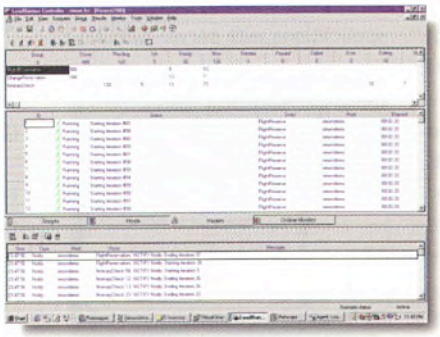
Segue Software's **SilkPerformer** 3.0 is a server **testing** tool aimed at e-business. It can simulate millions of transactions per day to test application **scalability**, and can verify that all servers are responding correctly. Pricing starts at £17,500.
wwww.segue.com

Features of the next Fortran standard, **Fortran 2000**, are included in **NAGWare f95** v4.0. The `ALLOCATABLE` attribute is now allowed on dummy arguments, function results, and structure components. And modules are provided to control **IEEE** floating point exception handling.
www.nag.co.uk

Test Suite 6.0 – it's a spoof

Just announced as we went to print was Mercury's sixth-generation Test Suite product. Evolutionary rather than revolutionary, the new release adds support for more data formats – including XML and Java2 – and protocols – such as Corba, JDBC, and LDAP – in the testing modules, and a new technology dubbed 'IPSpoofing' (in a not-so-subtle allusion to the hacker practice of similar name) for the load tester.

LoadRunner 6.0 sports the capability to spoof fake IP addresses onto the server requests during a load test, simulating the effect of multiple disparate users logging on simultaneously. This can be useful for customer-facing e-commerce apps, where additional factors such as network routing and server load-balancing can affect performance. The goal is to emulate 'real-life' scenarios as much as possible – in distinct similarity to competitor Segue's 'scenario testing' methods. The Injector software, which simulates the virtual clients, now runs on Linux, making it cheaper and easier to build up a bank of testing machines than under NT. ContentCheck – a feature added solely for Web applications – is the HTML equivalent of a standard GUI check, ensuring that elements such as GIFs arrive on screen as expected with the server under load.



WinRunner 6.0, meanwhile, features DataDriver, a visual method of building up test scripts and test data, eliminating or reducing the need for manual scripting. Mercury is at pains to point out that this function is intended to help, rather than replace, existing testing professionals. WinRunner can also keep an independent state record of database tables under test, for 'before and after' comparisons.

The final part of the puzzle, TestDirector 6.0, has new defect tracking functionality. Data is derived from the logs of passed and failed tests, as well as being available across HTTP in a standard browser to testers working on clients without TestDirector installed – though there are licensing implications here which Mercury had not yet decided on when we spoke to them. Finally, the product will now write reports directly in either Word native format or in HTML.

TestSuite 6.0 will be available from August, priced at $62,500 per seat. UK pricing will be available nearer the ship date.
w www.mercury-int.com

ER5 adds Java, WAP, & Bluetooth

The recent Symbian Developers' Conference had more of the feel of a Telecomms Conference. The emphasis was not just on its 32-bit operating system, Epoc, but also on the Wireless Application Protocol and Bluetooth. It saw Symbian announce the availability of Release 5 of Epoc (ER5). The major news is the addition of a Java SDK. While Java is now the recommended language for Epoc, C++ will continue to be supported. As for OPL (Psion's proprietary language, which also requires a virtual machine), it is currently supported but it might be dropped in a future release. ER5 was dubbed the 'largest increment yet' in terms of functionality, performance, and architecture. Java is now an essential part of Epoc (the JVM is a validated implementation of JDK 1.1.4 with some of the JDK 1.1.6 fixes implemented, such as Y2K and Euro support). Symbian SDKs can be downloaded from the EpocWorld website. Four levels of support have been announced, one of which is free and gives access to the SDKs, newsgroups, and a newsletter.

Epoc R5 is implemented as a set of common features, called the Core, and four Device Family Reference Designs (DFRD). Precise details of DFRDs will only be revealed in October, but they go from the Emerald DFRD for smartphones, to the Saphire DFRD for smartphones with keyboards, to the Quartz DFRD for pen-based communicators, to the Crystal DFRD for keyboard-based communicators.

Metroweks demonstrated its CodeWarrior for Motorola M•Core with Epoc support and Sybase announced a beta version of SQL Anywhere Studio for Epoc.
w www.epocworld.com w www.symbian.com

JACC '99

There is an impressive list of speakers lined up for the JACC Autumn '99 (Java and C/C++) seminar, the dates for which have been confirmed as September 15 to 18. Speakers already booked include Dan Saks, Andy Koenig, Barbara Moo, Jim Coplien, Mike Banahan, and Leen Ammeraal. The format for JACC is to have mornings of high quality themed talks with afternoons providing a wide choice for more hands-on workshops. Tracks include Patterns, Games, and Embedded Programming, along with C, C++, Java, and PDAs.

The event will be held at the Oxford Union. Prices for EXE subscribers and ACCU members start at £75 (£95 for others) per day with a special 'four days for the price of three'. Look out for further information on topics and workshops on EXE OnLine and in the August issue of EXE. JACC is organised by EXE in association with ACCU.
w www.accu.org

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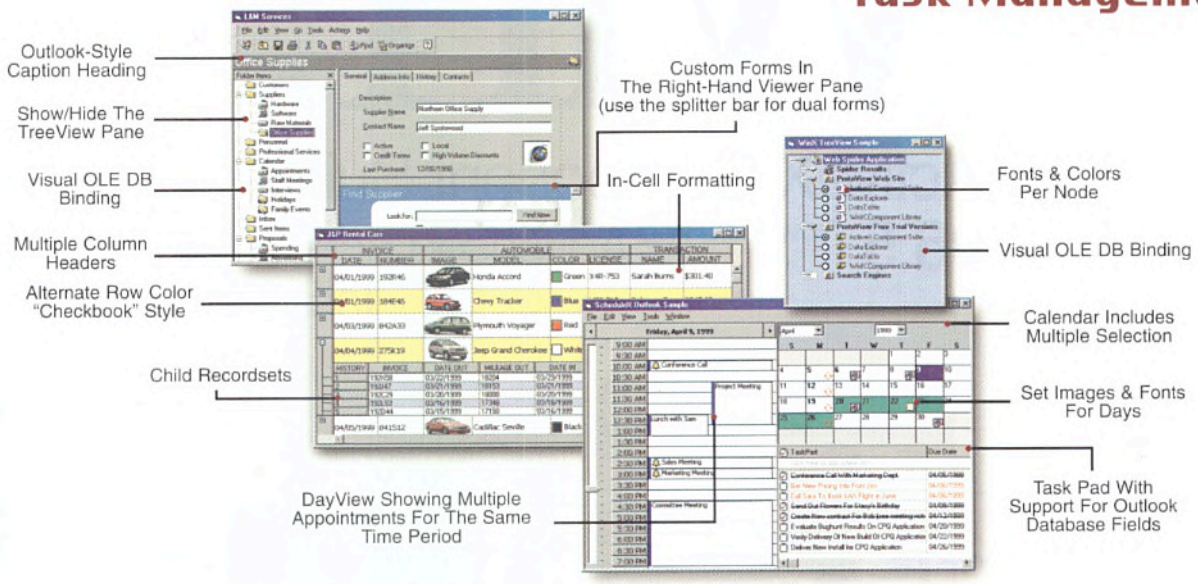

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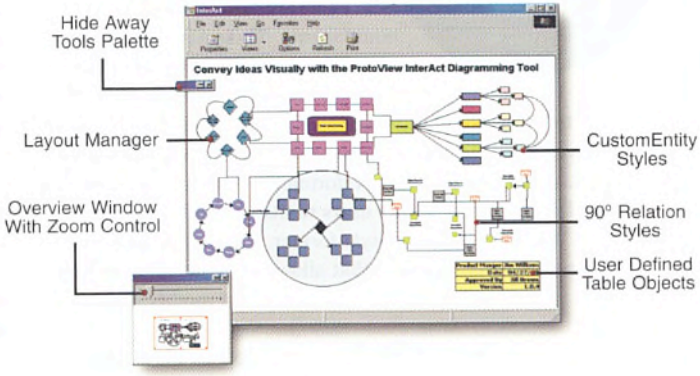

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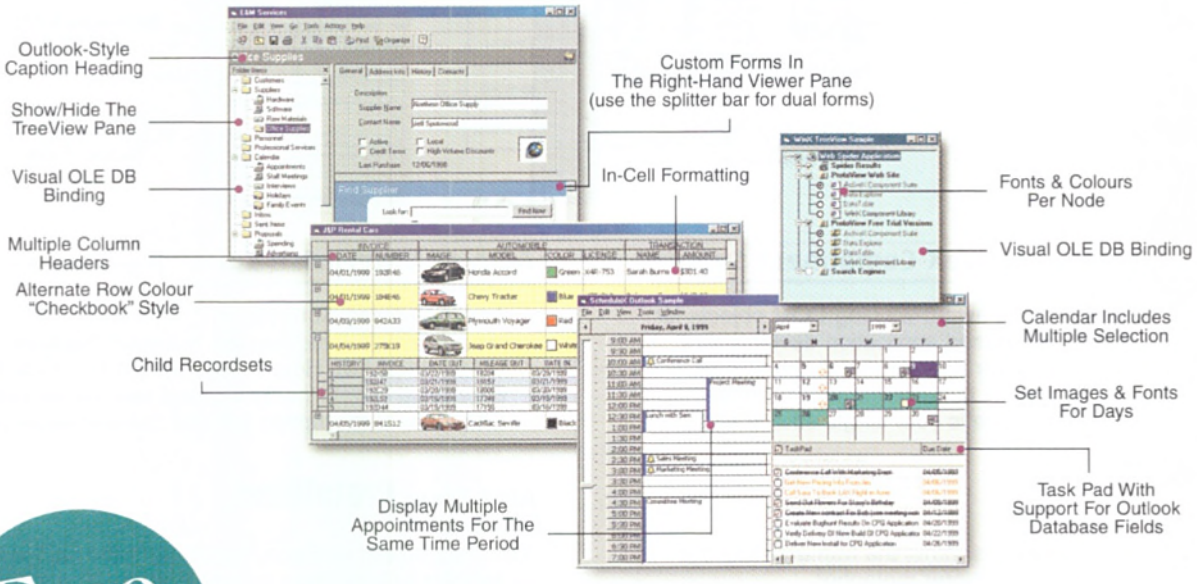
New Win!

ActiveX Component Suite v6.5

Now Including Advanced Scheduling And Task Management



Free Draw

ProtoView Development Corporation is a leading developer of reusable ActiveX and Java components. Their ActiveX offerings include the WinX Component Library, DataTable, Data Explorer, and InterAct. The WinX Component Library contains seventeen of the best ActiveX user interface components available on the market today. DataTable is a high performance ActiveX grid control. Data Explorer allows users to display and edit data in a Windows Explorer style format. InterAct is an ActiveX diagramming component that allows an application or end-user to create and modify diagrams.

EXE and GreyMatter are pleased to give you the opportunity to win one of ten copies of their very latest ActiveX Component Suite 6.5 worth over £3000 in total.

ProtoView's **ActiveX Component Suite 6.5** is a set of 23 powerful, award-winning COM objects for client/server and web-based development that feature the latest in browser support, database access and advanced UI display capabilities. It includes Data Explorer 6.5, DataTable 6.5, ScheduleX 1.0, TreeViewX 6.0 and WinX Component Library 6.5.

"*...[ActiveX Component Suite] is an excellent toolset.*"
InfoWorld, Review

"*...it [ActiveX Component Suite] provides a variety of solid ActiveX components for your development environment.*"
Visual Basic Programmer's Journal, Review

"*...[DataTable is] an intelligent grid control that streamlines the creation of data-driven applications.*"
ActiveX.COM, Review of DataTable

To enter our free draw simply visit:

www.greymatter.co.uk/protoview

Extensible and sensible diagramming

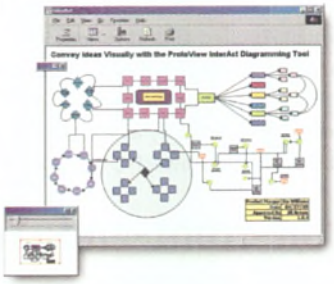
Adding a diagramming interface to applications is made easier with ProtoView's InterAct component. With version 3.0's support for VBScript and JavaScript through the Microsoft Scripting engine, it provides for user-driven interaction. Other features in this version include a Layout Manager, an Overview Window, the automation of diagrams with code execution, enhanced clipboard transfer, and a new entity type (table data). Built as a COM object, InterAct can be used in the various COM-supporting environments, such as VC++ and Visual InterDev. It includes a number of pre-built entities and diagram formats to help you get up and running.

The Layout Manager is intended to help bring order to cluttered diagrams – they can be quickly organised in either a hierarchical or compact format. Additional properties allow further customisation of layouts.

For easier navigation of diagrams, an Overview Window displays a thumbnail image of the diagram being edited. Multiple diagrams can share a single Overview Window as the user switches between diagrams. The visible area on each diagram is displayed using a rectangle that can be moved to navigate the diagram as well as be resized to zoom in or out.

Objects in InterAct 3.0 can be associated with the execution of code. There are built-in commands for run, pause, stop, goto, and if/then/else commands. This feature works with a range of languages, such as VBA, Visual Basic, JavaScript, VBScript, and C++.

Finally, InterAct 3.0 supports multiple clipboard formats to cut/copy/paste between diagrams or third-party applications, such as Adobe PhotoShop, Corel Draw, and Microsoft Office. And diagram entities can now include table data displayed in a grid format. Entries can be edited by the user and saved with the diagram.



Available from ProtoView, Developer Licences for InterAct Diagramming Object v3.0 are £865 per developer, which includes some technical support. Runtime licensing is royalty-based.

ProtoView has also updated its ActiveX Component Suite, to version 6.5. In addition to an updated Data Explorer, this release sees the inclusion in the suite of ScheduleX, a calendaring control. It consists of three lightweight ATL scheduling components (Calendar, DayView, and TaskPad) for the creation of Personal Information Management-style systems, or any application requiring scheduling or date management with a Microsoft Outlook-style UI.

The Calendar component is for the visual display of months, days, and days of the week. The user can select multiple dates and the control is configurable to display one, three, six, or twelve month groups. Other features include images in date cells, assignment of unique data to dates, and colour, font, and image options.

The DayView is a visual display for showing appointments for any given day. With configurable time slots, users can select, change, add, and delete appointments. There is in-place editing, right-click popup menus, and an optional trackbar.

Last of the three, the TaskPad control functions in a similar way to the TaskView in Outlook: it displays jobs or scheduled tasks in a list format.

The three components will communicate to synchronise behaviour as different dates are selected.

The ActiveX Component Suite v6.5 costs £299 and ScheduleX v1.0 retails individually for £175.

w *www.protoview.co.uk*

Instant ASP for Java

Written in Java, Halcyon's Instant ASP (iASP) lets developers deploy Active Server Pages or Java Server Pages (JSP) on Java-enabled operating systems platforms, web servers, and application servers. It is a Microsoft ASP-compatible servlet that extends the ASP environment and provides support for all the standard built-in objects and installable components. It can be used with VBScript, JScript, Perl, and JavaScript, and supports Java Server Pages, JavaBeans, Enterprise JavaBeans, and Corba components.

Working with Chili!soft's Chili!ASP, it provides deployment capabilities for most servers and operating system platforms. The servers include Apache, Sun WebServer, Netscape Fast Track Enterprise Server, IBM WebSphere, Lotus Domino, Microsoft IIS, and Oracle Application Server. The platforms include Windows NT, Linux, OS/2, Novell NetWare 4.0/5.0, Macintosh, SGI, and SCO.

A free developer version of iASP is available from the Web. It offers five concurrent sessions. The standard edition of iASP costs $495.

w *www.halcyonsoftware.com*

Installation

Installation the Windows 2000 way is supported by Wise for Windows Installer. The toolkit enables a five-step point-and-click construction of setup processes compliant with the Application Specification for Windows 2000. It can repackage existing installations into a Windows Installer installation, provide rollback functionality in the case of cancelled installations, and automatically repair key files that have been corrupted. It includes the ability to manage install and uninstall functions at the component level for an entire system. Wise price the toolkit at $795.

w *www.wisesolutions.com*

Jukesoft's **Hutmil 4.0** is Windows-based **website-maintenance** software. It enables you to add code or change properties for multiple web pages in one go. Actions include adding or changing **meta-tags**, adding code to the pages that can be removed or replaced at a later date by using an identification key, and finding and replacing. It costs $40.

www.jukesoft.com

From the world of **decision** support tools, Business Objects' **WebIntelligence** 2.5 is an online analytical processing (**OLAP**) system for the Web. It features a 'business intelligence portal', additional support for Unix servers, and a new API.

www.businessobjects.com

Style One is a Windows utility for the easy incorporation of **CSS** into web pages. It supports both level 1 and level 2 of the W3C standards. Its **style sheet** parser enables the editing of every CSS property, you can edit multiple documents, and create style rules on the fly. For Windows 9x and NT, V2.0 costs $20.

www.3-t.com

InstallWatch 1.1 Basic is a Windows 9x and 2000 application that records all changes made to a PC during the **installation** of software, whether from the Web, CDs, or floppies. The Basic version sees a simplified interface, limited `INI` file change tracking, and **Registry** change tracking.

www.installwatch.com

Help & Manual 2.0 is a tool for the creation of help files (Winhelp and **HTML Help**) and user manuals from a single source. The tool, from EC Software, also supports plain HTML and rich text formats. A WYSIWYG approach uses a wordprocessor-style interface. It runs on **Windows** 9x and NT 4.0, and costs $229.

www.ec-software.com

Embedded testing without recompilation

WebSynergy 2.0 is the latest version of **Continuus**' change management system for the creation, development, and deployment of web-based applications. There is an enhanced Web Content Developer component for team participation, **task-based** change management for Web teams, and the facility for webmasters and project managers to assign logical units of work to individual members of an extended Web team.
www.continuus.com

Forté Fusion is an integrated suite for **Enterprise Application Integration** (EAI). Fusion combines business process integration with an enterprise development and deployment environment. Forté claims it is the first fully **XML**-based EAI system. For NT and Unix, pricing starts at £130,000.
www.forte.com

VBXRef 2000 is BeCubed Software's cross-reference utility for VB developers. The add-in, for **VB** 5 and 6, enables you to **cross-reference** code and is designed to aid project navigation. It includes Procedure and Variable Browsers for the identification of code usage. There is a multi-string search facility, a Control Structure Analyser to diagnose problems with nested code, and a Project Explorer that indents variables and procedures. RRP is £75.
www.becubed.com

LiveCode is an interactive runtime tracing system for embedded developers. The tool, from AMC, enables you to trace and analyse the execution history of an application as it is running in the target system. This is without any preparation of the application source, object, or executable files. Developers can select portions of code to trace, insert debug statements, or modify variables without having to recompile the application. A software-only product, it has two primary components: the host GUI application, which provides an interactive trace environment, and the target monitor.

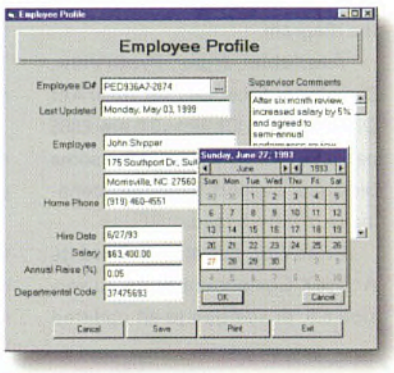
Captured information is presented in the Project Workspace, via an Explorer-style tree-view of the application structure. Functions, modules, and subsystems are represented – you select a component you wish to view and the tool automatically creates a sequence diagram, and an optional source-level trace window, to show the function interactions (and source-level trace information) during runtime. You can step forwards and backwards through the execution.

The LiveCode system is part of the CodeOptix family of tools, which Applied Microsystems describes as 'high-level software visibility tools for embedded systems'. It is initially available for the Motorola PowerPC architecture and the Tornado/VxWorks development environment.

AMC has also created two software-only versions of its CodeTest suite of test and analysis tools, which is designed to be used through the full embedded-software development cycle. These are: CodeTest-Native and CodeTest-SW-In-Ckt. Instrumentation-based, CodeTest-Native provides analysis for the desktop environment when embedded hardware is not yet ready. Once hardware is available, CodeTest-SW-In-Ckt uses the instrumentation to help provide runtime accuracy for the software testing.
w www.amc.com

They're rebuilding the front-end. Yes, always.

The avoidance of a jerry-built interface is the goal of FarPoint Technologies. The scaffolding to construct robust database front-ends and general data-entry screens has been put together in the form of Input Pro 3, a set of components for the validation of dates, numeric data, and text, whether entered from a database or via a keyboard. The components are Year 2000-compliant.



Input Pro 3 includes a currency control for the editing of monetary values, a DateTime control to format date and time values, a Boolean control for adding true/false functionality, a DoubleSingle control for editing floating-point numbers, a LongInteger control for editing integer values, a Mask control to format how data is entered and displayed, a Text control for displaying text strings, and a Memo control for displaying text larger in size than 64 KB.

Features in version 3 include the ability to bind to ActiveX Data Objects (ADO) 2.0 using OLE DB technology. There is support for ATL and OLE drag and drop. There is improved performance and functionality for the DateTime control, and the ability to save and load text files using the Memo control. Finally, there is customisation of the look and interaction of the controls.

Contemporary charges £99, with upgrades at £79 (as always, prices quoted in EXE exclude VAT).
w www.contemporary.co.uk

Books received this month

Publisher	Title	Author	ISBN	RRP
O'Reilly	ASP in a nutshell	A. Keyton Weissinger	1-56592-490-8	£15.95
Morgan Kaufmann	BeOS porting Unix applications	Martin C. Brown	1-55860-532-0	£34.95
Morgan Kaufmann	Database design for smarties	Robert J. Muller	1-55860-515-0	£32.95
O'Reilly	Director in a nutshell	Bruce A. Epstein	1-56592-382-0	£15.95
Morgan Kaufmann	Genetic programming III	J. Koza, F. Bennett, D. Andre, & M. Keane	1-55860-543-6	£46.95
Morgan Kaufmann	Java programming for Windows using AFC, WFC, and XML	Mark Watson	1-55860-516-9	£24.95
O'Reilly	Learning Python	Mark Lutz & David Asher	1-56592-464-9	£19.95
O'Reilly	Linux in a nutshell (2nd Ed.)	E. Siever & the staff of ORA	1-56592-585-8	£15.95
Morgan Kaufmann	Management of heterogeneous and autonomous DB systems	Elmagarmid, Rusinkiewicz & Sheth	1-55860-216-X	£44.95

Books received this month/cont'd

Publisher	Title	Author	ISBN	RRP
Morgan Kaufmann	Networked applications	David G. Messerschmitt	1-55860-536-3	£22.95
Morgan Kaufmann	Object-relational DBMSs (2nd Ed.)	M Stonebraker, P Brown, & D Moore	1-55860-452-9	£29.95
O'Reilly	Oracle database administration	D.C. Kreines & B. Laskey	1-56592-516-5	£24.50
O'Reilly	Oracle distributed systems	Charles Dye	1-56592-432-0	£26.50
O'Reilly	Oracle PL/SQL language pocket reference	S. Feuerstein, B. Pribyl, & C. Dawes	1-56592-457-6	£5.50
O'Reilly	Oracle SQL*Plus	Jonathan Gennick	1-56592-578-5	£23.50
O'Reilly	Programming embedded systems in C & C++	Michael Barr	1-56592-354-5	£19.95
O'Reilly	Programming web graphics with Perl & GNU software	Shawn P. Wallace	1-56592-478-9	£19.95
John Wiley	Ready-to-run Java 3D	Kirk Brown & Daniel Petersen	0-471-31702-0	£29.50
Morgan Kaufmann	See MIPS run	Dominic Sweetman	1-55860-410-3	£39.95
AP Professional	Tcl/Tk for real programmers	Clif Flynt	0-12-261205-1	£34.95
O'Reilly	TCL/Tk in a nutshell	Paul Raines & Jeff Tranter	1-56592-433-9	£15.95
Morgan Kaufmann	The design of children's technology	Alison Druin, et al.	1-55860-507-X	£24.95
Morgan Kaufmann	The grid: blueprint for a new computing infrastructure	I. Foster, C. Kesselman, et al.	1-55860-475-8	£42.95
Morgan Kaufmann	The Jasmine object database	S Khoshafian, S Dasananda, & N Minassian	1-55860-494-4	£32.95
Morgan Kaufmann	The usability engineering lifecycle	Deborah J. Mayhew	1-55860-561-4	£36.95
O'Reilly	The vi editor pocket reference	Arnold Robins	1-56592-497-5	£4.50
O'Reilly	Transact-SQL programming	K. Kline, L. Gould & A. Zanewsky	1-56592-401-0	£29.95
Morgan Kaufmann	UML for VB 6.0 developers	Paul Harmon & Brian Sawyer	1-55860-545-2	£24.95
AP Professional	Unix clearly explained	Richard L. Petersen	0-12-552130-8	£29.95
Morgan Kaufmann	Who's afraid of HTML?	Todd Howard	0-12-356915-X	£29.95
O'Reilly	Writing Apache modules with Perl and C	L. Stein & D. MacEachern	1-56592-567-X	£23.50

A question of trust

Big Brother is watching you! Actually, Big Brother doesn't see too well. Jules peers back.

'Good Morning!' beamed the appallingly cheery postman. Drawing on my natural wit and humour, I greeted him with a reciprocal 'Uggh?' It was, you see, first thing in the morning – an insistent banging on the door had summoned me back to the choppy surface of consciousness, and I'd staggered downstairs to confront the source of the disturbance.

Postmen must be used to seeing people in that state, because neither my appearance nor my apparent lack of language skills phased him in the slightest. 'You know what I like about you, Mr May?' he asked, and without waiting for my considered reply he continued, 'As long as you live here, I know I've got a job!' He shoved an enormous pile of envelopes, Jiffy bags, and cardboard boxes into my hands, grinned, and marched cheerily away, without waiting for my 'Uggh' in agreement.

With the benefit of half a gallon of tea, I was able to concentrate on my mail bag. It was big, but not abnormally so. Bill, bill, junk, red bill, junk, junk, junk, bill from a junk mail company, and a threatening letter in the same envelope as some junk mail. I selected one at random. It appeared to be from an old friend – someone who knew my wants, needs, and habits even better than I did myself, and with whom I was on first name terms. It talked about the popular parties that I gave at my address, and about the difficulties of juggling my domestic and professional lives. It discussed my plans for the future (how did they know so much about me?) and explained how much easier all this would be if I didn't have to worry about sanitary towels. Hang on, I've never wor... Ah! Bin.

'You bring it on yourself,' said my friends, rummaging through the extensive contents of my paper-recycling bag that evening, and chuckling at it. 'You should tick the little boxes that say you don't want any more mail.'

'Why? I like this stuff. So do you, otherwise you wouldn't be reading all my junk.'

'Doesn't it scare you that they know so much about you? Look, this one even knows what kind of man you want to marry. I never knew you wanted to marry a man.'

Generally, I've got the junk mail companies well trained now, so that I tend to get only the junk I want to read. But most people seem to regard junk mail as an invasion of their privacy. They don't like companies (or more accurately, the computers owned by companies) knowing about them. 'You never know what they're going to do with the information.' That's true, you don't.

Take the credit card companies. They rely on junk mail to get new customers, continually outbidding and leapfrogging each other in their cynical attempts to get you to spend their money on junk you don't need (some companies even provide a magazine full of things to buy, just in case you're too dumb to come up with your own ideas) and on which they get a 4% commission even if you do pay your bill on time. Amazingly, you don't get a card just for the asking. Perfectly normal people who apply for these cards get letters that say, however politely, 'Dear deadbeat, you're too irresponsible to spend your own money, let alone ours. Get lost. Another application form is being sent under separate cover.' People take it personally when they're refused credit, even if the refusal signifies no more than that the company is looking for a particular kind of customer (though the company never says that, of course, because it doesn't want to admit that it wasted its time and yours).

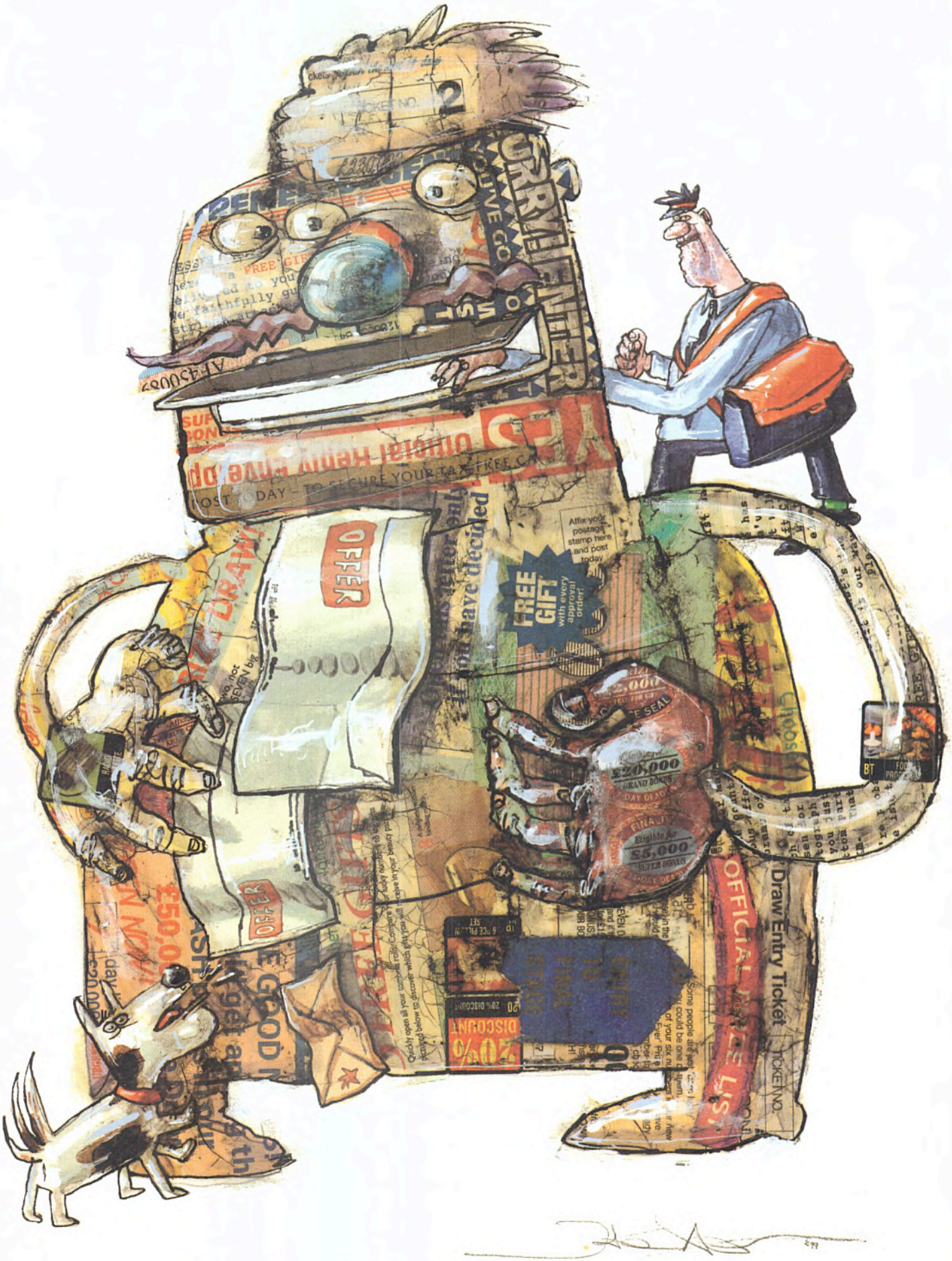
The card companies use credit reference agencies (which is a reasonably open system, even if biased against the subjects) and an approach called credit scoring, which is shrouded in secrecy and intrigue 'to keep the system working properly'. Ironically, any factors can be taken into account in a credit score – if some bank employee suspects that Africans living in Brixton are likely to be deadbeats, an applicant from SW9 called Winston Godogo is likely to be tarred with that brush no matter his circumstances or personal achievements, even though the bank is not allowed to ask his ethnic origin.

Nobody wants to have their personal information used to group them into some class. 'I'm not one of those,' they say, 'because *** makes me different.' Yet these are the same people who, deprived of their peer group or social identity, would be traumatised beyond pharmaceutical help. It is true that each person has their own motivations, situations, and even excuses, and it's true that those aspects are not acknowledged by the system (as they were in the days when you could talk to a bank manager, and the manager actually listened to what you were saying).

The problem, I think, is a question of trust. It's not that the companies know so much about you. It's that they don't know enough, what they know isn't accurate, and the tools they have for dealing with that knowledge are too crude. I'm quite gratified that the party-giving Miss May who apparently occupies my house cannot affect my credit reference, but I am a little concerned that she might affect my credit score. I'm more than a little concerned that the J May who lives two doors away from me (it's quite true, he does) can affect my credit rating (and he should be even more concerned that I can affect his!).

I reckon, what with the rise of the Internet, that things like credit applications and junk mail lists could be made more active, and more useful. Instead of filling out forms, you'd have a dialogue with the bank, and their computer would be tasked with maximising your credit score, or tailoring their product to your needs. Instead of being told Yes or No (which translates to 'Congratulations, you win' or 'Get lost, deadbeat'), you'd get grades of answers, such as 'Close, but not quite', 'You're not a student any more', or 'How about a card with a zero credit limit?' That's what real bank managers did, and nobody ever complained about them knowing too much. ■

Jules is trying to set a record for being on more mailing lists than anyone else. He then intends to move house. If you're quick, you can call him on 01707 662698, or email mayhem@jules.cix. co.uk.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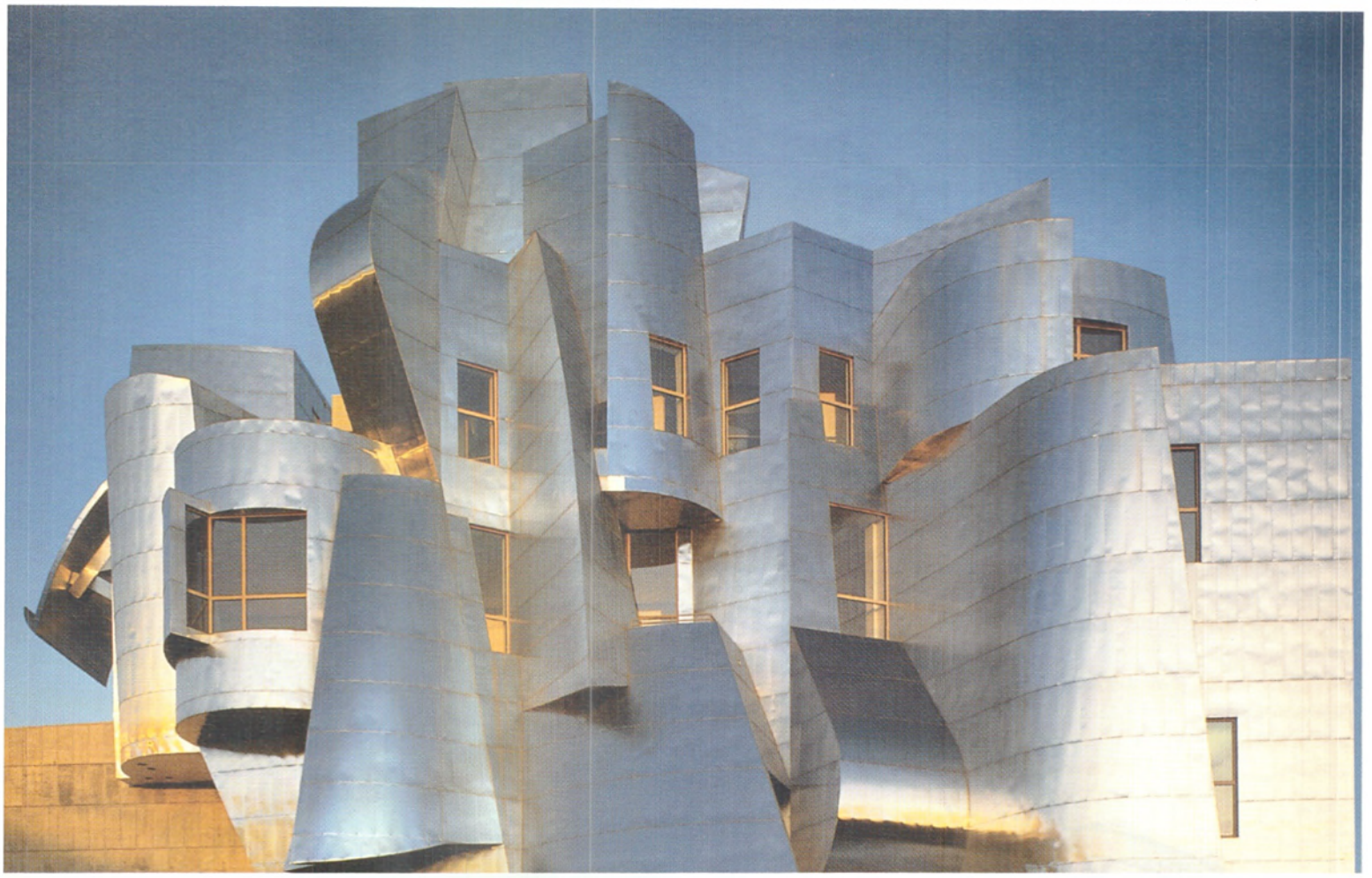

63 Saturdays
120,758 billable hours
412 client "discussions"
1 missed anniversary

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iomega.

Apparent blessings of VC++

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@exe.co.uk*.

Dear Sir,
In your recent news piece entitled *Microsoft declares its hand* (March, 1999) you note Bjarne Stroustrup's 'apparent' blessing of the Attributes technology that the Microsoft Visual C++ team is investigating for a future version of Visual C++. I wanted to make sure that your readers understand that at no time did Bjarne give his blessing to any of the efforts of the Visual C++ team. As you probably know, Bjarne does not endorse or recommend commercial products. While he has had the opportunity (along with other C++ language experts) to visit Microsoft and provide critical feedback on some of our C++ development efforts, he remains completely independent of Microsoft. When he visited us, he stressed the importance of full adherence to the ISO C++ standard and the role of C++ as a language that allows near-optimal use of hardware resources.

So we apologise to EXE, its readers and most importantly, to Bjarne for any misinformation or implication to the effect that Bjarne gave approval to our Attributes technology for COM+. Microsoft values Bjarne's technical contributions to the C++ community and will never seek to jeopardise his independence.

Thank you.

Jeff Ressler
Visual C++ Product Manager
Microsoft
msvc@microsoft.com (feedback)

Classic waterfalls

Dear Sir,
I was rather surprised by your article *Requirements for Success* by Andy Brice in the May issue. The 'typical software lifecycle' shown is the classic waterfall model where the project proceeds stage by stage from requirements to deployment. In practice, successful projects rarely happen in this way unless they are straightforward reworkings of projects already familiar to the team. Such projects seem unlikely arenas for the thrill-seeking readers of EXE, who I hope are more likely to be using risk reduction techniques, including iterative and incremental design, and prototyping, supported by flexible project managers. In practice, they will still be doing it, as all successful projects always have, even if their project managers aren't aware of it!

This is not to downplay the value of working hard on requirements, but to shift the focus to their change and improvement during the project, and to their relationship to other work products. For business-type systems, use cases provide a good way to document functional requirements in a way that both users and developers can understand, alongside a non-functional requirements document with more traditional headings, such as performance and availability.

Some good reads on this topic are Tom Gilb's classic (and radical) 1988 text *Principles of Software Engineering Management* (ISBN 0201192462), the OOTC's 1997 *Developing Object-Oriented Software* (ISBN 0137372485, also okay for non-OO systems), and Alistair Cockburn's *Surviving Object-Oriented Projects* (ISBN 0201498340) from 1998.

The Rational Unified Process and IBM's family of methods (including SIMethod for custom AD) provide foundations and guidance for a more realistic approach to application development.

Bruce Anderson
Senior Consultant, IBM EMEA
Object Technology Practice
Bruce_Anderson@uk.ibm.com

The diagram was a simplification of reality, as are most diagrams. In reality, there is always feedback between the different stages and the stages often overlap each other in time. Personally, I prefer to take an iterative approach where there are a number of builds, each comprising implementation and transfer stages. All I really meant to illustrate was where requirements gathering fits into the grand scheme of things: after making a business case and before specifying a solution.
Andy Brice

Joining user groups

Dear Sir,
A question was posed in the June edition of EXE as to why developers are not interested in joining user groups (*Delphi is on the up*, Letters). I think the answer relates to the breadth of functionality which constitutes a developer.

There are those among us who are interested in the mechanics of one or more programming languages and those who are not. Having an almost pathological interest in the structure of any language seems to bring with it the need to discuss and be involved with others of the same ilk.

Developers who use RAD products, in particular VB and Delphi, are rarely interested in much beyond creating a system and getting paid for it, either as a contractor or as a 'permanent' employee.

This does not necessarily mean that RAD developers do not have the ability to understand what is happening in the engine room of the programming language, just the lack of need, and perhaps more importantly time, to discuss and share with others.

Some of us do not see the need to join in discussions as to why an `ifend` is needed in one language and not in another and how in yet another the same structure could be represented as `endif`.

Who cares?

It is my view, therefore, that any survey based on the views of members of user groups would return a bias towards the non-RAD languages.

And what about age? Jules makes a good point (*Cool, sexy, old*, Mayhem, June) regarding the fact that we all get older, even (especially) programmers, and I feel that having reached a certain age (<n>) there is less incentive to discuss what we spend all day doing and that there are more important functions required of us by those who must be obeyed: cut the lawn, put up a shelf, etc.

There will certainly be those readers who will vehemently disagree with the foregoing. I do not attempt to denigrate those who operate at the coal face of the language and join user groups – they are a vital constituent of the profession – but seek to identify that there are many differences between both the working-practices and the personal needs of those who develop systems and that this difference is highly likely to account for survey trends which seem to give concern (maybe justifiably) to people such as Joanna Pooley (UK-BUG).

David Johnson
Managing Director
djohnson@copyhold.co.uk

Self-selection of the species?

Alex Telford ventures into the sensitive territory of programmer intelligence and language design, uncovering a process of self-selection within the industry. Unfortunately, all is far from well when the different groups struggle to communicate...

Discussion of programmer intelligence is unfashionable, perhaps even inadvisable, for political correctness holds that measuring people on a scale can lead to discrimination. All that is allowed, says PC, are jokey terms like 'no-brainer' and 'rocket science'. But rockets could not get very far without computers, so I am going to use that loophole to discuss intelligence and its influence on programming skill.

The motivation for this article is my perception, after 25 years in computing, that there is 'turbulence' in the area of software development. New languages appear that are often simplified versions of established languages. There is no consensus on the best development systems for software production: there are adherents for any of C, C++, Java, Delphi, Visual Basic, and the Builders. And then there are the various scripting languages. I'll examine some possible causes of the confusion and point a possible way out of the maze.

Measuring intelligence

Figure 1 shows a hypothetical distribution of intelligence among a random selection of 100 men and women aged 24. Measuring intelligence by a single number is, of course, suspect – intelligence is surely multidimensional and hard to map to a scalar variable. But most of us understand and accept that there is a rank order of intelligence: we see that there are other people whose understanding of programming concepts is better or worse than our own. My argument does not depend either on the detailed features of any particular distribution of intelligence or on the values of standard deviations of it.

Whatever measure is used, a distribution resembling Figure 1 is likely to appear. The key properties of interest here are the bands of intelligence marked H, I, and J. Employers of programmers will prefer to recruit from as wide a field as possible: from those people with average intelligence and above. Of the 100 people in our original population, 50 will remain. The distribution is non-linear, so typically there might be 34 in group H, 14 in group I, and 2 in group J. The H group of 'ordinary' programmers is more than twice the size of the other groups combined.

A process of self-selection has, I believe, differentiated the intelligence groups H, I, and J into performing different functions within the IT industry. Group J, with only two members, represents the creators of new computing languages and operating systems. Group I, the 'expert-teachers', write the compilers and the textbooks for the languages created by group J, the 'language-creators'. Group H represents the users of these languages – the software developers, or 'ordinary-programmers'. Of course, there is much overlap: the expert-teachers group will often be in software development. But it is unlikely that anyone from the ordinary-programmer group would have been involved in the development of a language.

Let me own up immediately – when last measured (as a child) my intelligence would place me in the middle of the group of ordinary-programmers. I, along with my fellow programmers, am a user of the products of the language-creators and the expert-teachers. But I have some minor additional talents that partly make up for lack of general intelligence. I like, and do not fear, mathematics. After graduating, I specialised in electronics and my career evolved as computers developed in power and sophistication. For people like me, seeing the historical development of computing in this way was a substitute for formal training in computing, although we did attend a few courses over the years.

The turbulence in current software development arises in my view as a breakdown in communication between the language-creator and expert-teacher groups and the bulk of the developers in the

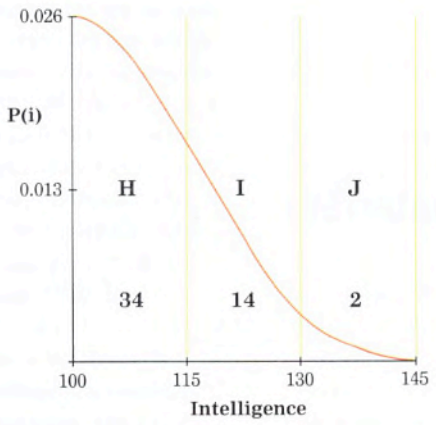
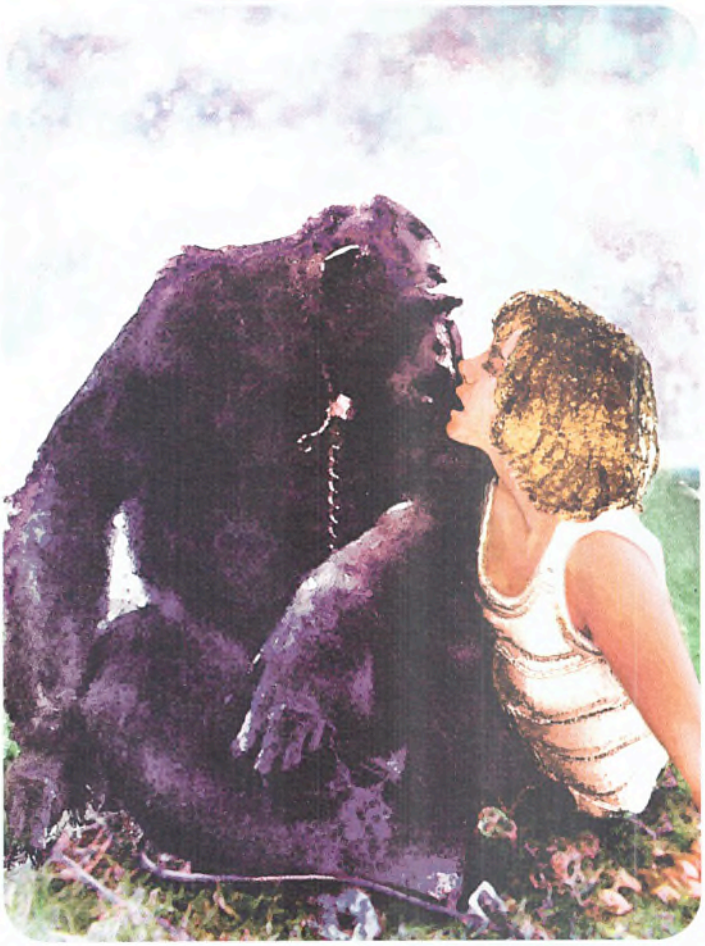


Figure 1 – Distribution of intelligence.



Patricia Deardorff. With thanks to Ricky Mazzullo and Pancho (see page 25)

ordinary-programmer group. To put it bluntly, the products of the first two groups have become too complex for the ordinary-programmers to understand and master with the fluency necessary for professional software development. As an example of the conceptual difficulties the average group encounters, let me describe my own experience of upgrading my C skills to C++. I was fortunate to do this after retirement – I could study at my own pace with no pressure to 'get results'.

The power of mathematics

I knew the key to understanding C++ was the concepts of 'class' and 'object'. I studied some books and bought a C++ compiler. I stuck to as pure C++ as possible by writing 'console' applications. The nearest jumping off point in C, I was told by the books, was the C concept of a structure. This I understood, and had used in C programs gratefully – in my Fortran days I often had integer, floating point, and character arrays all indexed conceptually by the same variable.

The books were very weak on the subject of class design – how should data be represented in the class definition? Choosing the data representation wrongly made the rest of the class unwieldy and caused frequent redesigns. I struggled. Then, when looking at operator overloading, I had a blinding flash of insight. The whole thing appears to be based on mathematical set theory and group theory! It seems designed to encourage the programmer to think about the operations on their class-objects: if the objects (instances) were constructed that way, what would adding two of them mean? Would it make sense to add them? What would -, *, and / mean? If it does not make sense, could the data be represented another way for 'addition' to make sense?

I was stunned. Why did nobody tell me that its origins came from the Mathematics department? Standing back from the detail gave the answer – almost everywhere in the English speaking world there is a flight from any reference to mathematics because of the puzzling failure to teach it successfully. Too many students finish their education with a distaste for it, and it is therefore excluded from most texts.

Of course, this will be true of other programming languages that support object-oriented programming by means of the class-object. Some of these other languages, Java for example, are reduced with respect to C++ along just the dimensions of mathematical abstraction I am discussing. It is a simplified language in this respect.

For the creator of C++, Bjarne Stroustrup, the concepts that were easiest to deal with were the ones that have 'a traditional mathematical formalism: numbers of all sorts, sets, geometric shapes, etc.' (I am quoting from *The C++ Programming Language* Second Edition, 1994.) Certainly, C++ has a rich set of object-oriented programming tools and, as it is the first object-oriented language I have studied and coded with, I use it here as an example for my comments. Other languages, like Lisp, were originally designed for the processing of symbolic expressions but were expanded to general-purpose languages later. I restrict my discussion to general-purpose object-oriented languages like C++.

We have the paradox that C++ has a formalism that can take advantage of the power of 100 years of mathematical structure, but anyone trying to learn to use it has to find their own understanding of it unaided... Some concepts are easy to grasp and some hard. Sometimes, I am okay because my 'mental accumulator', as it were, is larger than the concept I am exposed to. It fits without overflow, so I understand it immediately. Alternatively, my accumulator (proportional in size to my intelligence) is too small for a more difficult concept. Try as I may, I can see only a part of it at one time and can never fully understand it. And many concepts have the property of being self-referential or recursive – the whole must be encompassed for full comprehension. For me to understand a concept that I find difficult, I need help from someone who understands it and can explain it, perhaps by relating it to other concepts I already understand. This process shrinks a hard concept down to a size that fits inside my mental accumulator.

Operator overloading in C++ was the concept that triggered my first insight on the problem of data representation in class design. If + and * (multiplication) can be correctly defined for a class, then the whole power of mathematical linear analysis can be mined for its rich lode of theorems, giving access to many useful optimisations. Of course the opportunities to do this may be quite rare – many objects are not sufficiently 'number-like' to allow suitable definitions of + and *. More general than arithmetic operators are the set theory operations of 'intersection' and 'union'. That these are not often encountered in day-to-day class designs is perhaps an example of our failure fully to exploit the mathematical potential in the language.

The difficulty of C++

Is C++ difficult to learn for the group of ordinary-programmers? If such programmers are expected to do their own class design and find their own data-representation, they are going to need help. The syntax and grammar of C++, in my view, also needs rationalisation to simplify the learning process. For example, there is another kind of overloading in C and C++ – that of character overloading. C++ as a language is quite terse, and in the hands of experts can be very dense – a short string of

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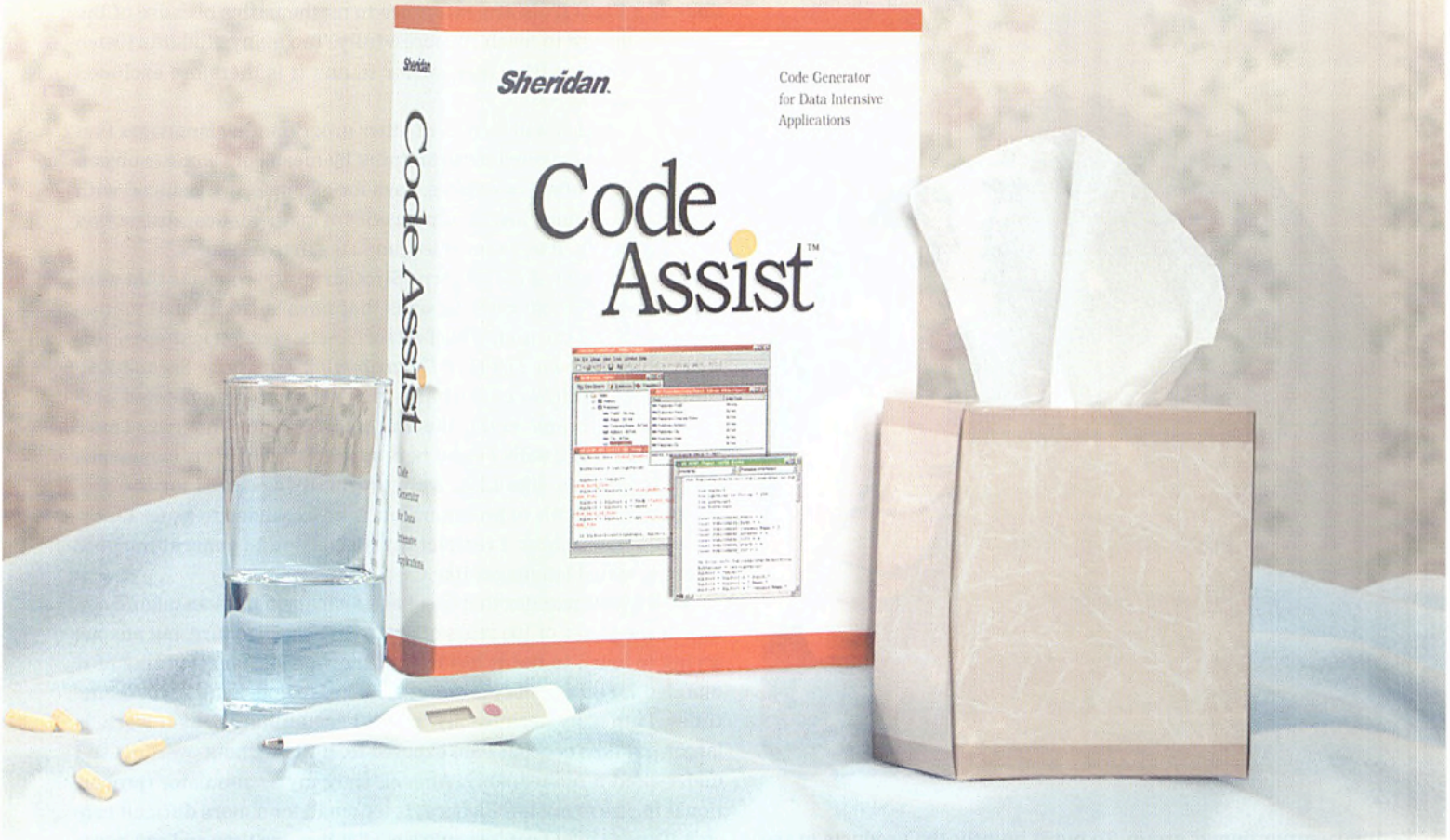

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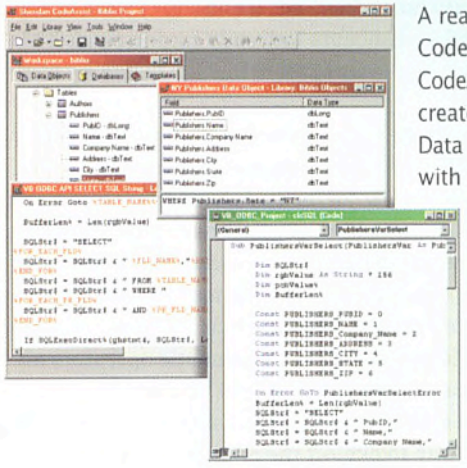

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code can mean many operations are being described and their order of execution is crucial to the result. Too often the meaning of a character has to be deduced from context; but that context is tiny, with no redundancy to give secondary clues. The worst character is *.

Consider:

```
Fnxyz() {
  int k;
  int* pS;  // line 2
  int * pT; // line 3
  int *pV;  // line 4

  // ... setup S and T

  k = *pS * *pT;       // line 5
  }
```

There are three different meanings of * in this code fragment. In lines 2, 3, and 4 the * is a qualifier on the keyword int, the result meaning 'integer-pointer'. Line 5 sees two more meanings. The first and third occurrences of * are the operation of 'indirection', that is to say, use the integer in the variable whose address is given. Finally, the middle * on line 5 is ordinary multiplication. To confuse the educational process further, lines 2, 3, and 4 show alternative and accepted forms of specifying a pointer to an integer! This is really confusing to a beginner as he will encounter all three methods while reading other programmer's code.

Here is how it should be written (in D++, as it were), *with no variants allowed:*

```
Fnxyz() {
  int k;
  intPtr pS;
  intPtr pT;
  intPtr pV;

  // ... Setup S and T

  k = @pS * @pT;
  }
```

In essence, one character does one job: * is always multiply for the objects it operates on, and is nothing else.

No doubt some will point out that C and C++ allow me to use `typedef` to specify my own `intPtr` type. But this makes it *worse* for the beginner, because some authors will use it and others not, further complicating the range of ways of expressing the same concept.

The past

It verges on the lunatic that our profession has stuck with the character set that was available on a 1960's ASR33 teletype. This is after nearly 20 years of bit-mapped graphic displays that could show any character whatever. In my view, C and C++ require a complete overhaul. During the process of language clean-up and simplification there should also be a compulsory move to a single, universal 32-bit character system where every character has its own standard *and* unique coding. There are 4,000 million codes to choose from. Even within the standard Windows character set there are characters available to break unnecessary overloading: ⊗ ⊕ ∩ ∪ ⊃ ⊇ ∈ ∇ ∏ ◊ ⊂ ⊆ ⇒ ⇐ ⇔ ⇑ ⇓ ↔.

Most programming languages had, at the time of their creation, strong links with mathematics. The first computers were in, or very close to, the mathematics departments of the institutes creating the machines. Fortran was one of the first 'high-level' programming languages; the stimulus for its development was the desire of the applied mathematicians to input their differential equations directly as they would appear in print. Subsequently, we have had Algol and APL. The mathematics departments added 'Programming' then 'Computer Science' to their syllabuses. Students were taught Basic and Pascal as training languages. Was it really envisioned that these students' employers would go on to teach them some 'real industrial-strength' language? Computer Science became a university department in its own right. Research projects began within these new departments into even higher-level languages, for example `yacc`, which can produce compilers for other languages. Research in AI produced Lisp, a language capable of high abstraction. All of these were rooted in a mathematical view of the world.

Perhaps there is a forgotten hidden agenda at the heart of the design of C++. An application for which the code is small enough can benefit by having a single software developer. He or she can model the entire project in their mind – a powerful simulator that can see opportunities for improvements. Larger projects require the activities of several programmers and the added discipline needed for communication between them. In both the single-developer and multiple-developer cases, decisions have to be made about the class interfaces for users. In essence, which variables and functions are to be `public` and which `private` or `protected`? The single-developer has access to the entire code of the project and can promote or demote these assignments at will. But in a group project, not all members usually have this freedom. While learning C++ I had the uneasy feeling that the model was really that the clever programmers would do the class design and the data representation design, then would hand down the finished class for use by less gifted programmers. If this *is* the model, then it should be made explicit – we would need some reasonable rules to define this demarcation.

Other problems with C++ also derive from its history. In the days when C was created, computer memory was scarce, and vast ingenuity was used to create programming systems that reused memory as much as possible. Stack-based function calling and global memory heaps were solutions that are now deeply embedded in the foundations of C++, deriving as it does from C. But my ordinary PC has 64 MB of memory, and soon 128 MB or 256 MB will be standard. Do we really need to stick with memory allocation schemes that complicate software development? Why do we have to worry about memory leaks in our programs? Every time I create an object in C++, even ones that take just a few bytes, I have to deal with possible memory exceptions, and the mechanism for this is horrible. And why do we need casts, another ugliness and yet another call on the programmers memory for arbitrary data?

Barriers of communication

There is evidence that the language-creator and expert-teacher groups do not experience these difficulties I have with C++ grammar and syntax. Books and articles on C++ techniques display their author's complete fluency with these idiosyncratic constructs. Finding no difficulty themselves, they are puzzled as the ordinary-programmers stumble over the syntax and fail to grasp the higher concepts. This is a common failing in educational systems. It seems reasonable to install as a teacher of a subject, if possible, someone who has mastered it thoroughly and finds it as easy as breathing. But the problem is that if such a teacher has never

had any difficulties with learning the subject, then they are at a loss in trying to understand the source of a less able student's difficulties. The best teachers are those who have encountered every possible obstacle to understanding and overcome them.

One of the most insidious hidden assumptions in education and elsewhere is that a practitioner of high intelligence in a profession can subsume the talents of anyone less gifted. Some do have that skill, but it is rare. In my 25 year's experience I have so often seen discussions, between a would-be explainer and a reasonably intelligent co-worker seeking help, to be completely at cross-purposes due to the inability of the explainer to mentally model their colleague's difficulty. The inability of the highly intelligent to model lower intelligence seems to be a real barrier for the effective communication of ideas. I have encountered an explanation of this when trying to build a chess-playing program: the grand masters could not tell us (in sufficient detail to program) how they saw good moves. They seem to have access to the output of a high quality chess-move mental module without being able to describe the algorithms internal to the module. Another problem is tedium. The language-creators are motivated by intellectual challenge and even with the best intentions their attention will wander if forced to re-explain a concept too often to a slower mind. The result of this is the presence of limits to effective communication based on the range of intelligence between the communicants. Note that our group of ordinary-programmers of average intelligence has to rely on the translation talents of the expert-teachers interpreting the work of the language-creators.

Programming language design and research on the Web

Programming languages group, University of Illinois
http://vesuvius.cs.uiuc.edu:8080/home/pl.html

Queen Mary and Westfield College, Peter O'Hearn
http://www.dcs.qmw.ac.uk/~ohearn/

Logic and foundations of programming
http://www.dcs.qmw.ac.uk/research/theory/

Advanced programming language design, Raphael A. Finkel, 1996
http://www.davison.net/catalog/books/0805311912/

Programming language research, Mark Leone
http://www.cs.cmu.edu/afs/cs.cmu.edu/user/mleone/web/language-research.html

WWW virtual library – software engineering
http://rbse.jsc.nasa.gov/virt-lib/soft-eng.html

Links on objects and components
http://www.parallax.co.uk/cetus/software.html

Composable software systems
http://www.cs.cmu.edu/~Compose/

Some programming language links
http://www.cs.oswego.edu/~odendahl/html/programming.html

TOPPS research
http://www.diku.dk/topps/Research.html

Psychology of programming interest group
http://www.ppig.org/home.html

Programming language design, Thomas Green
http://www.ndirect.co.uk/~thomas.green/workStuff/res-proglangs.html

'Cognitive dimensions', Thomas Green
http://www.ndirect.co.uk/~thomas.green/workStuff/TG_aboutWork.html

Thinking with diagrams position statement, Marian Petre
http://www.mrc-cbu.cam.ac.uk/projects/twd/position-statements/marian-petre.html

A modest proposal

A possible way out of this maze of confusion generated by our failure to re-examine the axioms on which our computer languages are built now presents itself. If mathematics is no longer to be relied upon as a model for a new programming language, then something must take its place. I recommend a bootstrap approach. After 30 years of programming in languages from Fortran to C++ it must be clear by now *which set of constructs* are required to build all previous applications and, by extrapolation, all future applications. By *set of constructs* I mean a minimal set, and with a grammar and syntax that allow no room for multiple representations of the same functionality. It should be a 'clean' language in the sense of being logical, and that the memorising of just a few rules gives access to nearly the entire language.

Writing in the *C/C++ Users Journal* (*Embedded C++ Update*, February 1999), P. J. Plauger gives an interesting short history of the standardisation of C++. This article presents some insights as to why this process has taken nine years. It seems that committees dominated by users working on desktop systems 'favoured power and completeness over economy of concepts and compactness'. During the protracted standardisation process, development to clean up the syntax of C and C++ was frozen (for the preservation of backwards compatibility), as was any effort to start a new language design with a 'clean slate'.

Before starting the ambitious undertaking of designing a new language I believe a research program is necessary to find which language constructs are currently giving students difficulties, and to discover the source of the difficulty. 'Pointers' are a likely candidate for this list. A related study could analyse recently-produced source code from widely differing origins, cataloguing the frequency of use of each language construct. It may turn out that some constructs have effectively zero usage.

For the new language, standards committees with members from the language-creator group should be discouraged from trying to make every random string of the language mean something and compile – just in case it turns out to be useful in one out of a thousand programs. There are exciting possibilities with the huge range of

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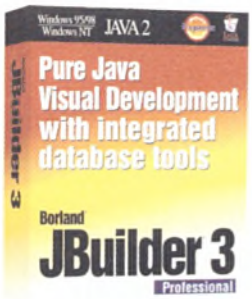

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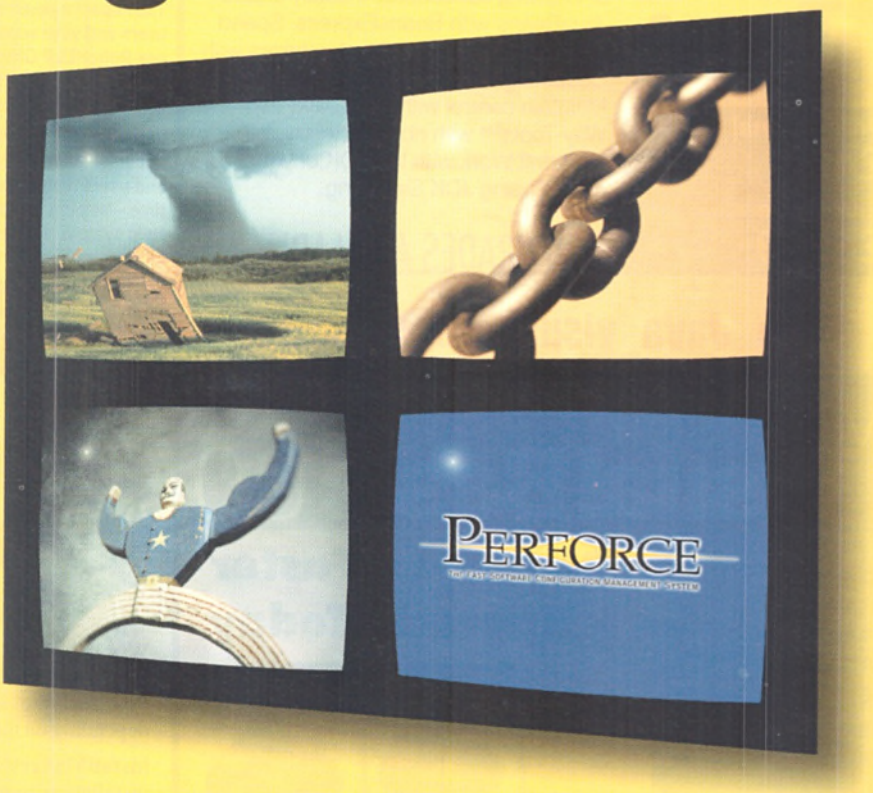

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characters available on current GUI systems. And the language should *avoid* richness: it should achieve its aims by having a carefully chosen set of basic functions with which any operation can be coded.

Current directions in programming language design can be seen on a number of websites (see *Programming language design and research on the Web*). The continuing bias towards a mathematical foundation is clear and is illustrated concisely by the contents page of Raphael A. Finkel's book *Advanced Programming Language Design* (ISBN 0805311912). A minority view more in tune with my concerns is found at the site of the Psychology of Programming Interest Group, particularly the work of Thomas Green and Marian Petre. More encouragement should be given to this kind of research, which takes a wider perspective of programming language research and design. ■

After graduating in Physics (BSc) in 1964, Alex Telford moved to London to support researchers in physchometric testing using the first minicomputers generally available. A transfer to a large Medical Research institute brought exposure to a Unix environment where they networked over 200 PCs. On retirement, he set up Solarix Software, which offers systems developed in C++ for Windows for a select group of clients. Contact a.telford@dial.pipex.com.

Chimpanzee chronicles

The picture accompanying this article shows Ricky Mazzullo with Pancho the chimpanzee. This particular tête-à-tête was about good manners for eating. (The photograph was taken in 1974 and has been improved by Patricia Deardorff.) Mazzullo taught Pancho the American Sign Language. Here's a short note from Mazzullo about the picture:

'Pancho was unusual for an adult male chimp... gentle, approachable, and not at all aggressive. We used to wander through the woods displaying (the way chimps do, to assert their authority) at the occasional cow. I never mastered his ability to climb trees, so we did not share this particular treat. But he definitely taught me how to scare away those cows.

We shared food and "conversation".

Pancho taught all of us how to get past some of our social taboos. At dinner, he would stare at our mouths to show his interest in sharing, or simply to find out what it was we were tasting. And he would eagerly lean across to communicate without worrying about saying "excuse me".

Pancho showed genuine affection and curiosity. He was happy to see me and sad when we parted. During the time I spent with him, I gradually became more approachable and more willing to show my own feelings.

I wanted to teach sign language to Pancho because I thought if he could only learn to sign, he could tell me what it was like to be a chimp.

Instead, Pancho taught me how to be more human.'

A Developers Job is Never Easy -
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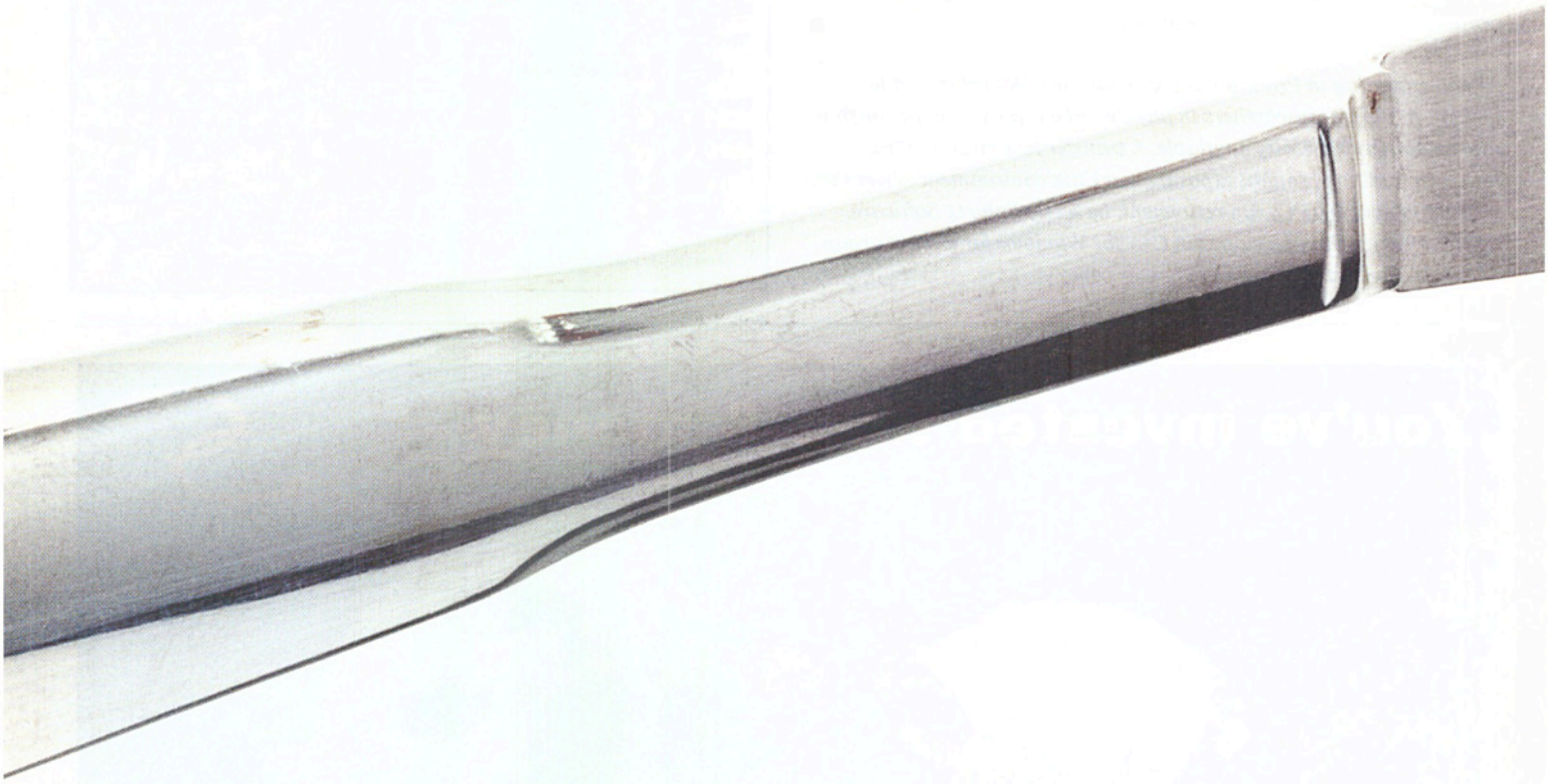

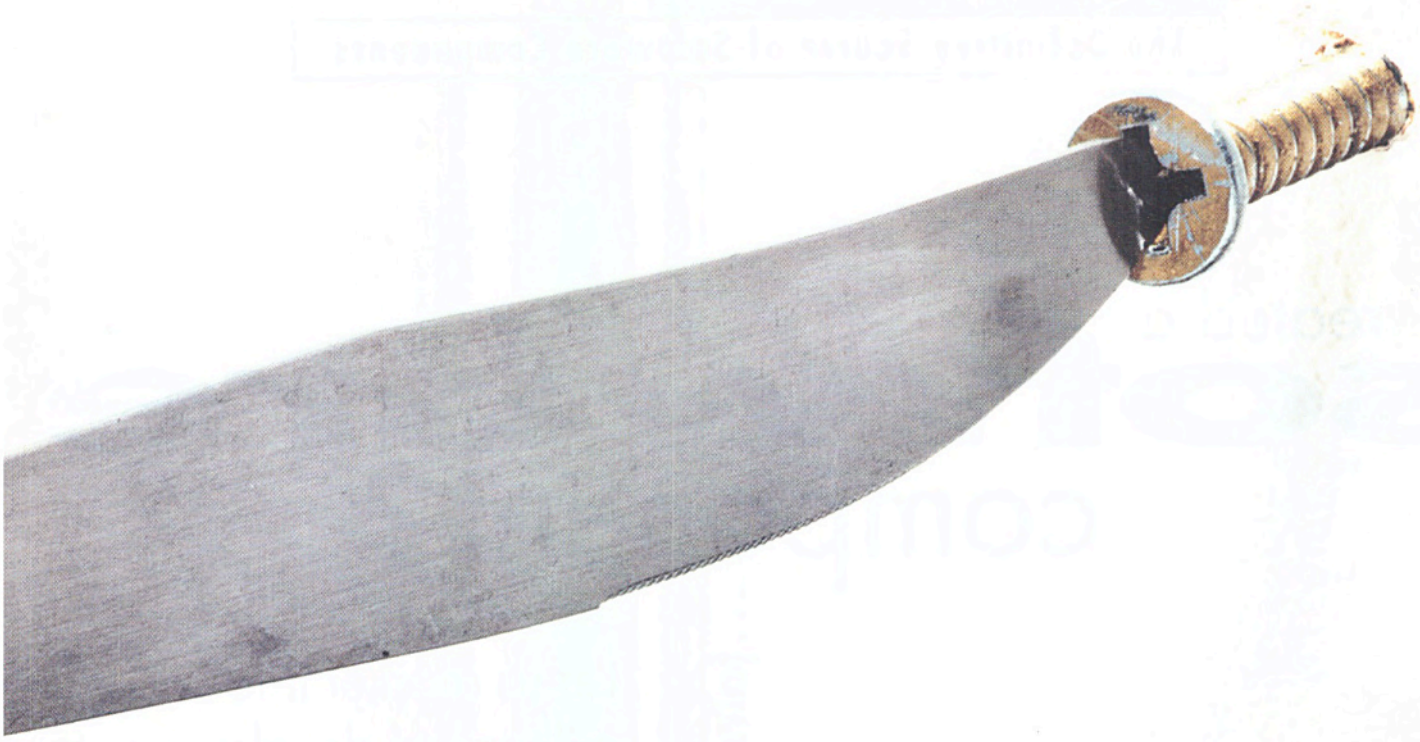

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Putting Windows in their place

The Microsoft Installer technology represents a major overhaul of installation practices. Ian Murphy believes it will be welcomed by those in charge of corporate support budgets, but what about the onus placed on the developer?

We all know the feeling of installing a new application and then watching a bunch of other applications fail. Maybe you just deleted an application and now something totally unrelated has failed. Of course, if you have spent any time on a support desk you will know these symptoms very well. For many organisations, these problems are so common that they are going to extraordinary lengths to minimise the downtime caused. Long before Microsoft announced IntelliMirror inside Windows 2000, corporate support desks were already configuring user machines to store all critical data on network servers. Then, when the applications did crash, they simply wiped the hard disk and carried out a clean installation. Others turned to Microsoft Terminal Server as a solution as this enabled them to limit severely the potential damage. Who is at fault and what can be done about it?

Who's to blame?

As to who is at fault, well that's a difficult one to resolve. I've trashed my own machines with code I've written and although I'm reasonably confident that none of that code was ever released to a customer site, I couldn't swear to it 100%. I suspect that many of you may have been through the same scenario and some of you may even have been sent offending code, often masquerading as beta code. The ability to send relatively untried, untested, and often dangerous products out to sites under the label of a beta, and then shrug off any damage is unique to the software industry. Imagine doing this with a cruise missile and then explaining to the party involved that you have no responsibility for the fact that their 300 million pound guided-missile cruiser is lying at the bottom of the ocean. On the other hand, if your *software* failed and left their aircraft carrier wallowing in the middle of nowhere, they would very quickly accept that these things happen.

Is the fault that of the support desk or the users? After all, the first thing we teach people on support desks is that users cannot be trusted. They delete critical files and then deny all responsibility, even though they were the only person awake in the entire Northern Hemisphere at the time. Often, they were only using the install or uninstall routines that came with the software, so should they really be blamed?

At the end of the day, there are probably two key issues. The first is that installation, just like documentation, is extremely low on the list of priorities. Many sites don't even begin to think about how they are to deliver an application until they need to ship copies of beta code to the test team. (However, developers in the distance learning world have been forced to treat the question of delivery as a priority concern, even before they are anywhere near the start of designing the course.) The second issue is that we have lacked a formal approach for installation/uninstallation and proper policing of any such methodology. Microsoft recognised the problems early on with DOS-based programs and during the early days of Windows 2.01 and Windows 3.0 they formulated a logo programme that contained instructions on where to place DLL and system files, along with the application's configuration or `INI` files. With Windows 3.1, this logo programme was supposedly enforceable, and when Windows NT and Windows 9.x came along they just slotted into what had been created for Windows 3.1 with a few minor revisions. The result has been disastrous although the system architecture and lack of widespread public use of Windows NT has allowed it to avoid the worst excesses of this problem.

The Stock Market

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Installer technology

For some time now, Microsoft has been showing and talking about the new Microsoft Installer (MSI). This technology is extremely important to the company and it has the potential to reduce and even remove many of the problems. More importantly, as we get closer to Windows 2000, Microsoft has decided that the concerns of installation need to be given a higher priority if they are to convince corporate customers that the idea of resolving the Total Cost of Ownership (TCO) issue is to be advanced.

As a first step, Microsoft gave over three sessions at last year's PDC in Denver just to deal with the issues surrounding installations and it also issued an incomplete set of APIs for this new technology. Updated APIs have since followed and they can be found on the May MSDN Platform SDK CD as part of the US Development Platform set. Yet much of the work on the MSI technology has been going on between Microsoft and three key partners – InstallShield, Wise Solutions, and Veritas (the company formerly known as Seagate Software, according to its telephone system) – for well over a year now.

To demonstrate what the new MSI offers, Microsoft ensured that all the betas of the Office 2000 product used it, and this has enabled a lot of corporate organisations to get a first look at this technology in action. In fact, the product manager responsible for this part of Office 2000, Mike Kelly, believes that the inclusion of MSI has improved Office 2000 itself through the added resiliency it has provided (along with other features that I will deal with later). Outside of Microsoft, the response has been extremely positive from anyone who has used MSI or installed Office 2000, primarily because of one single feature: the self-healing capabilities of the installer. This means that if a required file is deleted or corrupted, instead of the application simply grinding to a stop or requiring a complete re-installation, MSI locates the missing file and re-installs it before starting the application. This one feature is likely to save corporate support desks several thousands of pounds each year as it reduces the time taken for re-installations.

As developers, many of us would argue that it does not always need a re-installation to solve these problems, but a busy support desk does not have the time, the tools, or the inclination to track down the missing files. Even if such an effort would help to prevent the problem reoccurring, it is still easier for support desks to re-install the application as opposed to fixing it because managers live in a world where they need to see something now rather than wait for a comprehensive solution. In order to live with the users, they have even shifted from blaming the user for deleting important files to simply blaming the problem on the software and the way it installs itself. While developers might be responsible for some of the problem, they are currently castigated for all of it and, for once, it really is unfair.

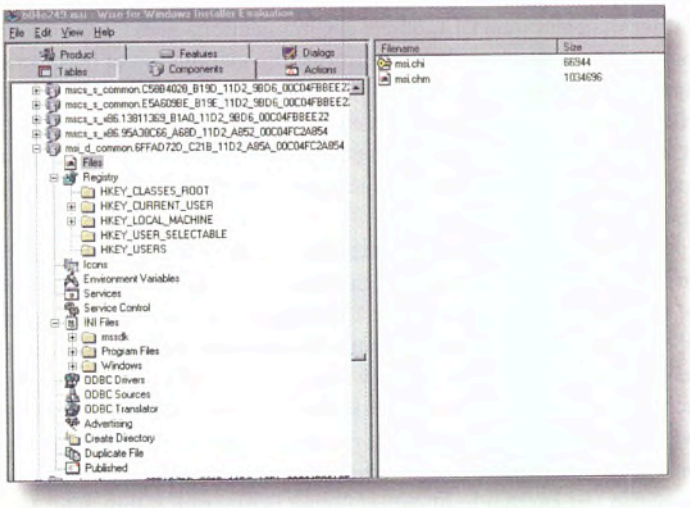

Figure 1 – Content maintained for a single component.

To implement the self-healing features truly, the programmer needs to have developed his components with such an approach in mind.

Designing for installation

However, to implement the self-healing features truly, the programmer needs to have developed his components with such an approach in mind. The reason for this is that an Installer package processes the headers and the linkage of components into a package in order to be able to detect the missing or corrupted components and subsequently self-heal. Brien Witkowski of Wise Solutions believes that the pressure on ISVs to MSI-enable their programs will come from the corporate community. Although still in the early stages, Wise Solutions is already using some of the features of self-healing that do not require the programmer to make massive changes. Introducing entry points to shortcuts that can be used to check the validity of a package is one example. Witkowski also points out that at Tech Ed recently, a developer was talking about using secondary applications that run before and after installation to check the validity of an installation. Such a piece of code could be created after the application was installed and could then become the key path for the shortcut.

This view is shared by Steve Schmidt of InstallShield, which has been running its Early Experience Programme for some time now and has seen many of the problems that developers are facing. Schmidt will be attending Tech Ed '99 in Amsterdam and will be picking up the MSI ball from Brien Witkowski. The view from Mel Raff at Veritas is slightly different and this is because Veritas is focused on the administrator rather than the developer. Raff believes that the need to program effectively for self-healing actually creates a problem for many IT shops that do not have the staff to encode the relevant markers into the vast array of components that they produce. He also suspects that this causes a problem for developers: turning application programmers into system programmers.

However, everyone agrees that the implementation of self-healing is likely to save a significant amount of money throughout the corporate support budget. They also share a common reservation about the extent of work required to implement self-healing fully and whether software houses will be prepared to go down to the utility level and add the headers to such small applications. Brien Witkowski believes that developers will face a backlash from corporate clients who will make MSI the only acceptable installation mechanism on their sites. In fact, Wise Solutions points to one of its existing oil industry customers who has recently gone to the length of creating installation packages, down to the level of the Windows Calculator, to gain a single installation mechanism to manage their global business.

To see the impact of self-healing you need to get hold of a copy of Office 2000. Any beta will do, although the May MSDN contains the gold code that will be in full-shipment by the time this article reaches you. Try deleting, at random, any of the components installed by Office 2000 and the next time you start up the application it will simply pause, ask for the installation medium, re-install the missing component, and then load. With software installed on a corporate server, this behaviour should create a reasonably seamless installation provided that the installation points to network shares rather than server/drive locations. To ensure the correct installation approach, you can use the Custom Installation Wizard from the Office 2000 Resource Kit. However, do not lose sight of the fact that every component inside Office 2000 has been designed with MSI in mind and therefore contains all of the required header code.

Assignment and publishing

Self-healing is not the only advanced feature of the installer that has caught the attention of support teams and will mean a new approach to installation from developers. When combined with the Active Directory components from Windows 2000 you can take advantage of two other features: assignment and publishing. Both of these are likely to lower the support overhead by making updates and newer versions of applications available 'on demand'. Yet we already have this capability via the Microsoft Management Console (MMC), so it is nothing new in itself. However, it does create some interesting changes in roles that could have a significant impact on developers and administrators, and how software distribution is perceived.

At present, if you want to do software distribution, you purchase a specialist package that includes software distribution as part of its functionality, such as Microsoft's Systems Management Server (SMS). This is designed for use by administrators who need to create distribution share points for their users and installers, yet it currently requires a lot of effort to create a range of shares to deal with different types of installations. In addition, any change to the underlying product could mean updating several directory locations and rebuilding any packages that you have created. You would have even more work to do to ensure that the user picked up the application and the components were installed in the correct location.

This is where some of the real elegance of MSI as a solution begins to appear and, unfortunately, not all of these features are available within the MSI v1. Many will not be delivered until the end of the year when Windows 2000 ships with MSI v1.1. The publish and assign approach is designed by Microsoft to link closely with the Active Directory and here we again see a split in the current products from the three third-party vendors. InstallShield and Wise Solutions have always been script-based tools that require an understanding of a procedural scripting language. This can make for a very powerful control mechanism although it does raise the stakes as far as the knowledge of the user of these packages is concerned. As a result, their primary market has been the developer community, yet that community does not necessarily have any involvement in the planning of the network infrastructure or the design of software distribution mechanisms. For developers to come to terms with this mechanism, they will need to become a closer part of, or even an integral member of, the network management team. This will mean training developers for an area in which they are likely to possess very limited knowledge.

Veritas on the other hand is heavily focused on the administrator market and the development of distribution packages. Effectively, this is exactly what has driven WinInstall into most of its corporate accounts. Mel Raff believes that the complexity of MSI is ill-suited to providing a flexible environment for software distribution. And for MSI packages to be used in the way that Microsoft is promoting, there is a requirement for more comprehensive management components than Microsoft has made available. This is born out by reported comments coming from the SMS team in Redmond who find themselves facing a free Microsoft technology that can be used to create a poor man's SMS. Given the limited needs of many small to medium sized enterprises, we may well see MSI being used to usurp SMS for software distribution. This is the way that Veritas sees the market going.

This will mean training developers for an area in which they are likely to possess very limited knowledge.

Multiple DLLs

Since Microsoft first started to talk about MSI, it has ensured that all discussions have centred on the fact that MSI is part of the logo requirements. Lately, that position has been revised to ensure that MSI is part of the application requirements, and those requirements for MSI packages are likely to come at the price of disk space. Yet, with a seemingly unlimited amount of space on user machines compared to just a few years ago, this price is small. The first hit is simply the size of the database required to hold the information on the installer package. After installing the platform SDK on my machine, I was left with an MSI database of approximately 3 MB. Inconsequential you might say, and I would agree with you, but how about this...

At the PDC last year, Microsoft took the wraps off a technology it was calling Fusion Side by Side, which is meant to deal with the multiple DLL conflict issue and more importantly how that conflict is dealt with inside MSI. This would be achieved by using a local set of DLLs that would not be part of the Windows system, effectively allowing your application to run in its own space by loading up a local DLL rather than a system DLL. There are implications here for the effort required by a developer when planning the installation of their own application and how it will be used. To some extent this appears a retrograde step in keeping multiple copies of DLLs all over the machine. It was precisely this problem that originally led Microsoft to create a logo programme calling for all system-related DLLs to be installed in the Windows system directory.

This retrograde step has come about as Microsoft has attempted to deal with the management of the Registry. At present the problem of applications failing to update Registry keys properly with details of components during installation is a nightmare, such as the failure to increment a component count when it is required by more than one application. Similarly, the failure to decrement the Registry correctly, when one of those applications is removed, creates a climate whereby you dare not allow any component in the system directory to be removed lest another application ceases to function completely. Ask anyone who has installed and uninstalled IE4.

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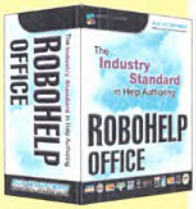

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In a way, it is a step backwards yet it really is the most logical way.

Brien Witkowski accepts this problem but points out that we do not operate in a perfect world. He went on to say, 'If this was a perfect world and we had one company in charge of components or creating components it would be a great environment. However, we are not going to see that because what is going to happen is that every ISV is going to be making their own components out of whichever group of files they would like. Microsoft's own concept of the perfect component is that no two components shall make the exact same change to a system. So that if you need to install file `X.DLL` you will have one component that does it with one GUID on it, so that component can be repaired or replaced or upgraded whenever it needs to be. Fortunately, the world is so large that it will never be one company that controls all the components to have that perfect working environment. I think they noticed that after they put out the edict that said "you shall have one component that will change the system in way X and no more".

That's pretty tough, because if two companies ship the same type of DLL and they need to exist in the same space, currently they could exist in two different directories but still have the same name. With Microsoft's change you could now have no DLL with the exact same name exist in two different directories, because they would technically have to be the same component that a user could pick where they would install it. Well, whenever you ran a person's application, they would keep overwriting each other. In a perfect world, it would be great if we dealt with the Registry properly. But what Microsoft said was, "We've told you to put it in the Windows system directory and then we said put it back into your directory and then we said put it back into the System directory. Now we're telling you to put it back into your own directory and we'll make something called Fusion Side by Side and everything will just work." If they had done this back in the early days it would have made things a lot easier because they could have said, "Whatever you need goes in your directory, you're self contained and you're done." In a way, it is a step backwards yet it really is the most logical way.'

The Install Service

The Microsoft Installer uses two key components: the Install Service that runs with Service Level privileges and a Client Service that can run only with the access level of the user. The first advantage of this approach is that it enables an application to be installed on any machine irrespective of the level of the user. This is critically important in an increasing number of corporate sites that are keen on locking down access to computers completely. It is also important if you are going to make applications and components available on demand. For example, in large organisations there is a high likelihood of files being received in a file format that an individual may not be in a position to process on their computer. The options are to give the user permission to install the file converter themselves, send someone down to do it for them, or have them bring the file to you for conversion. If a service can simply locate and install the component without compromising system security, it has a place in my setup.

The Installer looks for an installation package and this file will have the extension `MSI`. It is simply a relational database containing all the information required to install your application, yet you do need to treat it carefully. One of the tools used by developers when installing on Windows 9.x and NT, is the `REG` file. If a user clicks on a `REG` file, it will attempt to update their Registry with its contents and there have been cases where such files have been used to damage the Registry on a computer. Ironically, I know several training organisations that deliberately use the abilities of the `REG` files in just this manner to create problems on troubleshooting courses.

When you click on an `MSI` file, the Install Service checks to see if the package is already loaded on the local computer. If the product has yet to be loaded, the Install Service will take over and install the product as described in the `MSI` file. For a product that already exists on the local computer, the Install Service will check the `MSI` file to see if the installed product needs to be changed in anyway, such as upgrading to a newer version or adding new features. This mechanism has a distinct advantage in that you can use a logon script, or similar method, to place a new icon on the users desktop with the 95% certainty that most people will click on it before they pick up the phone to say something strange is happening.

Fortunately, the Install Service is transactional and can be configured to build a complete action table so that an aborted or damaged installation can be rolled back without damaging any underlying components. This can be seen if you cancel an installation of Office 2000 after it has started. You can sit and watch as components are removed from the system leaving your previous applications untouched. The same should be true of the Windows 2000 beta code although I have not yet had the time to do an upgrade to an existing version of Windows NT 4 and then force Windows 2000 to give it back to me. Any brave soul out there want to let us know how it goes?

This database contains a Product, which is the highest-order object and acts as a master container for all the other objects in the database. Each Product can contain as many Features as necessary and, to continue with the Office 2000 references, we can see Office 2000 as the Product and Word, Excel, PowerPoint, and Access as examples of different Features. One thing to be careful of with Features is that they are officially the smallest user-installable piece, so each Feature is entitled to have Subfeatures and the example Microsoft often uses here is a spellchecker. Look under the tools menu or press F7 in all the Office 2000 applications and you will find the spellchecker. If you then search through the Office 2000 `MSI` file, you will find the spellchecker clearly marked as a Feature.

Below the level of Features you finally come to components. But not the nice, neat, self-contained COM-like components that Microsoft has been exhorting developers to write for the last few years. These components are monsters. They are as similar to your delicate pieces of COM code as a child's toy train set is to an American Amtrak railway engine. Everything you install on the hard disk, every change to the Registry, and every icon and shortcut – these are all part of a component and every component has its own component ID or GUID. Whenever you carry out a modification, installation, uninstallation, upgrade, or whatever, each component will be treated as a single entity and be removed or modified in its entirety. Each component keeps control of its own resources and does not share them with another component. At this point, I would like to suggest you return to the earlier discussion on components and Fusion Side by Side.

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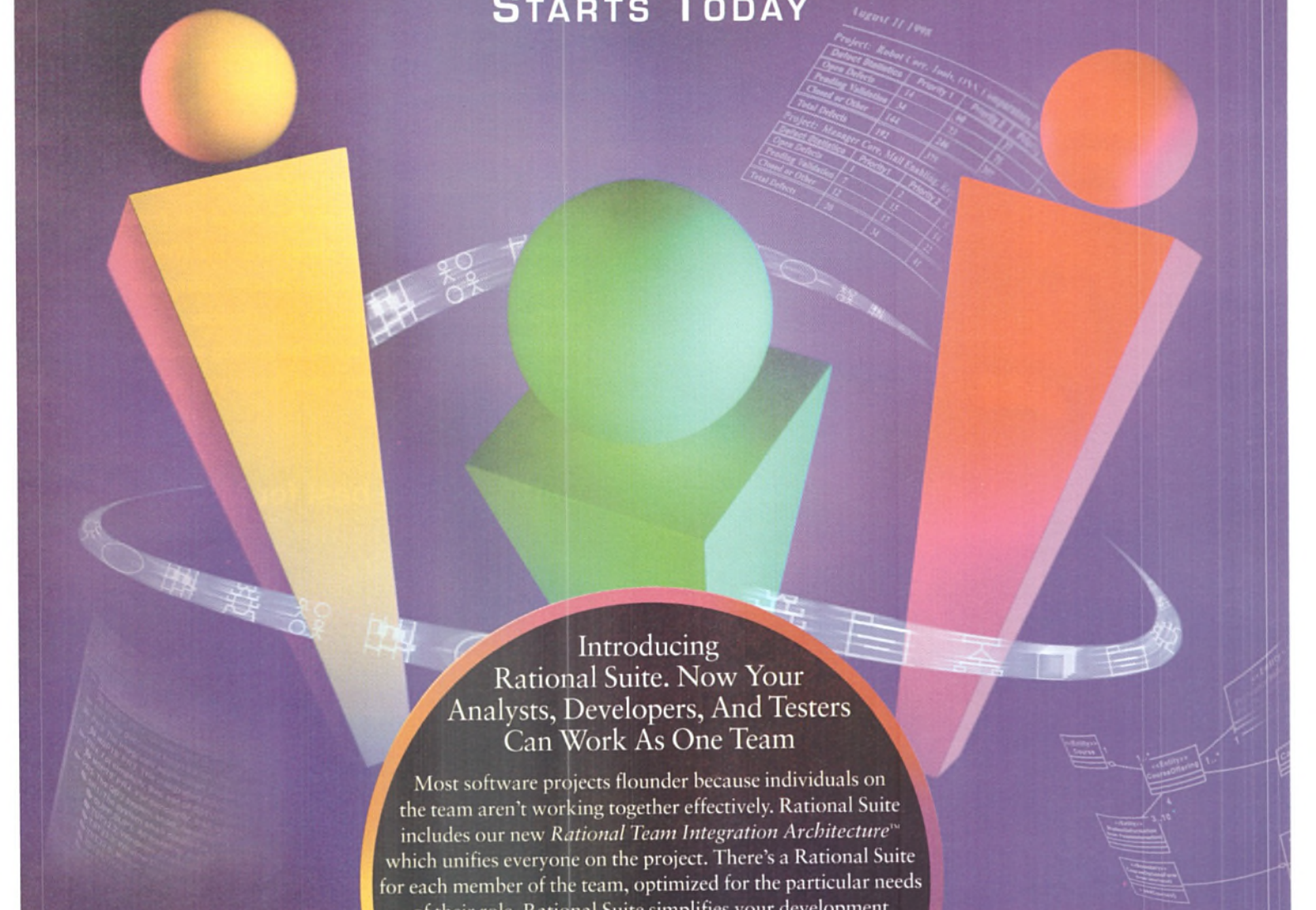

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All of this can be a substantial amount of data and, if you have recently installed the platform SDK as I have, try using any of the available tools to open it and look at the contents. It is truly massive and each component can contain a large amount of data. As an example, I have cut the content from a single component at random and placed it within Figure 1. To keep this in context, I installed most of the platform SDK Features and that meant installing over 11,190 different components!

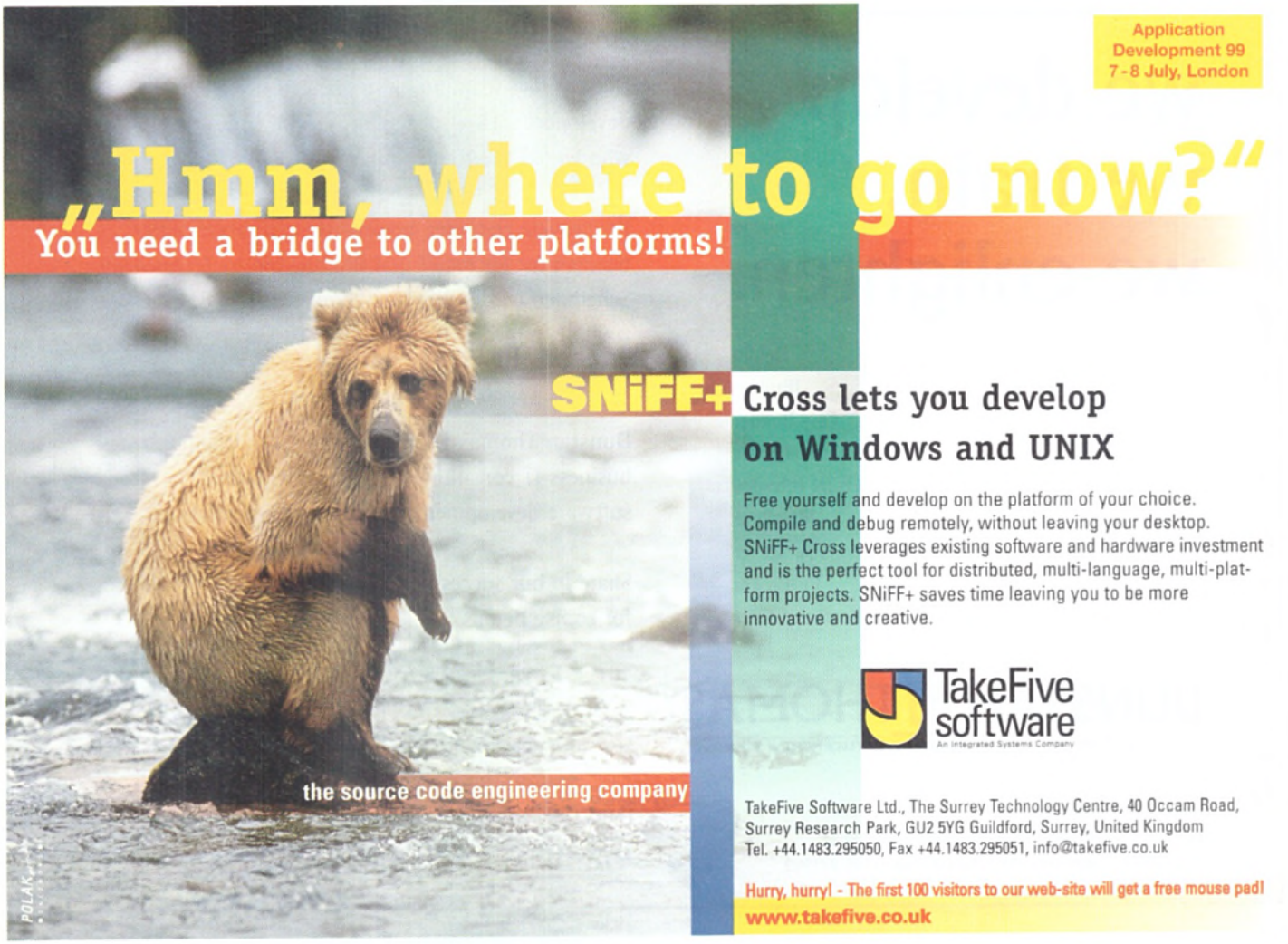
Delivery of packages

For many support organisations, their focus in not on how to port an application, it is about the delivery of an application to their users. No matter how good the technology, they are not going to work out how to bring together 11,190 components to create a comprehensive installation. The solution lies in the approach of the Custom Installation Wizard in the Office 2000 Resource Kit. Once your ISV has delivered you an MSI-compliant application, you can take that initial `MSI` file and build a transformation package. These packages can be used to change or modify the base package so that you can tune an application for a relatively small group of users. As well as controlling the Features provided to different sets of users, it can be used to deal with hot fixes, and even upgrades to a package, provided that the upgrade does not involve replacing a significant amount of the original package.

In this, we come to an important issue for both developers and support staff. The slipstreaming of changes and upgrades was seen as being a bad thing when vendors such as WordPerfect used it to make

Figure 2 – The InstallShield PowerEditor.

minor bug fixes without updating the product release codes. Today, it is back in fashion because it limits the changes and therefore potential for disaster on a computer. When users complain of a problem with their application or want a new feature, this often requires carefully replacing existing files or a complete re-installation. To be able to create a transformation or patch file, simply apply it the next time the user starts the application and then let the application update the components without letting the user know that something has been changed. This takes away the problem of too many updates causing the users to distrust the software, and it means that support staff can easily test a fix and have it applied to any site around the world in a very short space of time.



As you have seen, building an Installer package by hand is an extremely complex operation, particularly when dealing with the number of objects that make up the components. As a result, Microsoft does accept that it is unlikely that anyone is going to use just the APIs available via the platform SDK or Visual InterDev from which to build their packages. That is a relief because the documentation on the Windows Installer runs to over 996 pages. While there are a number of development tools out there that make this look like kindergarten stuff, I doubt if even Mastermind would take up the challenge of setting you questions on this particular set of APIs.

Collaboration

Therefore, the approach, even from Microsoft, has been to persuade you to invest in the beta programs from Wise Solutions, InstallShield, and Veritas, with each of these vendors now having products available for use. Both Veritas and Wise Solutions are shipping commercial products today and InstallShield is expected to do so before Tech Ed Europe when it will have the product on its stand.

I've not had sufficient time to properly assess the differences between the various offerings because of the late arrival of one of the products. As a result, it would be unfair to draw any real comparisons between them, but if you contact most of the vendors, they do have demo versions available for you to try now.

I believe that the new Microsoft Installer will make a significant difference to the way software is managed in organisations, but it will mean administrators, support teams, and developers collaborating like never before. Such collaboration is achievable, and to resolve the problems surrounding the installation/uninstallation issues we need to do this so that we can concentrate on other matters, such as generating real financial returns on our time instead of trying to figure out why our applications keep crashing.

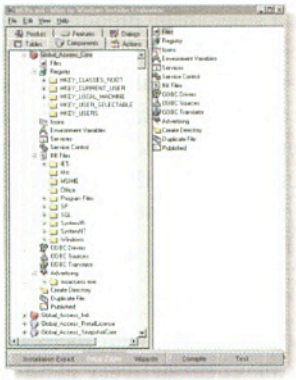


Figure 3 – The Wise for Windows Installer Evaluation.

Ultimately, developers are the key group because unless they are prepared to adapt their applications and put the relevant headers into files, the whole thing becomes another lost opportunity. ■

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

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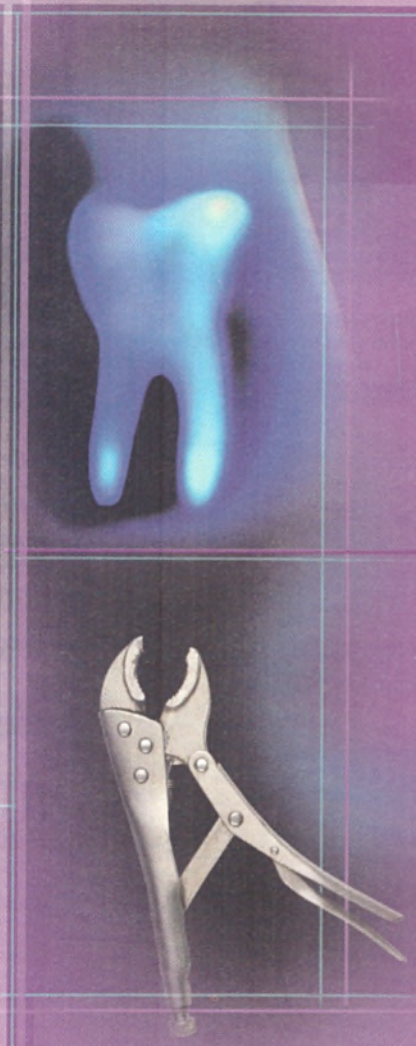

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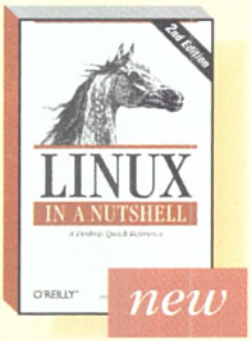

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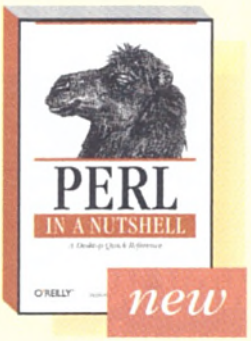

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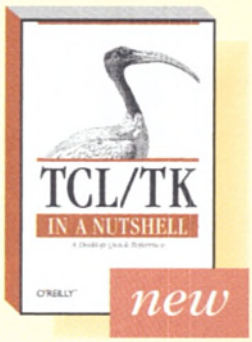

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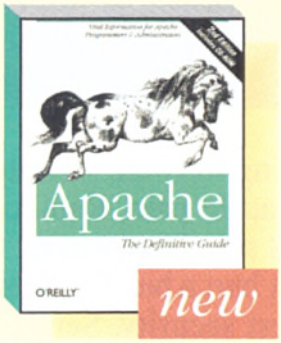

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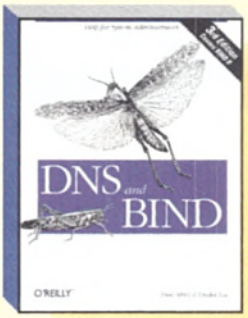

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A visual transformation

Traditionally, Unix has been terse and cryptic, providing maximum effort for minimum keystrokes. But Peter Collinson welcomes a more princely user interface – Gnome, the Free Software Foundation's window-based GUI.

Since Unix emerged from the academic environment into the competitive commercial world in the early '80s, the media has been quick to label it as 'not ready for the desktop'. This labelling started back when nearly all input to computers that wasn't on cards was done using a command line-based interpreter. The 'not ready' label has persisted as we have moved to the GUI-based environments and into the all-pervasive One Microsoft Way.

Unix was a system designed by people who wanted to use it every day, and for a large part of each day. Since I've managed this level of usage for years, the terseness of both the command line input and the manual pages was (and is) welcome. I like the effect of maximum effort for minimum keystrokes. However, I've always conceded that the initial learning curve for command line input is somewhat steep, and Unix has traditionally done very little to help the new or occasional user.

Lucy Bristow

The X Window system

The push into graphical interfaces on Unix with the X Window system didn't really improve things for the user. The designers of X had a much harder job in the multi-processing Unix environment than was suffered by designers of the early Windows systems. Early Windows ran on a machine that could really only do one thing at a time, and it was clear which program 'owned' the screen, keyboard, and mouse at any instant. To be fair, Windows apps have to support many 'parts of the operating system environment' that Unix applications obtain for free. But programming the windowing system was much more difficult on Unix, where users were used to be able to start several things happening at once, and would expect to see each process update their 'part' of the display screen as execution proceeded.

X also inherited another part of the Unix culture: everything should be configurable. The user should have complete control over their working environment. This ability is actually pretty wonderful, both for the user who can change things they really hate and for the programmer who can hand on some design decisions to the user. For example, the X calendar program that I wrote in 1993 successfully works in France and Japan by simply replacing the strings that the program uses. I should say that this was done before 'internationalisation' was a big thing.

Configuration of X applications is done by loading a set of values from a text file into the live X server. At the time that X was designed, controlling programs using text files was the method of choice on Unix. The actual mechanism for X is often hard to use, mostly because application designers don't always document the interface properly – on occasions, I've spent several days fighting to achieve some effect. However, setting things up is something that's done rarely, so once you've configured the file, the pain of doing so fades with time.

Thus Unix is 'not ready for the desktop' because traditionally many systems are configured from text files using varying formats

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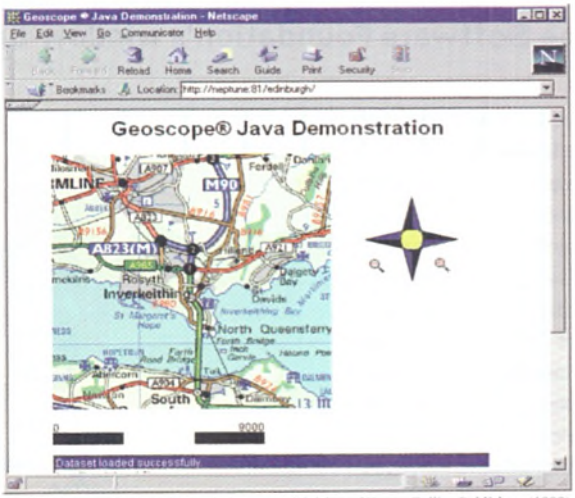

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scattered over the system rather than from some window-based GUI. These days, people find text editors daunting (perhaps people have always found text editors daunting). And the main user interface, X, is not easily configured by mortals, who need to reach semi-guru levels to know how to change things.

There's help at hand

Well, the picture I have just painted is not quite true. Many Unix vendors have provided GUIs for carrying out standard system configuration tasks. For example, for some time Sun has provided a set of visual administration tools for its systems. On Linux, we have `linuxconf`, which collects many system configuration actions into one GUI. The Common Desktop Environment (CDE) has allowed users easily to control some portions of their desktop environment, like colours and background images, albeit at the expense of losing control of other portions. Generally, the efforts have been somewhat disparate and are vendor dependent.

Into this void springs Gnome (from the Free Software Foundation) which, I think, looks to be a huge leap in the right direction. Gnome is an acronym for the GNU Network Object Model Environment, and is regarded as being part of the GNU project. In American phonetic-style, the 'G' in Gnome should not be silent, so Gnome is supposedly pronounced 'Guh-Nome'. However, you are allowed to say 'Nome' should you wish to.

Gnome is highly configurable by mortals, using a set of window-based tools and the settings that you establish are remembered and recalled by a session manager. Gnome includes a panel for starting applications or monitoring status, a desktop where data and applications can be placed using drag and drop techniques, and a set of standard desktop tools and applications. Last, but very far from being least, Gnome provides a set of conventions that make it easy to co-operate.

To the right is the file manager, which behaves in a familiar way to those who know where they want to go today.

You can see the visual components in Figure 1, which is a screenshot taken at startup. The initial setting gives you some desktop icons for your home directory, a link to the Linux Documentation Home Page, and finally the Gnome website.

To the right of these icons is the file manager, which behaves in a familiar way to those who know where they want to go today. The file manager is based on GNU's Midnight Commander (GMC), and the program is advertised as dealing with a 'virtual filesystem'. This means that it copes with the regular filesystem, will open `tar` files (Unix's archive format), and will also access remote FTP sites. The latter feature can be a little dangerous if the site is not functioning; your desktop can freeze, because the desktop is actually provided by a back-end process that's part of the file manager.

You can move files from the file manager using drag-and-drop or double-click to open them with an appropriate application. The only gotcha that I've found with this interface is that the default drag-and-drop action is to move the file. To copy it, you need to hold down the Ctrl-key on the keyboard and wave the mouse appropriately. However, there is no visual indication of what action is being undertaken. This means that you can easily move a file and be under the impression that you have taken a copy.

The file manager is much helped by the use of MIME file types to decide what icon is to be shown for which file. Generating sensible icons in file manager-type applications has long been a problem for

Figure 1 – The Gnome desktop at startup.

Unix file manager programs because Unix has no file type information stored with the file metadata. File suffixes on Unix systems are really only used by convention, so we see people using `.jpg` and `.jpeg` for Jpeg image files or `.html` and `.htm` for HTML. MIME encourages us to create standard mappings for file types onto the file extension.

Back to Figure 1. To the right of the file manager, and partially obscured by it, is the Gnome Help viewer. The program pulls together the Gnome User's Guide, the standard Unix `man` system, information from GNU's Info System, and some more information about Gnome applications. Much of this information is in HTML, although Gnome documents start in SGML using the DocBook DTD. I really want the ability to search these documents, a feature that is missing at present. And it would be helpful if the system allowed pointing at the Linux HOWTO documentation, or at any random documentation. Linux comes with many sets of documents and one window into them all would be useful. Incidentally, I've seen this thought on a Gnome wish list, so there's a chance that it will happen.

Along the bottom of the screen is the main panel. You can tuck it out of sight on the right or left by clicking on one of the arrows at either end. The default panel contains the Gnome footprint icon, which is analogous to the `Start` button for Windows. In Figure 1, I've single-clicked on the button, the menu has popped up, and I've used the slide right menu to look for a multimedia application.

Moving along the panel, the four icons in the row launch the Gnome Help Browser, the 'Control Center' that allows control over the user interface features of Gnome (analogous in some respects to Window's control panel), Netscape ('nuff said), and finally a terminal emulator window.

Next to the four icons is an applet that controls the virtual screen-pager system. At startup, Gnome supports four virtual screens and each can have a set of active windows running in them. You switch between the virtual screens by clicking in the appropriate tiny window. This is a common idea in X Window managers. Moving an application's window from one virtual screen to another is simply a matter of dragging the window in the appropriate direction.

Next to the virtual pager is a list of the windows that are active in that particular virtual screen. This acts as an iconisation area for the

window. When a window is minimised, it disappears from the screen and can be made to re-appear by clicking here.

The panel is very configurable. It's possible to add new pre-defined applets for clocks, printer controls, system usage meters, and the like. You can also add launchers for your own pet non-Gnome applications should you wish to. You can move the panel to different quadrants of the screen. And you can create additional panels that may occupy corners or edges of the screen.

Gnapplications

What about applications? Well, Gnome is not short of those. Let's start by looking at what might be termed 'personal management tools'. There's a personal calendar program that allows you to store appointments and to-dos. It uses the vCalendar standard, so your data should exchange with other like-minded applications. There are several text editors, including `gnotepad+`, which is very simple to use, and can be used for authoring HTML. There's `Gnumeric`, a spreadsheet that seems pretty basic. There's a calculator, if you need to do some quick arithmetic. Addresses and contact details can be stored in a card index `Gnomecard`, which uses the vCard interchange standard. There's a time tracking tool that allows you to log how long you spend on doing things. And there are, of course, several games, which I will gloss over.

A couple of image viewers are present, and of course there is GIMP for editing images (more of which later). And there's a CD player and audio mixer.

There are many system tools, although I suspect that some need super-user privilege. For example, there's an interface to the RPM (Red Hat Package Management) system that seems to need to have super-user access to perform correctly. Although it could be a mis-configuration in my system that I haven't had time to get to the bottom of yet.

If it just seems some integration exercise for yet another window manager, then you are mistaken.

Of course, the system would be not useful if it would run only Gnome applications. In fact, any X application should work with no problem under Gnome. Any command line application will run in one of the plethora of terminal emulators.

Windows management

Well, if all the above seems somewhat unsurprising, just some integration exercise for yet another window manager, then you are mistaken. What's interesting about Gnome is that it's not a window manager; it works with a window manager to provide the object-based environment. In fact, when I said above that 'Gnome supports four virtual screens', it's actually more true to say that Gnome's pager provides access to four virtual screens that are supported by the window manager.

For those who are wondering what I am blathering about, a little word of explanation is in order. The traditional X environment consists of a set of X applications talking to an X server. The X server is responsible for managing the hardware and communicating events to the applications. However, the control of positioning applications on the screen is handled by a special application called a window manager. When you see the 'look and feel' of an X environment, it's mostly the window manager's work that is noticeable; it provides the outside border to the windows with the minimisation buttons, the control menus, etc.

Looking for Gnome

The Gnome website is *http://www.Gnome.org*, and it contains all of the documentation that comes with the system so you can look before you try. Incidentally, all Gnome documentation is written in SGML using the DocBook DTD that's used by Sun. This can be translated into HTML, so all of the documentation is Web viewable.

Themes for GTK+ and Enlightenment can be found on *http://gtk.themes.org* and *http://e.themes.org* respectively.

Window managers were employed for at least two good reasons. First, they reduce the amount of code that's needed in the X server. Keeping the code small is important because it's the X server that is ported from machine to machine. Second, X has always tried to deliver choice. Cynics would say that choice was important because the X consortium was funded by several major Unix companies, each of whom wanted to provide their own proprietary look and feel. However, whatever the reason, the result is that you can run any window manager that takes your fancy. The vanilla Red Hat 5.2 system comes with four different window managers and an easy way of switching between them.

Gnome needs to work with a Gnome-compliant window manager. Mostly it needs the window manager to expose some of its internal workings as properties that can be interrogated by Gnome applications. At the time of writing, Gnome is supported by two window managers: Enlightenment and Window Maker. There is work in hand to modify some other window managers. I've only used Enlightenment, which seems to work well, and was installed with Gnome.

As it happens, Gnome and Enlightenment both use an X widget set called GTK+ that was derived by the GIMP project. GIMP is an extremely good bitmap-manipulation program that's free software and is a standard Linux application. It rivals Adobe PhotoShop or Corel PhotoPaint for usability and features.

GTK+ supports the notion of 'themes', loadable files that present a different look to the widget set and the desktop. The look can be loaded while the system is running and, in fact, the Control Center provides some hooks to allow you to set new themes. The widget set has generated a whole new graphical industry, creating themes for public consumption. There are a couple of websites devoted to the publication and dissemination of themes, see *Looking for Gnome* for details of where to find them.

Corba

Gnome isn't a window manager but it is a bunch of additional processes that provide several services. Most of the interesting services require programs to communicate with each other, and the Gnome designers have adopted Corba as the intercommunication method. Well, I must confess that I know little about Corba. I did go to a disturbing object-oriented programming conference a couple of years ago, where the participants sat around nodding their heads sagely saying, 'Yep, Corba is *the* solution.' I waited for someone to stand up and shout out, 'Listen, you fools, you have it all wrong...' but I went home disappointed. All conferences need dissenters to make them interesting.

Anyway, Corba is the Common Object Broker Request Architecture and its aim is to allow applications to communicate irrespective of where they are located and who has designed them. Since we are talking objects here, you'll understand that this means that we can pass data and methods (or as I would prefer to think, access to methods) between applications in a portable way. Since Gnome is written in C (for portability reasons the developers tell us) then my more tangible explanation should have some basis in truth. However, since Corba is aimed at OO applications, it has ways of dealing with object creation and destruction, and all those goodies that form the OOP world.

Corba has a number of components, some of which are conceptual rather than tangible. Logically, the Object Request Broker (ORB) sits between the clients and the servers, making communication easy. The Gnome project has written its own ORB, called ORBit, because they found that extant ORBs didn't support C. Looking at the code, it reminds me of all the nastiness that lurks in Sun's XDR definitions, allowing machines to perform RPC and cope with data representation in a coherent way. The author of the Gnome FAQ section on Corba draws this same analogy.

The promise of early days

It seems to me that Gnome has picked up on several well-defined technologies and glued them together to make something that's been missing in the X world. Of course, being GNU, all the components have to be Free Software, so they have needed to write some code portions to fulfil this aim.

Installation was painless. All I wanted was the base user files and I just installed Gnome from a set of RPM files supplied by Red Hat. You will need a good Internet connection to pull these files: they come to around 27 MB. Getting started to use it is trivial too; you add a one line file called `.Xclient` to your home directory. Removing this file allows you to revert to where you were before, so it's non-threatening.

There are a number of things about the system that are under development. For example, the Gnome group's aim of providing complete session management is incomplete. By 'complete session management', I mean that you resume an application at the same point that the user was when they logged off, with the application holding the same data. To achieve this aim, the application needs to know how to dump its session information into the session management system on logout, and recover it on startup. Most Gnome programs have this ability, many other applications don't – as yet.

It's early days for Gnome, and it's still somewhat flaky – programs will crash from time to time for no apparent reason. I feel sure that this situation will improve. However, the interface is good enough, attractive enough, usable enough, friendly enough, and functional enough for me to switch to using it full time on my Linux box.

Gnome will run on more than just Linux, and I may consider putting it onto my Solaris system to see how it does in comparison to CDE. I haven't decided on that, quite yet. ■

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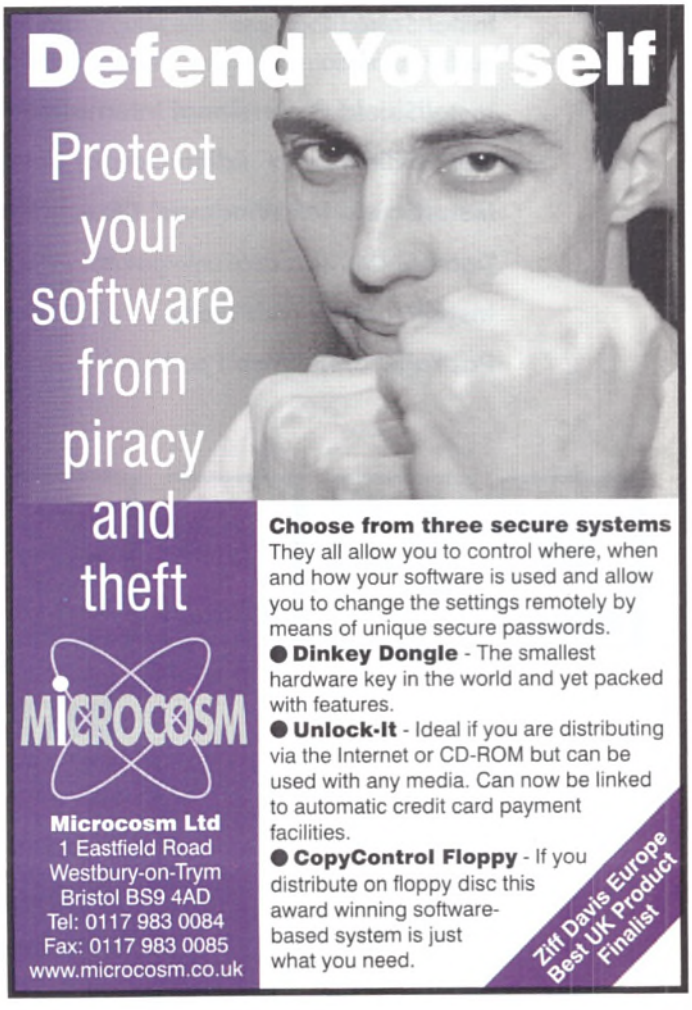

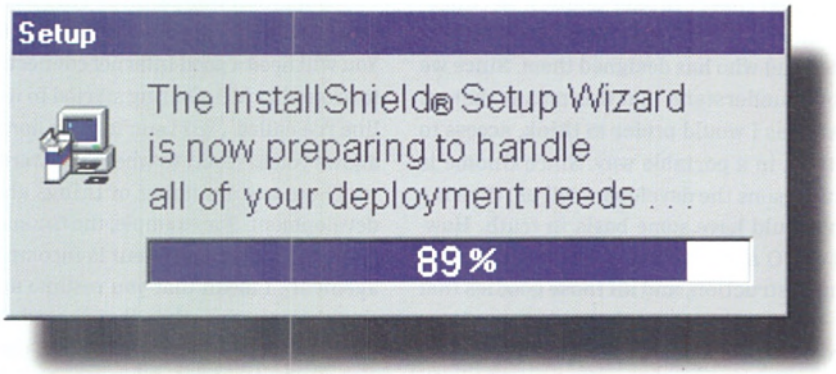

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Down to a size_t

Francis Glassborow warns of subtle problems involving the standard typedefs size_t and ptrdiff_t.

Hopefully, we will be getting C++ implementations that claim to be fully conforming. You may find that such an implementation does not do what you expected. When you contact your suppliers they may accept that yours is the correct view, however they might not. There may be an ambiguity in the Standard, or maybe the Standard simply does not say anything or even contradicts itself.

Another possibility is that you are studying the Standard to ascertain how you should write your code in as portable a manner as possible and despite careful study you cannot make sense of some item and you suspect that this is because the wording is imprecise or even wrong.

There are more serious possibilities where you have purchased source code that causes you damage or financial loss when you compile and execute it on your hardware. Who is to blame? The implementor, the author of the source code, or someone else?

There is a general process for dealing with these problems that is set out by ISO. In addition, there is the process that WG21 (the ISO Standards Committee responsible for C++) has determined in order to provide maximum information as early as possible. Think of defects in a Standard as analogous to bugs in an application you use. You want to know about the bugs as early as possible, so that you can work round them. You would also like to know what the service patch or upgrade will do, so that your work-around will not cause further problems later on. All that ISO mandates is that there will eventually be a Technical Corrigendum (TC) that formally amends a Standard. TCs take years to materialise (about three or four to be more precise), so the WG21 committee is providing a website where you can check up on what has been reported for consideration and any tentative responses to these issues (*http://www.dkuug.dk/jtc1/sc22/wg21/*).

There are various possible responses including 'not a defect' (ie carefully reading the whole Standard resolves the issue), 'a careful reading shows that' (ie 'we were not as clear as we should have been but this is what we intended'), 'yes, this is a defect', and 'this is a (disguised) request for an extension to the language and so must be rejected'.

That last classification is sometimes hard to determine. Pure extensions are easy to deal with. When someone proposes that C++ needs a keyword to refer to an immediate base class, it must be rejected however strong the argument may be that it would be a useful addition to the language. Proponents of such items should persuade implementors to try it out as a vendor-specific extension and then propose it as an addition in the next version of the Standard. For example, I think I can make a good case for providing a form of pure virtual function that must be directly implemented in all non-abstract derived classes. In other words, if a derived class does not provide a direct overrider to this pure virtual, the derived class is an abstract one. That is clearly an extension and not a defect.

What is harder is dealing with apparent defects where the most sensible correction includes an extension (something that makes code valid that was not valid before). These cases largely arise where the Standard currently provides a surprising result, often by disallowing something that anyone would expect. Such cases require very careful consideration. In order for these to be defects, WG21 needs to be persuaded that the current circumstance represents a serious flaw rather than just an irritation, even a major one. One thing that has to be considered is the potential of impact elsewhere. If there is any, the almost certain response from WG21 is to reject it. On the other hand, changes that have strictly localised effects and that only make undefined behaviour defined have a good chance of making it.

The vector template container

Let me give you a brief example of such a change. It was certainly the intention of most of those developing the vector template container that it should be a logical replacement for the C-style array. However, those responsible for the wording of the Standard failed to include any words that required successive elements of a vector to occupy contiguous memory (there is little doubt that this was unintentional because part of the specification of vector allows its relocation if more space is needed even though there are costs to this: invalidation of iterators and time penalties for the move). The Dublin Meeting of WG21 determined that contiguity of elements was intended and would be required in the first TC released. As all implementations currently implement vectors with their elements in contiguous memory, the result of this decision has zero impact on current code while ensuring that future implementations will know they should respect this constraint.

That is it for now. Next time I will explain how you raise a Defect Report (DR).

Being a (self-employed) dutiful citizen

I hope you will excuse me if I write a few words about a non-programming topic. I am in the midst of serving a term of jury service. Quite rightly all citizens registered to vote are liable for this, but those who are self-employed can suffer badly. The maximum that a juror can claim for expenses including loss of earnings is £50 per day (that goes up to £100 if your jury service lasts for more than 10 working days). Claiming as a self-employed person is less than simple, and for those such as myself who earn substantial amounts for infrequent weeks the loss can be considerable (I cannot accept a contract to provide a week's training unless I know I will be available for the whole week).

I have a radical suggestion. The lost earnings of the self-employed because of jury duty should count as tax credits, ie your tax bill should be reduced by the average amount that you would have earned during your period of jury service. Assuming that your period of service is 10 working days, this would mean that in a year in which you did jury service you would receive a tax credit of 4% of your declared earnings for the year. Similar arrangements could be made for employers who make up their employees' incomes while they are busy out on jury service.

For this reason, I have changed my coding style to include a guideline: 'Strongly prefer pre-decrement and pre-increment.'

Last month's problem

Look at the following function that a student wrote to print out the letters of a word in reverse order. At first sight, the function is fine, but when the code was tested the computer appeared to lock up. Why?

```
void reverse_print ( char const * const word,
                     size_t size){
   assert(size>0);
   for (; --size >= 0; )
        putchar(word[size];
}
```

Actually, the above code contains a silly error that will prevent it from compiling. However, when you have fixed it by inserting the missing closing parenthesis it will compile and when it is executed the code will certainly not do what the writer intended.

Look carefully at the controlling expression of the `for` loop. Think about the type of `size` (a poor name for that variable, something like `word_length` would have been much better). The one thing we know for certain is that `size_t` must be an unsigned integral type of sufficient range to report the sizes of all objects in the program. The key feature in this context is that it is unsigned. This means that when you decrement the zero value of this type you will get the largest value for the underlying type. In other words, it is impossible for `size` to represent any value less than zero and so the loop will never terminate.

What makes it harder to spot this, is that `putchar()` provides buffered output. This means that nothing will be displayed until the output buffer is full. Among the problems that arise after the first wrap round of `size` is that we will be accessing memory outside the `word` object. This gives us undefined behaviour. Some of these bytes might represent control characters that affect the output in such ways as cancelling it. Fortunately, the undefined behaviour that results from reading values from outside the limits of an array of `char` is unlikely to be any more disastrous than that.

Pre-decrementing

Some readers may wonder why the student wrote the loop that way. The idea was simple: start with the last letter and step back through the word, letter by letter. As `word[size]` initially addresses the `char` one past the end of the array `word`, it seems sensible to take an initial step back. As we have seen, this does not work. Indeed, as long as the control variable `size` is of an unsigned type it can never be made to work this way. While the concept of reversal is easy, it is not that easy. Instead, you need to write something like:

```
for( ; size; --size)
     putchar(word[size-1]);
```

Some may question my use of pre-decrement in this context. If you are a pure C programmer and never intend using C++, then it does not matter. Indeed, in the context of built-in types it does not matter even in C++. But if you are using a user-defined `operator--` for a class type there is a significant difference between pre- and post-decrement. The former is likely to be orders of magnitude more efficient (which is why the early versions of C++ did not provide any mechanism for user-defined post-decrement). I think it makes sense to adopt a style that will always work well. For this reason, I have changed my coding style to include a guideline: 'Strongly prefer pre-decrement and pre-increment.'

The ptrdiff_t typedef

While I am writing about `size_t` you might like to consider its interaction with `ptrdiff_t`. Remember that both these are standard `typedefs` and on modern platforms they are likely to be either `unsigned long` and `long` or possibly `unsigned int` and `int`. The former case is particularly awkward because:

```
char bigarray[(size_t)( -1)];
```

appears to declare a maximum size array of `char`, but this array is usually too large for `ptrdiff_t` to handle. In other words, most implementations are more limited by the range of `ptrdiff_t` values than by the maximum value of `size_t`. Until recently, this has been of purely academic interest because only super-computers could provide enough memory for an array of that size. This is no longer the case and a subtle and rare bug is now possible. Subtle, rare bugs are the worst type to find because we lack any experience of finding them.

C9X

The forthcoming new C standard introduces another problem. In C89 (ie the ANSI C standard of 1989, or the ISO C standard of 1990) even the amended form has `unsigned long` as the largest unsigned integer type. This meant that if you need a `size_t` value in a known type you cast the value to `(unsigned long)`. The upcoming version of C (the so-called C9X) introduces some extra standard types, which include `long long` and `unsigned long long`. Both of these have been popular extensions but, as such, a conforming implementation could not use them for `size_t` and `ptrdiff_t`.

Despite repeated objections from a number of numerical programming experts, WG14 and J11 (the Standards Committees for C) have refused to restrict the use of these added types so that they cannot be used for `size_t` and `ptrdiff_t`. What particularly irritates some of us is that it is carefully crafted portable source code that will be damaged. Granted this is a tiny proportion of the C source code in existence, but it is exactly the part that should expect maximum consideration from the Standard.

This month's problem

Comment on the following code snippet:

```
if (fn(<argument list>) == true) dosomething();
```

C programmers should replace `true` with `TRUE`.

This problem may seem to be devoid of context, but that is almost always the circumstance with coding guidelines. You should consider all aspects of the code. ■

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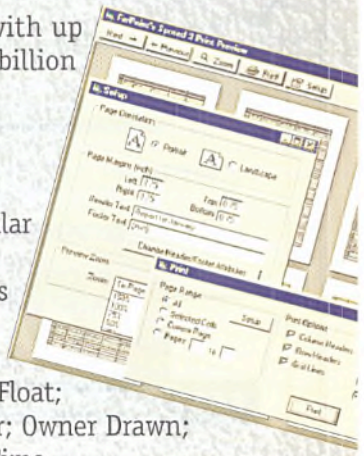

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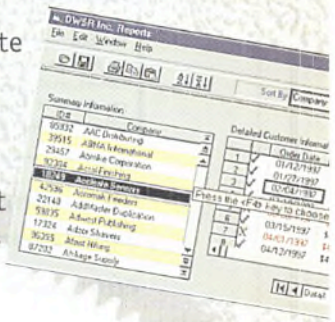

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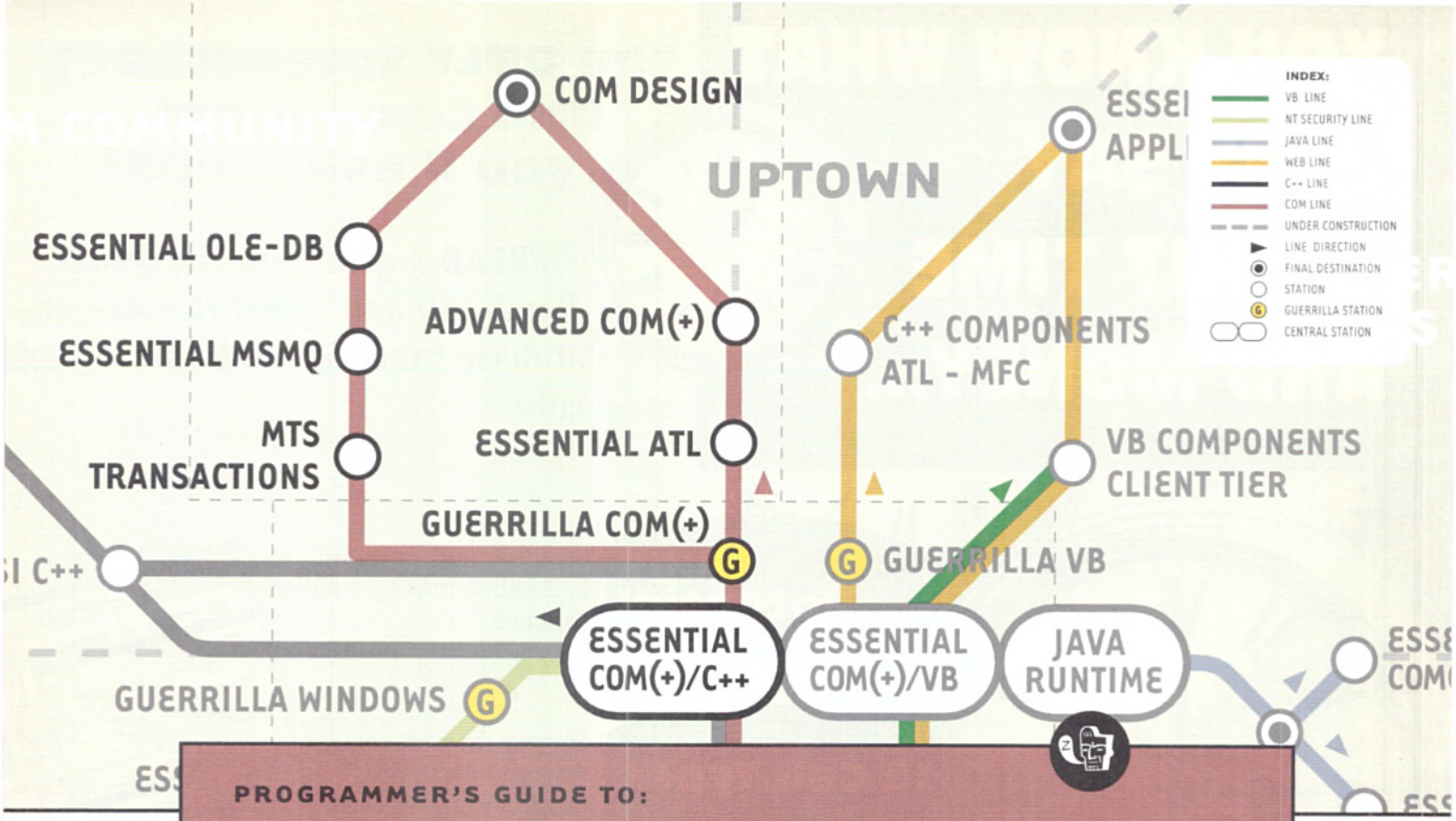

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My type of library

Mark Smith traverses the structure of a type library using Delphi.

When I started thinking about interrogating type libraries, I was surprised how little information there is available. Kraig Brockschmidt mentions them in *Inside OLE 2* (ISBN 1-55615-843-2) but doesn't go into details, and a search through Dillons' computer section turned up a blank. There was an article by Don Box in *Microsoft Systems Journal* from the point of view of a C++ programmer. Meanwhile, searching the MSDN website turned up two example C++ applications, one of which, OLEView, turned out to be very useful. As far as Delphi was concerned, I'd seen Charlie Calvert's demonstration of a basic type library explorer a few years ago, and there are some calls to type library functions in `OLECtrls.pas` but that was it. This article is not a comprehensive breakdown of how everything in the type library works, but it concentrates on the most useful aspects.

I started off thinking that the COM type library would be a well-organised and consistent collection, a little like Delphi's `TypeInfo`, but as you will see, this is not the case. In this article, I present a more consistent interface, built using Object Pascal objects and lists. Before going into further details about the sample application, it is probably worthwhile reviewing what goes into a type library.

Inside the type library

A type library is a collection of objects, records, and arrays that collectively describe the objects, functions, and constants presented by a COM server. Normally, you interact with type libraries either by creating your own (as in last month's script-enabled editor application) or by importing the type library of another application into your Delphi application. These two activities are described well enough in the Delphi documentation.

Figure 1 shows the bare bones of the type library structure. The VCL module `ActiveX.pas` contains Object Pascal declarations of the type library interfaces and records, and it might be worthwhile having `ActiveX.pas` open while you read the rest of this article. The major problem I had when working on this subject was that it is often hard to determine what the designers of the `ITypeLib` record structures intended, though presumably efficiency figured highly in their plans. However, it sometimes looks otherwise. For example, the return type of a function is hidden six-deep down a chain of record structures.

A type library presents itself as an object implementing `ITypeLib`. This interface exposes several methods that allow us to get more information about the contents. The first useful function is `GetTypeInfoCount`, which gives the number of entries in the type library. Once we know how many entries there are, we can call `GetDocumentation` to retrieve the name and description of the entry, passing the index of the entry we want information about. And we can call `GetTypeInfoType`, which returns a constant indicating the type of object the entry describes.

We can also iterate through the type library calling `GetTypeInfo` for every entry. This returns an `ITypeInfo` object, which gives basic information about the entry as well as pointers to other more useful structures. For example, the `ITypeInfo` interface contains a method `GetTypeAttr`, which gives a pointer to a `TypeAttr` record. This record contains the number of functions and variables the object being described has. Additionally, `ITypeInfo` has a method `GetNames`, which fills an array with the names of all the named entries that make up the information for the item under examination. For example, when looking at a given function, `GetNames` gives the names of all the parameters.

Interfaces

Interfaces are the mechanism by which a COM server application exposes its functionality, and navigating an interface is the trickiest part of reading a type library. Building a list of functions supported by an interface is moderately straightforward. The `TypeAttr` record stores, in the field `cFuncs`, the number of functions that an interface has. We can obtain a description of each function by calling `TypeInfo.GetFuncDesc`, passing in the index of the function we want information about. The `tagFuncDesc` record we get back contains most of the information about the function, including a flag `invkind`, which has the value `INVOKE_FUNC` if this really is a function and not a property accessor method.

We can get the names of all the function parameters by calling `TypeInfo.GetNames`, though we need to take care since the first entry in the names array is actually the name of the function itself. As I mentioned, to get the return type of a function, we need to navigate a chain of record pointers `TypeInfo.FuncDesc.elemdescFunc.tdesc.vt`, which gives an integer constant that tells us what the function returns. See the function `VTToStr` in the unit `TLEUtil` for more details of con-

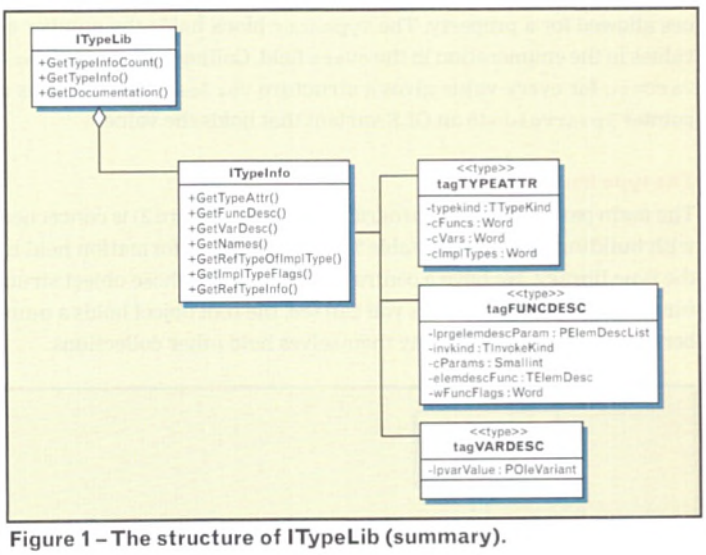

Figure 1 – The structure of ITypeLib (summary).

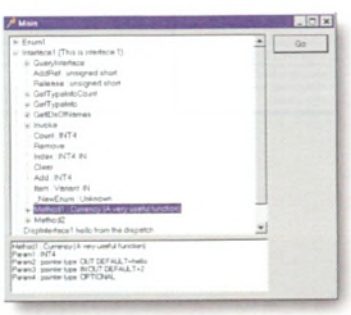

Figure 2 – The type library explorer in action.

verting these constants to strings. Information about each of the function's parameters is held in an array called `lprgelemdescParam`. Every entry in this array is a `TElemDesc`. The `TElemDesc` record gives us access to the IDL (Interface Definition Language) flags used to define the parameter. Function `IDLFlagstoStr` (again in unit `TLEUtil`) converts these IDL flags to strings. If the parameter does have a default value, then the record structure chain `ElemDesc.ParamDesc.pparamdescex.varDefaultValue` defines both the type and value of the default. Once more, there is a helper function (`DefaultToVar` in `TLEUtil`) that gives you a string representation of the default value.

Finally, we turn to functions that are really property accessor methods. Everything in an interface has an ID number, and the *Get* and *Set* methods that make up a property have the same ID. This makes it easy to build a list of properties – just iterate through the function collection, combining information from functions with the same ID.

Other elements

As you will know if you spend much time with the type library editor, interfaces are not the only thing that you find in a type library, and the other entries are worth a look. If an entry describes a `CoClass`, then it supports other interfaces. We can check how many interfaces a `CoClass` supports by examining `TypeAttr.cImplTypes`. And we can examine the list of interfaces that a `CoClass` supports by calling `GetRefTypeOfImplType`, passing in the index of the interface for which we want to retrieve information. This gives us an `HRefType` that we then pass as a parameter to `TypeInfo.GetRefTypeInfo`, which gives us the `ITypeInfo` interface that describes the interface supported.

You can also explore the simpler types in the library, such as enumerations – a list of integer constants used to specify the range of values allowed for a property. The `TypeAttr` block holds the number of values in the enumeration in the `cVars` field. Calling `ITypeInfo.GetVarDesc` for every value gives a structure `VarDesc` that contains a pointer `lpvarValue` to an OLE variant that holds the value.

The type library explorer

The main part of the demo program (shown in Figure 2) is concerned with building a more acceptable interface to the information held in the type library. We have a central `TTLETypeLib` whose object structure is shown in Figure 3. As you can see, the root object holds a number of collections, which may themselves hold other collections.

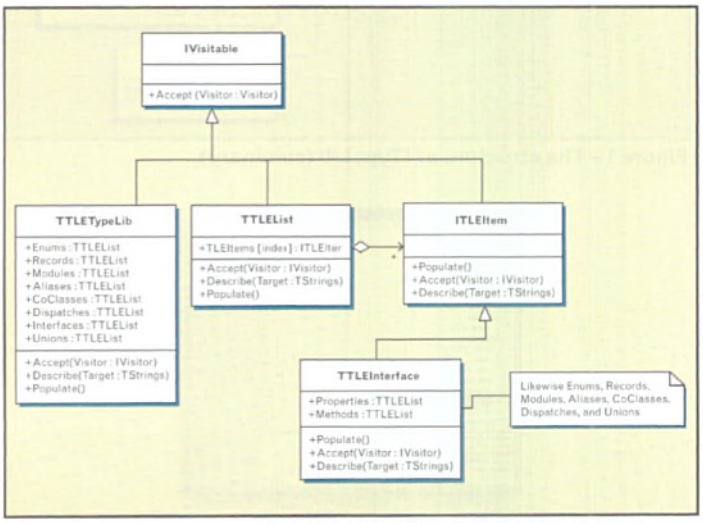

Figure 3 – The structure of TTLETypeLib.

Delphi developments

Bill bails Borland

While Apple had been 'in turnaround' for even longer than Inprise, it seemed to take the injection of wads of Bill's bills to give people the confidence to buy a new iMac. If the same holds true this time, it looks like Microsoft's investment of $100 million in Inprise might just save the company. Borland's problems over the last year have been well documented. A mixture of flaky product releases, management reshuffles, and changes of direction have led to a lot of people losing confidence in Borland and not buying the new release unless they really needed to. Despite management assurances that the enterprise tools business was going to be the mainstay of Inprise's activities in the future, the reduced tools revenue must have been a major cause of the recent losses. While it's too soon to say anything about Delphi 5, Borland representatives have assured me that stability is the highest priority for the upcoming release. I'm hopeful that this year we will get a stable release with sufficient cash to market it properly. Whether Borland manages to snatch defeat from the jaws of victory remains to be seen.

CodeCentral

Another interesting development is the beta release of CodeCentral, a MIDAS-based code repository built by Borland's developer-relations team. Essentially, it is a database of code tips and snippets and is well worth a look. By the time you read this, the developers may have had time to release the production version.

I wanted to open up the object hierarchy to allow browsing in accordance with the Visitor design pattern. To allow this to happen, everything in the hierarchy implements the `IVisitable` interface. For more details on the Visitor pattern, see the December 1998 issue (*Programming with interfaces*) where I look at how Visitor can help you to navigate object hierarchies. Essentially, any object in the hierarchy can accept a visit from an object implementing the `IVisitor` interface. The visited object then calls the visitor object, passing itself to the visitor. The visitor can then decide what it wants to do with the visited object – typically reporting its properties. If an object contains sub-objects (such as enumeration containing a list of the constant values that make it up), then the object calls `Accept(Visitor)` on the sub-objects so that the visitor can traverse the entire tree structure. In actual fact, things are complicated slightly by the need to represent the nesting of objects in the tree-view, but the principle remains.

You will see that the main form does not actually have a tree-view control on it at design-time. I use a descendent of the standard `TTreeView` to allow me to specify what kind of node the tree creates. This `TTLETreeView` is created at runtime because I did not want to add a package to the demonstration application. See module `TLETreeView` for more information.

A joint-development script editor

The demonstration program shows how to get most of the information out of a type library. The original intent behind getting type library information was to make it available at runtime, so that it could be used to add a 'code-completion' feature to the script editor application from last month. I'm inclined to make the script editor into a joint-development effort. If you are interested in taking part, please mail me. ■

EXE ONLINE *Mark Smith is a Delphi contractor. You can reach him as msmitha@cix.co.uk.*

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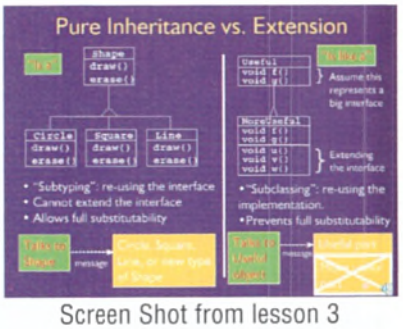

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Power and flexibility with Java Servlets

Tom Guinther gets to grip with the server-side components that allow you to extend the functionality of a web server in a modular way.

If your primary motivation for developing in Java is the design and implementation of web-based architectures and you're not currently using Java Servlets, then you may be missing a key piece of the architecture puzzle. Java Servlets, in case you hadn't guessed, are server-side components written in Java that allow your application to achieve a tight coupling with the web server. The ultimate purpose of a servlet is to extend the functionality of the web server in a very modular way. The type of functionality provided by a servlet is largely unlimited and can be very general purpose (such as a monitor servlet that tracks statistical information on client requests, or an application-specific API that interfaces to a back-office database).

If you have ever written a CGI (Common Gateway Interface) script, then you should have a good idea of the type of applications where servlets are most useful. Of course, servlets have many advantages over CGI. It goes without saying that because a Java Servlet is written in Java you achieve a certain amount of platform-independence that you can't get with CGI. Another big advantage of servlets over CGI is that servlets are persistent. The web server loads the servlet once (typically on demand) and it remains resident ready to handle subsequent client requests. This persistence provides two significant advantages, the first being performance. Unlike a CGI script, which is loaded, executed, and unloaded for each client request, a servlet remains loaded and available immediately to service subsequent clients. The second advantage of servlet persistence is that state can be maintained across client requests. This allows a servlet to be designed to use vital system resources, such as database connections, more effectively. A different server thread handles each client request to the servlet so you won't need to provide your own thread pooling.

If you're more of an application programmer and you haven't used CGI, then you can think of a servlet as a Java applet that runs on the server. Because a servlet runs under the control of the web server the security restrictions that hamper the typical Java applet don't apply. That is not to say that a servlet is unsecured. Because the web server is in control of access to the servlet no one can access the servlet without appropriate authorisation. Even if you have never done any server-side programming, the Java Servlet API makes writing servlets as easy (or easier) than writing an applet. The Java Servlet SDK (available from the JavaSoft website *jserv.javasoft.com*) and the classes and interfaces it contains are designed to allow you to focus on the functionality that the servlet needs to provide, and remove the need to worry about most other implementation chores. The one area that is likely to slow you down is not the design or implementation, it is the web server administration required to setup and configure the servlet. The administration tasks vary from web server to web server, but I will outline a few of the basic principles that should apply to whichever web server you're running.

How servlets work

Although the web server plays a pivotal role in the use of servlets, each web server is architected differently, so this discussion is somewhat generalised. However, because this is a discussion about logical flow, the concepts should translate seamlessly regardless of which specific web server you are running. It all starts with the client (typically a browser) making a request to the web server. Typically, this request would use the HTTP protocol, which is handled by a server component specifically designed to handle HTTP. If in the process of resolving the URL a reference to a servlet is encountered, an 'Invoker' servlet is called to load the referenced servlet. If the servlet has not been previously loaded, the servlet's `init` method is called to perform any required initialisation. The `init` method is not required to do anything although this is a good time to setup any servlet-specific resources such as database connections or timers. After the initialisation completes (and not before) the appropriate servlet method is called to service the HTTP request. In the case of a HTTP `POST` command, the servlet's `doPost` method is invoked. There are other methods for servlets that process HTTP protocol requests (see *The HttpServlet class*) that correspond to HTTP commands. Although many servlets process HTTP requests, a servlet can simply implement `service`, a method of the servlet interface that is invoked for all client request types. The following code fragment shows the typical skeleton of a servlet that processes the HTTP `POST` command.

```
import javax.servlet.* ;
import javax.servlet.HttpServlet.* ;

public class MyServlet extends HttpServlet {

   // called when the servlet is initially loaded
   public void init(ServerConfig serverConfig) {
      System.out.println("MyServlet: Loading...") ;
   }

   // handles the HTTP POST command
   public void doPost(HttpServletRequest httpRequest,
                      HttpServletResponse httpResponse)
   {
      System.out.println(
               "MyServlet: Processing HTTP POST") ;
   }

   // called when the servlet is unloaded
   public void destroy(){
      System.out.println("MyServlet: Unloading...") ;
      super.destroy() ;
   }
}
```

The doPost method is passed two parameters: an object representing the client request and an object representing the context for the web server response. The request object provides the ability to extract the data buffer and parameters passed by the client to the servlet, as well as other useful information about the client such as IP address (getRemoteAddr) and remote host name (getRemoteHost). The response object is provided to allow the servlet to communicate back to the client, via an output stream, in a context controlled by the web server. The methods getOutputStream and getWriter provide access to the server output stream, which is ultimately returned to the client. If your servlet writes HTML or other formatted text for display in the client browser, use getWriter to obtain an instance of PrintWriter. One thing you must remember to do before calling getWriter is to set the content type using the setContentType method. The following code fragment shows how to set the content type to HTML text and obtain a PrintWriter object to generate simple HTML output.

```
try {
   response.setContentType("text/html") ;
   PrintWriter out = response.getWriter() ;

   out.println("<html>") ;
   out.println("<center") ;
   out.println("This is a test of MyServlet</center>") ;
   out.println("</html>") ;
   out.flush() ; }
catch(Exception e)
   {  System.out.println("MyServlet: " + e) ; }
```

Alternatively, you can create a PrintWriter object as follows:

```
response.setContentType("text/html") ;
PrintWriter out = new PrintWriter(response.getOutputStream()) ;
```

Servlet chaining and filtering

Of course output is of prime importance, but being able to scan the input stream is also essential. Reading the input stream plays a crucial role in servlet chaining, aka filtering. In servlet chaining, the output of one servlet becomes the input stream of another. Servlet chaining has many uses, the most obvious being servlets that act as filters. One example of filtering is a general-purpose servlet that parses the HTML output of another servlet, looking for meta-format tags such as table or xml data and reformatting the data associated with the meta-tag. In the case of a table meta-tag the contents of the tag would include a description of the columns in a table and optionally column header information. The table filter, upon encountering the appropriate tag, would read the table description and format the subsequent data accordingly. An xml data filter would work in a similar manner: read the description of the information and format the data into an XML data island. Any upstream servlet that knows about the filter servlets could use these meta-tags to have data automatically formatted for it. This centralises the formatting code in one location and localises changes to one code base. Of course an upstream servlet does not have to be aware of the functionality provided by a filter. Another example is a servlet that filters all HTTP output to replace abusive or explicit language with a comic book-style expletive, such as #!&@!.

The Java Server architecture, implemented by the Java Web Server, contains a special filter that goes by the more glorified name of SSInclude (Server-Side Include). The SSInclude filter scans HTML document requests for embedded meta-tags that indicate that a servlet needs to insert content at that point in the HTML document stream. When the SSInclude servlet encounters a <servlet> tag it attempts to load the specified servlet, initialise it, and then execute it. A good example might be a portfolio page that contains a server-side include to execute a servlet to produce a real-time graph of the FTSE index. The servlet that produces the graph will be loaded, connect to a price-quote database or other financial news feed, and obtain the closing level of the FTSE for the last 90 days. Once the data is obtained it renders a GIF or JPEG graphic and inserts it into the HTML output stream, which is displayed in the client web browser when the page is rendered.

The HttpServlet class

The HttpServlet class is an abstract class that simplifies writing HTTP 1.0 servlets. It extends the GenericServlet base class and provides a protocol handling framework. Methods include:

`HttpServlet()`
The default constructor does nothing.

`doGet(HttpServletRequest, HttpServletResponse)`
Performs the HTTP GET operation.

`doPost(HttpServletRequest, HttpServletResponse)`
Performs the HTTP POST operation.

`getLastModified(HttpServletRequest)`
Returns the time the requested entity was last modified.

`service(HttpServletRequest, HttpServletResponse)`
An HTTP-specific version of the `Servlet.service` method, which accepts HTTP specific parameters.

`service(ServletRequest, ServletResponse)`
Implements the high level `Servlet.service` method by delegating to the HTTP-specific service method.

Source: jserv.javasoft.com

Finding more information on servlets

Servlets are an extremely flexible and powerful way to structure Java-based client/server architectures. One of the first things you'll need is a web server that supports the Java Servlet API, or a third-party product that extends a web server that doesn't have built-in support. The Java Web Server implements the Java Server Architecture in which the Java Servlet API plays a key role. Other web servers have varying levels of support for servlets. If your web server doesn't provide the level of server support you require, don't despair. Live Software makes a great product, JRun, that extends non-servlet web servers to include full support for Java Servlets. There are three great things about JRun that make it an obvious choice. First, it is free. Second, it is fully supported. Third, it has a great web administration front-end that makes it easy to administrate and install servlets. Just in case you're wondering, it works great with Microsoft IIS and Personal Web Server. Did I mention it was free?

Another recommendation is to pick up one of the many books on Java Servlets. This is a good idea because while writing a servlet is relatively straightforward, the administration and configuration of servlets on the web server (a necessary evil) can be a tedious experience. Among other books I read, *Java Servlets* written by Karl Moss and published by McGraw-Hill (ISBN 0-07-913779-2) was fun and informative. It also included quite a bit of detail on servlet administration. ■

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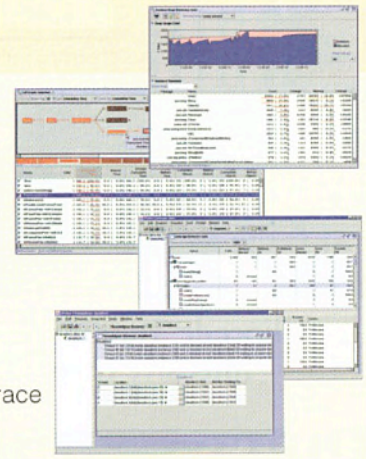

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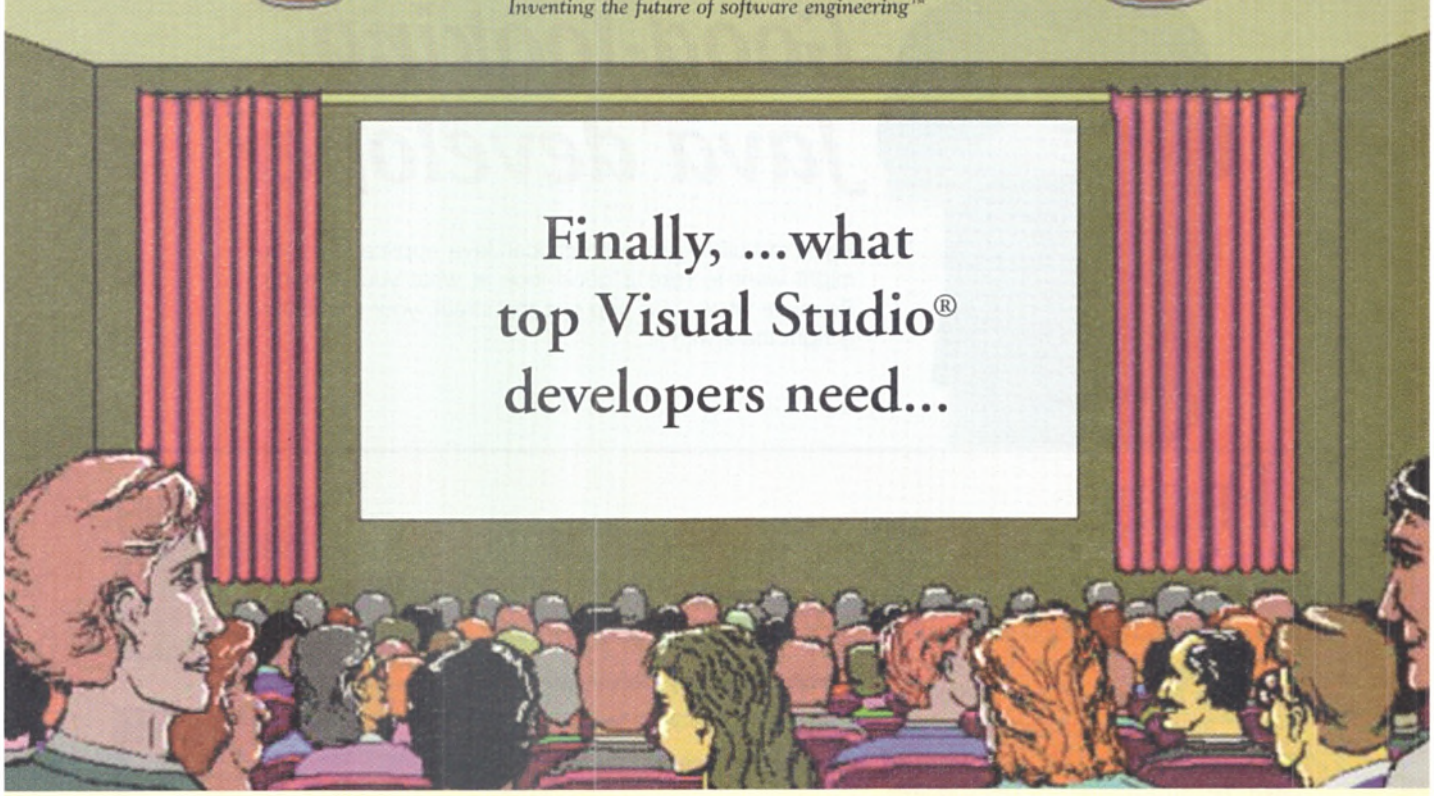

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WebClasses – extra tuition

Jon Perkins continues his coverage of the VB 6.0 WebClass technology.

Last month I discussed the basics of WebClass technology, notably the simple Request/Response model that facilitates the passing of information from client to server and back. This month I am expanding the topic to provide deeper coverage of this same issue, and to explain how a web-based application can retain state information.

Sending client data to the server

Web pages are, more often than not, a one-way flow of data. The user requests a specific page, for which a navigation request is passed to the server, and then the next page is sent back down. Sometimes, however, the user needs to send data up to the server, for example to send in registration details for a newly purchased software product. This is implemented by setting a section of the HTML page with form tags, specifically `<FORM>` and `</FORM>`.

Within this defined region exist individual items such as text boxes, radio buttons, check boxes, and so on. Two standard components that are also used are a Submit button and a Reset button. The Submit button sends the data that has been entered into the form up to a previously determined URL, while the Reset button initialises the values of each control within the form region. A single HTML page can contain multiple forms, but each separate form will need to have its own Submit button.

The form tags themselves have a couple of parameters that are worth discussing before we go any further. The syntax of the form tag is:

```
<FORM action=value method=value name=value> ... </FORM>
```

To illustrate the point I have created a new HTML page called `RegData.htm` and have added it to my WebClass project as a new WebItem called `GetRegData`. Visual Basic has made a copy of my file called `RegData1.htm`. Using this as a basis, I can explain each parameter by giving an example.

The `action` property specifies the name of the target where the data from the form will be sent. If you define your HTML page in a generator tool such as Visual InterDev, then this value will be empty when you initially define the form region. However, once you import the HTML page into your WebClass project as a WebItem the value will automatically be set for you, which is perhaps one reason why Microsoft decided to give you a working copy of your original file.

The `method` refers to the manner in which the data will be sent to the server. Web browsers generally support two different values for this property, called `Get` and `Post`. To understand the difference between the two it is necessary to know that an HTTP request can consist of just a header, or a header with a body. A header can store only 1 KB of data, whereas a body can – in theory anyway – store an unlimited amount of data. The difference between the `Get` and the `Post` methods is that `Get` will only send the header, whereas `Post` is able to send the body as well. For this reason a `Get` method is often unsuitable, and is in fact not supported by WebClasses. Therefore always specify the `Post` method when designing forms for a WebClass target.

The `name` value merely identifies the form.

Putting all this together, we can see a typical form description (as generated by Visual InterDev, trimmed by me, and subsequently modified by Visual Basic) that includes two text boxes, a submit button, and a reset button:

```
<HTML> <BODY>
<H1>User Registration</H1>
<FORM action=
   "WebClass1.ASP?WCI=GetRegData&amp;WCE=FORM1&amp;WCU"
   id=FORM1 method=post name=FORM1>
<P>Please enter your details below:</P>
<P>Name: <INPUT id=text1 name=text1></P>
<P>Email address: <INPUT id=text2 name=text2></P>
<P><INPUT id=submit1 name=submit1
     type=submit value=Submit>
   <INPUT id=reset1 name=reset1
     type=reset value=Reset></P>
</FORM>
</BODY> </HTML>
```

Once the Submit button is pressed, the data is passed up to the target specified in the `action` property as name/value pairs. I said earlier that I had created a new WebItem based upon this form definition (which was left with the default name of FORM1). When this WebItem was created Visual Basic automatically created a new event called `GetRegData_FORM1`, which offers a suitable point at which to extract the items of data that are being passed up. This is done by calling the `Form` property of the Request object and supplying the name of each required element in turn. For example:

```
Dim sUserName As String
sUsername = Request.Form("text1")
```

Sending HTML to the client

The Response object is concerned with passing a stream of HTML back to the client browser. This process can be performed by either dynamically constructing an HTML page as I demonstrated last month, or by using an existing template. In order to facilitate the need to return dynamic data along with a predefined HTML page it is possible to insert special tags into the template itself that can be substituted at runtime with something else. For example, you might want to include a page hit counter value at the bottom of your home page.

Replacement tags, as they are known, are embedded within source HTML pages. These tags need to be prefixed with a predetermined set of characters, followed by a more descriptive suffix. Syntactically speaking, a prefix has to begin with an alphabetical character and should contain a unique character such as the @ symbol. The default tag prefix is `WC@`, so it follows that an example tag could be called `WC@hitcounter`. It is possible to change the value of the `TagPrefix` property in the Properties window for each WebItem. An example HTML page is shown below that includes two replacement tags.

```
<HTML> <BODY>
<H1>Centaur Communications Ltd</H1>
<p>Thank you for your interest in <WC@magname>
   our magazine </WC@magname>.</p>
<p>The next issue will be available on <WC@nextdate>
   the first of every month</WC@nextdate>.</p>
</BODY> </HTML>
```

When the `WriteTemplate` method for this particular WebItem is fired it will automatically scan the actual HTML source and look out

for anything beginning with the tag prefix. As soon as it finds something that qualifies, it fires the `ProcessTag` event in order to allow a substitution to take place. At this stage, you can alter the existing text between the tag markers. As processing of the source HTML template continues, the process is repeated for each subsequent tag that it finds. If you are expecting more than one tag to be passed, then it is best to use a `Select Case` statement, as shown below:

```
Private Sub Thankyou_ProcessTag(ByVal TagName As
String, TagContents As String, SendTags As Boolean)
  Select Case TagName
  Case "WC@magname"
    TagContents = "EXE magazine"
  Case "WC@nextdate"
    TagContents = "on the 1st of " & _
          MonthName(Month((DateAdd("m", 1, Now))))
  End Select
End Sub
```

It's worth remembering that the `TagContents` variable initially contains the original text embedded between the two replacement tags, which could be useful on occasions. The `SendTags` flag, which defaults to `False`, determines whether the resultant HTML code will contain either the substituted text still embedded within the tags, or just the new text. If the tags are still present, then the browser will probably ignore them so the end result will still look the same. The product of our example code is shown in Figure 1.

Maintaining state

By default WebClasses do not retain any state information between instantiations, much the same as conventional Windows applications. In the case of Windows applications such state information is either stored in the Registry or in a database. It is of course a different matter with Internet server-side components because there is no guarantee that a visitor will ever come back again, so is it worth storing any information? And for how long should such state information reasonably be stored on a server database? Needless to say this is a different matter from storing user-account information, particularly if you obtain a source of revenue from these accounts.

State information is often of a trivial nature. For example, your website might have a parallel set of pages that are optimised for either Internet Explorer, AOL, or a Unix browser, or alternatively you might have foreign language versions of your site. Either way it is more convenient for the user if, when they revisit the site a bit later, they find themselves at an initial page in which these preliminary issues (eg language) have been retained and automatically configured.

By default, a WebClass does not hold on to any information between requests. Therefore, if a user goes back to the same screen during the same session, then the default information will be presented on both occasions – it will not have remembered anything about their previous connection. This behaviour can be altered by a WebClass property called `StateManagement`, which can be changed from its initial value of `wcNoState` to `wcRetainInstance` (this facility requires Cookies, more of which later). This action changes the lifetime of the WebClass instance from previously being alive for only the duration of the HTTP Request/Response exchange, to being alive until either the WebClass calls the `ReleaseInstance` method or until the preset timeout period elapses. The upshot of all this to the developer is that your variables will either have data in or they will not. The trade-off to this facility is system resources. As more instances of WebClass objects are retained at any one-time then the overall performance will degrade.

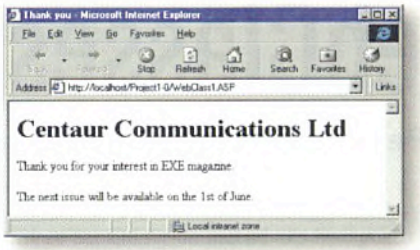

Figure 1 – Internet Explorer showing substituted text.

Session and Application objects

Two other ASP objects are geared towards holding state information: the Session object and the Application object.

The Session object relates to the logical connection that an individual user has to a specific web application. When a new user connects to the web application a `SessionId` value is generated that identifies the user. This value, called a Cookie, is sent to the client machine and is stored by the browser. Then, for each subsequent Request object that is sent, the `SessionId` value is also included. If the browser has been configured for a high level of security, then it might not accept the Cookie, in which case no state information can be retained.

The Application object pertains to a running instance of a specific application, regardless of how many users are connected to it. It is created at the time of the first user access to the website, and then continues until the website service itself is terminated.

Both of these objects support the storage of variables. For example, the Application object will be the logical place to record the number of hits to a site. This object begins life by holding only one predefined variable, called `~WC~WEBCLASSMANAGER`. Additional variables for either of these objects can be declared in a special ASP text file called `Global.asa` that allows for such initialisation to take place. Space doesn't permit me to give any coverage of this specific topic, but I would refer you to the Active Server Pages documentation in MSDN for more information. However, the principle here reminds us that the complete application resides as an ASP-based process running within the context of Internet Information Server. The WebClass that we produce is a DLL extension to the full application.

Using an Application-based variable, the running total for the hit counts to date could be incremented each time a new user shows up. This code would be placed in the `Start` event for the WebClass, as shown:

```
Application.Lock
Application("hitcount") = Application("hitcount")+1
Application.Unlock
```

The `Lock` and `Unlock` methods combine to prevent other instances from accessing this global value at the same time, and should be used for any Application variable that could possibly be updated concurrently.

Assimilating the Internet

These are the basics of WebClasses. To make real headway you need to have more of an understanding of the ASP object model, and of course you need to have at the very least a familiarity with HTML. Microsoft has demonstrated by its assimilation of the Internet into virtually everything that it produces that this is an apparently unstoppable trend. VB developers keen to keep their CVs up to date have little choice but to comply. Use these two articles as a starting point, and then experiment. ■

Jon Perkins is a freelance Visual Basic developer and a Microsoft Certified Solution Developer. He is a contributing author of Advanced Microsoft Visual Basic 6.0 by The Mandelbrot Set, published by Microsoft Press. Contact him at http://www.jonperkins.com.

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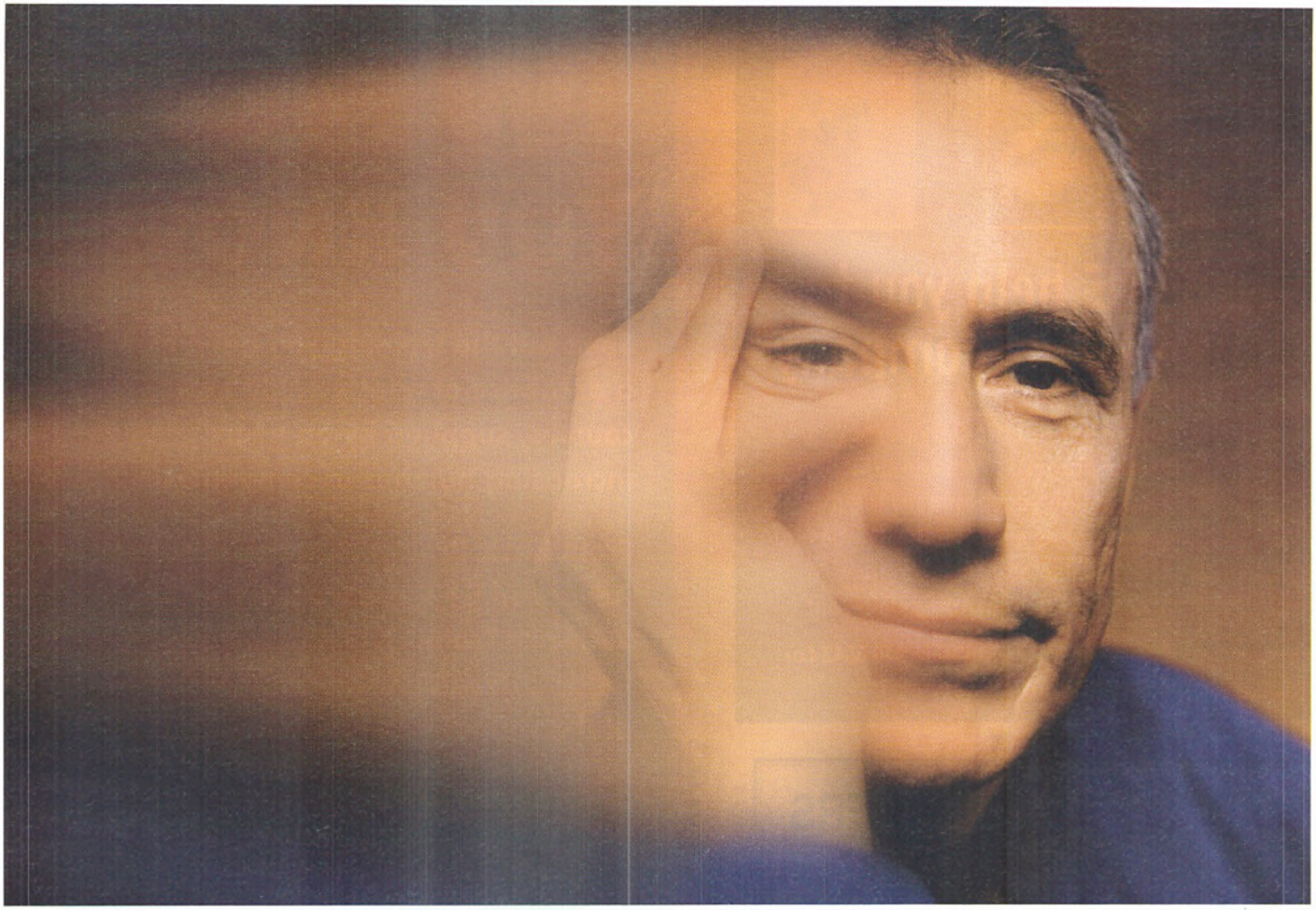

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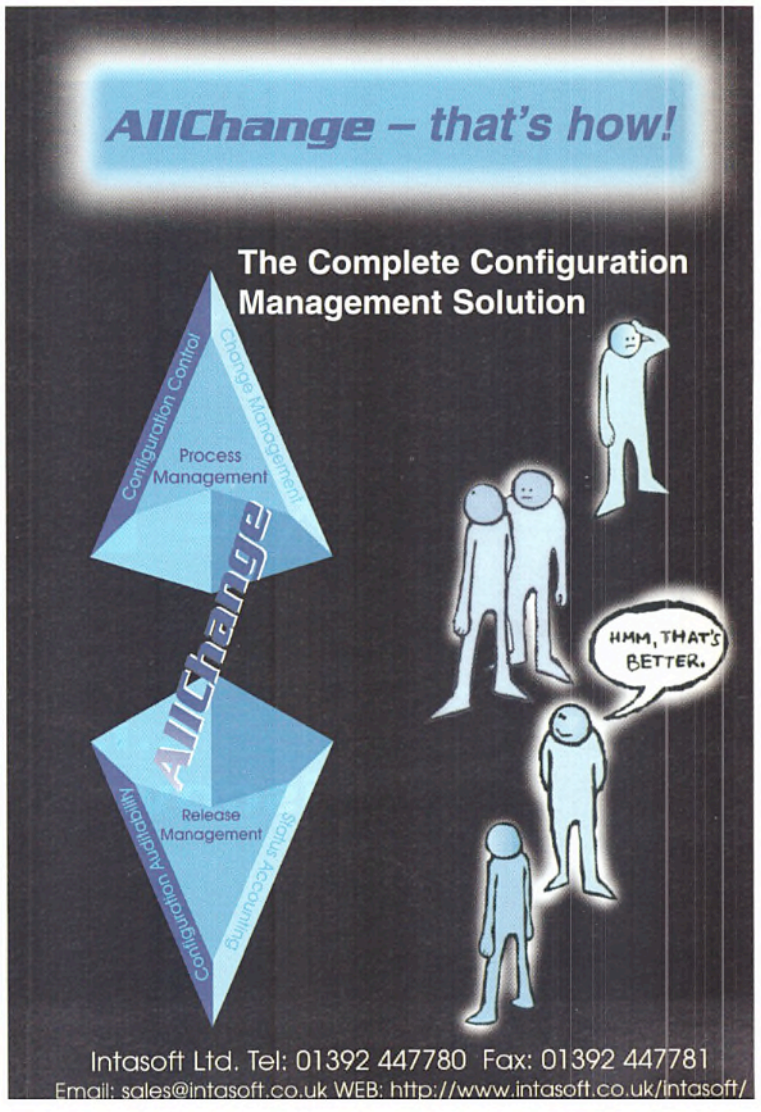
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Maximum insecurity

So there you are, doing a 5-stretch for a white-collar job in Dartmoor, on New Year's Eve, when all of a sudden the locks click open, the gates swing apart, and the screws run off and hide in solitary because Mad Dog Delphi Dan is now at large. Sounds crazy? Perhaps not.

An easily overlooked consequence of the coming Y2K meltdown is the possible collapse of penitentiary systems all over the developed world. Modern jails, it seems, rely heavily on computers for their operation and security. What with electronic locks, electronic tags, and computer-controlled surveillance systems, a warder's job may well not be a happy – or easy – one come January 1. Testing the myriad embedded chips in millions of systems around the world is likely to be an impossibility, with the result that underfunded areas like the prison system may miss out altogether.

Some people in the know are increasingly concerned about this scenario. One US researcher, Dr Michael Harden, suggested that 'if a prison is defined by its ability to control inmates and all these systems break down, a prison ceases to become a prison and it becomes a hotel.' Dr Harden, whose dismal prognostications were recently featured on the ever-vigilant *Wired News* (*http://www.wired.com*), takes the problem very seriously indeed. 'You couldn't build a modern prison today without computers... It makes them very vulnerable,' he said. 'The more modern the prison, the more likely it is to be reliant on computer chips or computer systems for control of all their security functions.'

As with other potential areas of Y2K concern – nuclear power stations, ICBM control systems, aircraft navigation computers, and of course the timer in *your* VCR – there are those who shout doom and gloom, and those who simply scoff. The only answer is to wait until January 1 and see who was right. Should we find ourselves on that cold winter morning with the hangover of a lifetime, amid planes falling from the sky, glowing in the dark from the fallout, fighting off desperate convicts, and unable to get our Visa card to work in the damn ATM, we shall know who to blame. You lot.

www.welcome-to-prison.co.uk

So what do you do while waiting for the Long Arm of the Law to reach out and feel your collar for using a sieve sort instead of a qsort in that ambulance dispatch system? You know they're going to get you – it's only a matter of time before you're standing in line for slop at the Scrubs. Perhaps its your first time inside (if you're a novice C++ programmer, chances are it will be. Those of us who've been around a bit and done some Smalltalk will almost certainly have spent some time at Her Majesty's Pleasure by now). Perhaps you've never seen *Sharky's Machine*, or *The Shawshank Redemption*, or even *Porridge*. How will you ever cope?

Fear not. HM Prison Service has wisely chosen to invest your tax dol... erm, pounds in a website that will tell you all you need to know (*http://www.hmprisonservice.gov.uk*). In contrast with most Government sites, it's actually rather nicely put together, with a nifty slate-blue-and-oatmeal motif, and has a FAQ to inform you of important facts such as 'A category A prisoner is one whose escape would be highly dangerous to the public, the police, or to the security of the state'. Not Jonathan Aitken, then.

Of particular interest is the list of prison slang terms, which will help you tell your nonces from your grasses, and the hilarious Lifer's section, where you too can discover that life imprisonment actually means about 13 years, and bone up on your knowledge of tariffs. And if you want to know what tariffs are, you'll just have to go and look for yourself.

While you wait

Okay. So you know what it's going to be like inside. You know when you'll be (prematurely) released. What do you do while waiting to get out? How can you turn your coding skills into the Top Dog position you so richly deserve? Here are a few suggestions.

- Reprogram the kitchen ordering system to buy only from Fortnum and Mason's. Slop is the leading cause of prison angst; slop *and* caviar will go down much better, and the lads will love you for it – but not in the shower, you'll be relieved to hear.
- Smuggle in your Palm III or WinCE machine, and a mobile phone. Download naughty pictures at night and sell them in the canteen later. Cash is largely useless inside, but it never hurts to have Slasher Harris owe you one in case a rival coder should ever challenge your supremacy.
- In some jails you may be allowed limited access to the Internet. Use your inside knowledge to crack the ecommerce systems you designed (let's face it, they *never* change the passwords) and arrange for a weekly delivery of luxury goods courtesy of a *mystery benefactor*. The warden will never allow it in, of course, so you'll have to hack into his email, find something embarrassing, and blackmail him with it.
- If all else fails, you can win prisoner kudos *and* trustee privileges by using your computer skills to get insider information and trade stocks and shares for the warden at massive profits, while making some money on the side to pay for elaborate schemes to get revenge on the people who put you inside. Well, it worked for that bald bloke in *Bugs*, didn't it?

Stob Raider

'My life is just as glamorous as Lara Croft's,' claims Verity Stob, wildly. 'I should think Eidos could make a very exciting game out of it.'

Practice level: Verity's flat. Take your time to explore your surroundings and hone your game control skills.
Scenario: It is a weekday morning. Verity has to get up and get ready for work. There are two secrets to be found.
Opening doors: When confronted with closed doors at this level the temptation is to use Verity's authentic karate kick action: press the Kick key then very quickly press Jump and hold down Forwards. Although this does work, you will sustain 5% damage – 'stubbing the toe' – each time you do it, and remember there are no medipacks on this level.
Flushing the loo: You flush the loo in Verity's flat by climbing up onto the seat so that the cistern is at eye level. Now pull the lever (tap the Action key) three times vigorously and backflip out of the bathroom to land square in the middle of the hall (found by OooziM). If this doesn't work then you were probably too slow – you must wait five minutes for the tank to fill up again – so if you get it wrong you will probably want to reload your game at this point. You did remember to save your game, didn't you?
Traps: When going from morning room to kitchen, be sure to leap over the trailing aerial cable from the television.

Beware the milk in the fridge – it is poisonous! (If you like, you can crouch down and use the Look key to see that it is 12 days past its sell-by date.) You will want to place the carton into Verity's combat carrier bag for combat use later on.
Secrets: Vault into the bedroom sideways and look down. You will see there is a crawl space underneath Verity's bed. You will find assorted magazines and unwashed clothes, a hairgrip, her purse, and car keys.

The clean underwear is hidden in the washing machine (found by Daveman).

The level ends when you exit the flat.
Tips: OooziM writes: I found that the thermostat doesn't work properly unless you turn off the radiator in the bathroom.

Swazzer says: The doofer for the TV is hidden in between the cushions of the sofa, but it doesn't have any batteries so it doesn't work (Playstation version only).

Level 1: Getting to work.
Scenario: Verity travels from home to work. There are two separate strategies for completing this level.
Strategy 1: As you leave the flat you are accosted by the boring neighbour who wishes to tell you about his long-running dispute with the council. The correct approach is to crawl along under the cover of garden wall, then do a running jump (Forward, then quickly hit the Jump key) over the dustbins, and thus reach the safety of the car. Alternatively you can just sprint across the lawn and squeeze through the gap by the skip (found by Sophie). NB only evasive action is effective at this point. *Do not use your weapon!* Sour milk does not work against the boring neighbour.

Starting the car: press and hold the starter motor (Roll key) for thirty seconds while vigorously pumping the throttle (Action key). When she fires, pull out the choke (Choke key) about one quarter of the way.
Traps: It is a very good idea to save your game before trying to start the car.

If you pull the choke out too far, or too early, the carburettor will flood, and you will be unable to start her.

If you pull the choke out too little, or too late, the battery will run down, and you will be unable to start her.

If all this sounds too much like hard work then you can fall back on:
Strategy 2: Taking the Tube. Fairly straightforward and obvious except that you get more points if you kill the man who barges into the queue for the ticket machine with a karate blow to the neck rather than simply tripping him up into the path of the oncoming train (thanks to The_Gaffer for this).
Secrets: You stand a remote chance of getting a seat if you wait two thirds of the way down the platform, between the broken chocolate vending machine and the vandalised help point, and then push like hell (Push key) when the train arrives.
Bugs: There is a bug in the PC version that causes the train to stop between stations for periods of up to five minutes. No patch available so far. :-(:-(

Level 2: Arriving at work.
Scenario: The main task of this level is to get through the security door, which is protected by a keypad and electronic card swipe.
Strategy: The strategic options are:

1. Try to sweet-talk Reception Ed into pressing the release button (Sophie claims to have had some success with this strategy, but nobody else can make it work). *Do not use your weapon on Reception Ed!* Receptionists are immune to the powers of sour milk.
2. Hide behind the postal trays, waiting for someone with a card to open the door. Wait until the last moment, then do a running jump over the screen and sneak through behind them, innocently whistling (Innocent Whistle key).
3. If you have used the cheat code to get all the weapons, you can use the Uzi to shoot out the lock. However, be aware that this causes the Building Manager to come out of her office to see what the noise is about. Now you are in big trouble. The Building Manager cannot be killed without the thermo-nuclear turbo-laser from the Caves of Tharg, which we will visit in Episode Three (Daveman).

Link scene: After you have overcome the terrors of the security door, an inter-level animation appears, where the Manager says: 'Verity, please can you make some tea – the directors are in an important meeting.'

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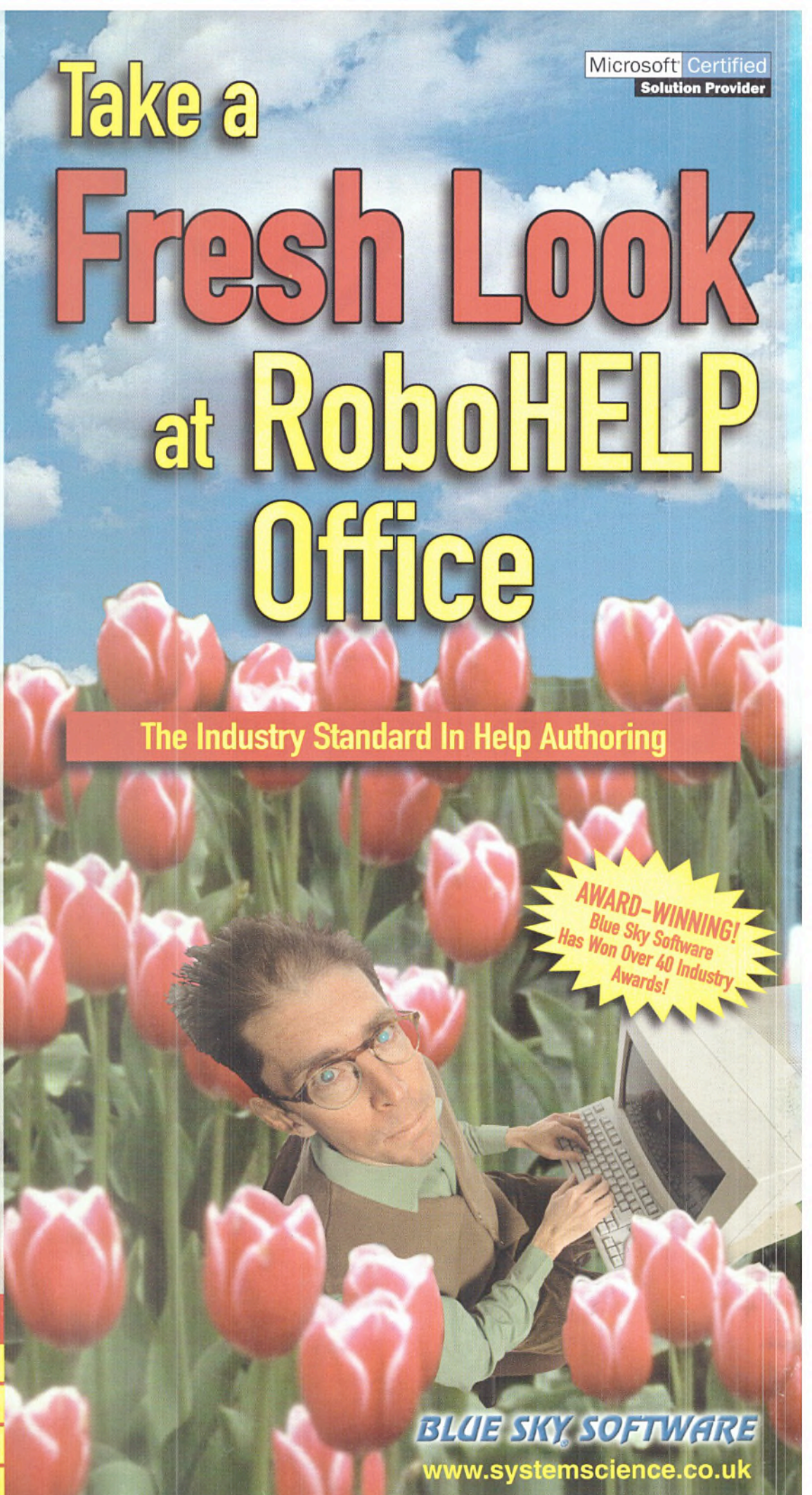

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