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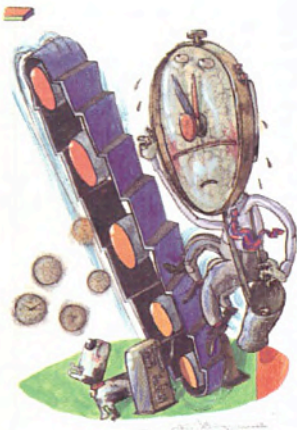
Oracle keeps developers busy with releases of JDeveloper and the Oracle Application Server, Vision Jade compiles business rules to Java, and there's a report from the Kona meetings of the C and C++ Standards Committees. The native storage of XML for the Tamino information server, WebUpdate 1.0, and this month's books.

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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, UK.** **EXE Tel:** 020 7970 6541 **Fax:** 020 7970 6741 **Advertising email:** advertising@exe.co.uk **Subscriptions Tel:** 020 7292 3706 **Fax:** 020 7970 4099 **email:** execirc@centaur.co.uk. EXE is available by subscription at £38.50 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 go to <http://sales.centaur.co.uk> or if you have a subscription query, please call 020 7292 3706 or write to Gary Markin, 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:** © Corbis/Burstein Collection **ISSN:** 0268-6872 **http://www.exe.co.uk**

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Better the devil you know

So, the fix is in. Microsoft is officially a naughty boy who should know better, and may yet get *such* a spanking. All is right with the world. Justice has been seen to be about to be done at some indeterminate point in the future. Larry Ellison can breathe more easily. Eric Raymond can smile again. The Great Satan of Software is to be put to the sword. Up in Silicon Heaven, Gary Kildall must be smiling a wry smile.

The news that Microsoft is almost certain to get it in the neck when Judge Thomas Penfield Jackson finally makes his ruling in the DOJ case has sent shockwaves rippling through the industry. It's not that people didn't expect the case to go against Microsoft – that's been most people's forgone conclusion since the days of the botched video evidence – but the findings are almost entirely against the company. If it weren't obvious that Judge Jackson is entirely impartial – well, he'd have to be, wouldn't he? – you might suggest he had it in for Bill Gates.

The news also brought an assortment of MacHeads, Unix weenies (as the *Unix Hater's Handbook* loves to call them), and other interested parties out of the woodwork, to joyfully gloat about what they see as Microsoft's impending doom, as if it were the emancipation of the slaves we were talking about rather than as-yet-unspecified sanctions against a large corporation. It's a peculiarity of the software industry that those in it behave as if the to-ings and fro-ings that rack it from time to time are events of historical, even biblical significance. A sign, perhaps, that we are all taking ourselves too seriously.

If you're a paid-up anti-Microsoftie, you might be shaking your head at this column right now. So be it. But at least listen to my reasoning before dismissing the notion out of hand. Much of the battle against Microsoft revolves around the issue of *choice*. Most anti-Microsoft campaigners say that Microsoft has effectively reduced choice by eliminating competing products such as OS/2 and severely denting the sales of others like Lotus SmartSuite. This is, in all probability, true. A question I have not yet heard asked, though, is whether or not

imagine having to develop your application for ten or fifteen platforms instead of just for Windows, as is the case for the majority of desktop applications today.

I don't expect Microsoft to last forever as the leader of the pack. Technology moves on and eventually the PC – and Windows – will become irrelevant. Just as IBM was deposed by new technology that it invented but could not control, so Microsoft will, in turn, be eliminated or at least overturned. But that will happen when the market – and indirectly the customers – say it should, not when some flunky

transferable); it was Microsoft that drove the development of the Internet as an application platform with Active Server Pages, Transaction Server, and COM+, when the best Unix could come up with was CGI. If it weren't for Microsoft, would the Open Source movement exist today? Would Linux exist today as a viable OS?

The software industry needs a bogeyman as much as it needs a leader. Microsoft, though undoubtedly flawed and guilty of some dirty dealings, fulfils that role nicely. OS/2 fans might argue that the world would be a better place if it hadn't been killed, but the reality of it is that those developers who would have been spending their time and energy porting Widget Plus 5.0 to Presentation Manager can spend their time instead creating new software for Windows. The programmer with Win32 skills knows that he need never go hungry (at least until IR35 comes into force). Users actually have more choice – of applications – than they otherwise would have. Do we really want to punish Microsoft so badly that we're prepared to return to the bad old days where every platform specialist sits nervously at his desk day after day, hoping today isn't the day that all his experience and know-how become irrelevant?

It's fashionable to become tired of the devil you know, and seek to replace it with the devil you haven't tried yet. But in business, as so often in politics, the devil you haven't tried turns out to be exactly what you thought you were getting rid of. My message to those who are queued up to take a pop at Bill Gates and his company is to be careful what you wish for – you might just get it.

Neil Hewitt



It's a peculiarity of the software industry that those in it behave as if the to-ings and fro-ings that rack it from time to time are events of historical, even biblical significance.

choice in the software industry is actually a good or bad thing.

How can choice be a bad thing? Easily enough – choice means having multiple products from multiple vendors for any given solution. Multiple products invariably means multiple incompatibilities, multiple competing technologies, and multiple support headaches. It means multiple skillsets required by developers, multiple SDKs to acquire and learn, and far longer development times to produce products that support all available options. Choice in operating system platforms is probably the worst example;

in the Department of Justice decides that it's time. In all likelihood, this case will go right down to the wire, followed by appeal after appeal after appeal, so that by the time that the DOJ gets to take any punitive action against Microsoft it may well be irrelevant; the company could have reinvented itself by then.

As software developers, we should never forget that for all its faults it was Microsoft that reduced the number of platforms most of us have to develop for to one; it was Microsoft that gave us a standard class library in MFC (whether you like it or loathe it, at least the skills are

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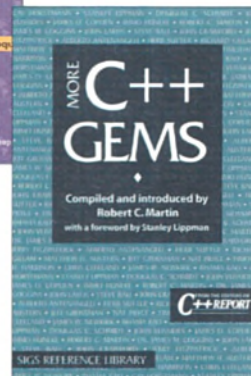
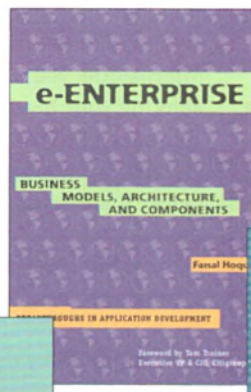
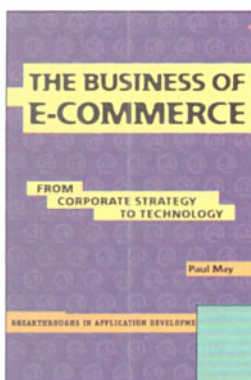
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Scott W. Ambler

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Managing Object Technology, 19

Tried and True Object Development

Industry-Proven Approaches with UML

Ari Jaaksi, Juha-Markus Aalto, Ari Aalto,

Kimmo Vättö and Derek Coleman

Written by four experienced Nokia Telecommunications software developers, this is a practical book concentrating on the most important issues in real-life software development.

£24.95 Paperback 0 521 64530 1
343pp 1999

Managing Object Technology, 16

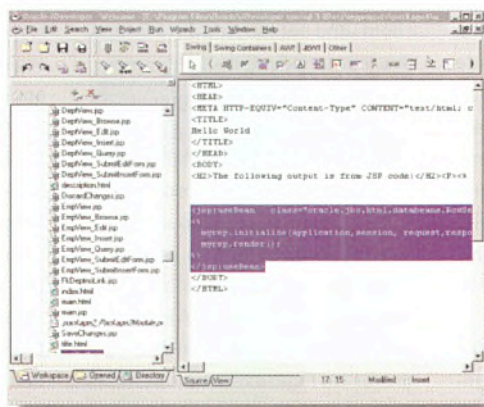
Oracle Business Components for Java

The rapid development and deployment of Java Server Pages (JSPs) is provided by two Oracle product releases. Along with JDeveloper 3.0, the Oracle Application Server 4.0.8 supports the company's new Business Components for Java, which represent a framework to increase the productivity of Internet developers (enabling you to build, customise, and deploy reusable components for both packaged and custom applications). The main feature of the framework is its capacity to reuse and customise the same business logic across multiple applications. To cover the range of Java server-side technology, the application server also supports EJBs and Java Servlets, as well as JSPs – the releases provide for the integration of development tools, application server, and database (Oracle8i).

The Business Components for Java function within JDeveloper 3.0. Wizards automatically generate and optimise framework code that handles database interaction. This is intended to reduce the com-

plexity previously associated with development and customisation by allowing you to focus on the business logic rather than the low-level database interactions.

The components are capable of executing entirely in the ora-



cle8i database because they use its resident JVM, Oracle JServer, to provide a Java framework scalable to tens of thousands of users. The framework enables you to tune the business logic for high-performance by providing full control over SQL and the database interactions. To use Oracle's phrase, it automates deployment

of optimised, multi-tier database applications.

The framework is built entirely on top of the EJB server-side component model (the architecture provides facilities for transaction and state management and provides for the reuse of business logic). The Oracle technology thus enables applications to be written once and deployed as Enterprise Java Beans or Corba objects inside of Oracle8i, Oracle Application Server, or any other standards-based server. Oracle advertises that this flexibility in deployment will allow rapid re-partitioning of applications in response to poor network performance or

over-utilisation of the database server, helping to bring enterprise scalability to Java applications.

The Oracle Application Server 4.0.8 is available via Oracle's online store at www.oraclestore.oracle.com and will be available for free download to developers on OTN (Oracle Technology Network).

www.technet.oracle.com

The **JProbe** 2.5 ServerSide Edition of development tools adds suite-wide **Solaris** support, enhanced performance tuning capabilities, memory debugging, and thread analysis of **EJBs** and servlets. A Launch Pad automatically configures JProbe to work with various application servers. www.klgroup.com/jprobe/

The **JBuilder** 3 Enterprise, **Solaris** Edition has been released. As well as the Java technologies previously incorporated, it includes support for the forthcoming Java 2 Platform, Enterprise Edition (**J2EE**), which is in beta. A feature matrix can be viewed on the Web. www.borland.com/jbuilder/

Mabry's **RAS/X** control provides easy access to **Dial-Up** Networking. You can establish Internet connections – to send mail, or transfer files – under program control and without operator intervention. It supports the management of phone book entries. Costing \$49, there are COM object and **OCX** versions. www.mabry.com/rasx/

WML – the time is right

With the availability of **WAP 1.1** (Wireless Application Protocol), the arrival of **GSM** phones supporting it, and the launch of **WAP** gateways and services by most **UK GSM** networks, this is the right time to consider **WML** – the **Wireless Markup Language** – and all the other associated protocols. According to **Phone.Com**, founder member of the **WAP Forum** (which has more than 180 members), most current **WAP** developers have **HTML** experience. With this background, development is quite fast. The issues are not really technical. You need to focus on what's different about mobile use and the biggest challenge is to make navigation as simple as possible.

The **SDK**, **Up.SDK**, is now at version 4.0 and is free to download (17,000 have been downloaded from **Phone.Com**'s website in the last three months). To test applications, **Phone.Com** provides a test gateway that can be reached over the Internet and phone emulators to run on your PC. Currently, to access most **WAP** services from a mobile phone you need to establish a data connection. Some gateways such as **Phone.Com**'s and some phones like the **Siemens S25** (not fully **WAP 1.1** compliant) support **WAP** over **SMS**. Next year, when **GPRS** starts to become available, the connection between the phones and the networks will be packet-based and always on. This will be an incentive for new types of applications.

www.phone.com www.wapforum.org

Rational Suite

Rational has new versions of its Suite, v1.5, and of **ClearCase**, v4.0. Some new features of the Suite are present across all the products included. For instance, they're all internationalised – you can now run the suite on a non-English OS. There are over 3,000 **HTML** pages on **Unified Process** (best practices for e-business) and these can be extended. Use Case management between **Rose** and **Requisite Pro** is integrated. All the products can be installed silently from a single CD.

Many enhancements are product-specific. **DeveloperStudio** has support for **DNA** (Visual Studio 6) and for **JavaDoc** tags (JDK 1.2). Integration with **Rose** has been increased to ease parallel development.

www.rational.com

High-level access to the **HTTP** client protocol is provided by **Mabry** Software's **HTTP/X** component. Available as an **OCX** or **DLL**, it supports pipelined request mechanisms, and non-blocking, pseudo-blocking, and true-blocking modes. It costs \$79.00 and, with **C++** source, \$199. www.mabry.com/httpx/

Build! VB, from **Innovasys**, is a tool to add advanced **error** reporting and diagnosis to a **VB** project at build time. While leaving your existing handlers unchanged, **GPFs** and other exceptions are converted into normal runtime errors so that they can be captured with context information. 'Graceful failure' procedures can be included in individual modules or on a project basis. It costs \$199. www.innovasys.co.uk/products/

Business logic rules OK

Telelogic Tau 3.6 combines **UML** support for requirement capture, analysis, and modelling, and **SDL** support for real-time system design and implementation. It compiles to C, C++, or Chill making it ideal for designing and writing **comms** software. It runs on Windows 9x and NT, Solaris, and HP UX. Targets include Tornado, VxWorks, pSOS, Chorus, QNX, Orbix, Win32, and Solaris.
www.telelogic.com

To develop **SIM** applications in Java, **Bull** has **SIM Rock'n Lab**, a portable development environment written fully in **Java**. **SIM Rock'n Lab** includes a card reader and a test card compliant with JavaCard API 2.1 and SIMToolkit 3.19.
www.cp8.bull.net/sct/uk/partners/becoming/

Palm Computing and **Nokia** have announced a joint development agreement for **Palm** to port the **PalmOS** interface onto **Symbian's Epoc** kernel on the **ARM** architecture. Don't expect products before 2001. The goal is for devices to be able to run both **Palm** and **Epoc** applications.
www.palm.com/devzone/

VxDCOM is a real-time implementation for embedded apps of the **DCOM** Windows interface. Available on the **Tornado II** development platform and requiring **VC++ 5.0+** and **NT**, it's an extension to **Wind River's VxWorks RTOS**. With a 280 KB footprint, it is fully compatible with **OLE** for **Process Control (OPC)**.
www.windriver.com

AspGrid v2.5 is an **HTML**-generating **ASP** component that provides a **Web**-based read/write interface to **ODBC** database tables. Single-user licences cost £85 and site-user licences are £249.
www.componentsource.com

The value of e-business is not defined by data, but by the logic you use to run the business. This is the proposition behind **Vision Software's Vision Jade**, which has been launched within the UK. Taking a declarative approach to specifying underlying business rules, which are compiled into Java components, the system comprises the **Jade Developer Studio** and the **Vision Business Logic Server**. The system integrates with **IBM's WebSphere**, to provide a Java server that combines logic execution services with those of an application server. This includes presentation delivery to Java- or **HTML**-based clients.

Using the **Developer Studio**, the core objects of a system are identified (whether re-engineered from relational databases or imported from modelling tools) and then related to their attributes to define the business rules of the organisation. In addition to an integrated Java editor and a **Business Rules**

Designer, there is an **Application Designer** for the easy construction of clients: you drop business objects into a workspace and use wizards to specify form navigation, data dependencies, and captions. There is support for local and remote Java debugging and for client- and server-side **Java Beans**.



Components created by the **Vision Developer Studio** are made available to the **Vision Business Logic Server** for automated and scalable deployment. Along with a rules compiler and schema integrator, its logic execution services provide for the sequencing and optimisation of business rules.

For existing applications and data sources, **Vision's XDA (eXtensible Data Access)** architecture can apply the automation of the business rules to relational databases and standard

object formats, such as **Corba**, **COM**, and **EJB**. **XML** support is to follow.

Vision Software's idea is that the in-built flexibility of changeable rule definitions frees you to concentrate on value-added developments and specific customisations, instead of focusing on **APIs** and low-level language issues as required by 'first generation' web application servers.

According to **Mike DeVries**, **Vision's** VP of Marketing, 'The **Vision Business Logic Server** is the first in a new category of product to combine the scalability of application servers with the time-to-market and business flexibility that only business rules automation can deliver.'

Version 4.1 supports **NT** and **Solaris** for server development. Pricing starts at £7,000 for the minimum configuration (two **Vision Business Logic Servers** with five developer seats).

www.vision-soft.com

Tamino for e-business XML

Tamino is **Software AG's** information server for **XML** data sources. Designed for e-business applications, the name stands for 'Transaction Architecture for the Management of Internet Objects'. Because it can store **XML** documents natively, no intermediate conversions to other formats are required, which also brings performance benefits. This management includes the storage of nested structures that hamper **SQL**-based approaches.

There is a web download of a **Tamino CLIP (Component Library Integration Package)** module for use with **Bolero**, **Software AG's** application builder. (Developer editions of **Tamino** include a **Personal Edition CD** of **Bolero v2.1**, which supports **Java 2**.) While **Bolero** can provide a **GUI** for **Tamino**, there is an **SDK** for direct access through **DOM (the Document Objects Model)**.

Software AG defines an information server as a 'scalable architecture for information staging, integration, and exchange'. Rather than replacing existing data storage, **Tamino** is intended to act as an information hub that helps administer enterprise data. Information can either be stored directly or just processed through the information server (the server stores the remote location of the data and how to access it). In terms of **Tamino's** architecture, the **X-Node** mapping services provide access to existing databases, enabling the mapping of such data to **XML** structures. **X-Port** is an **HTTP**-based interface to allow **Tamino** objects to be accessed directly from the Internet via the use of **URLs**. The **Tamino Manager** is a browser-based 'remote control' administration interface.

For **Windows NT**, versions for **Unix** will be available during 2Q2000.
www.softwareag.com/tamino/

Go fast JVM

The easiest way for an application server running **Java** to be made faster, by an order of magnitude in a short period of time, is to drop in a much faster **JVM**. That's the market **Tower Technologies** is after with its **TowerJ**. It claims performance boosts for process-intensive server-side **Java** applications of 3x to 5x. A 15-day time limited **JVM** is freely available. **Tower Technologies** used to be known for its **Eiffel** developments—the move from **Eiffel** to **Java** was relatively easy and most of its developers' experience could be reused immediately. **TowerJ** works by doing object optimisation on the whole system and then generating a high-performance binary runtime. It is offline native compilation.

The current version supports **JDK 1.1.5** up to **1.1.8**. Support for **JDK 2** is in beta test. **TowerJ** for one server costs \$5,000, for two servers \$6,000 and for ten servers it goes to £14,000.

www.towerj.com



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Standards Committees meet in Hawaii

The Standards Committees for three languages (C, C++ and Java) met during the last two weeks of October.

To continue work on the C Standard, WG14 (ISO) and J11 (ANSI) met in joint session for four days in Kona, Hawaii. The FDIS (Final Draft International Standard) had been passed in mid-September, so all that remains for the new C Standard is actual publication at which stage it becomes an International Standard (IS). Unfortunately, while the FDIS was out for vote, a serious incompatibility with the POSIX Standard was reported (for format specifications in the `LC_TIME` category). The rules prohibit altering a Standard at this stage, so the committees decided on the unusual step of attempting to rush through a TC (Technical Corrigendum). This meeting largely decided the content of this TC while incidentally classifying a number of other problems as less urgent, to be delayed to a later TC. The intent is that the TC will be published at the same time as the IS. Future work will include an addendum to better specify sequence points and possibly work on an enhanced library for dates and time, as well as consideration

of low-level support for embedded controller technology.

For C++, WG21 (ISO) and J16 (ANSI) met in joint session for five days. This deliberately overlapped the C meeting so that areas of joint interest could be discussed informally. This notably increased the number of countries represented



in both groups. Interestingly, after several years of absence Microsoft provided two technical experts from their C++ compiler development team for this meeting.

The main business was processing the issues lists and deciding which issues were actual defects. These are then converted into Defect Reports that have to be addressed in preparation for a TC. Unlike C, C++ aims to take its time over its first TC, while publishing its tentative decisions on the Web.

The biggest hot potato is `vector<bool>`. It has become clear that the decision to provide this as a specialisation of the `vector` template was a serious error of judgement. The functionality is fine, but it should not have been provided that way.

Those working on the core of the language have a major problem with cleaning up the semantics of `friend` functions. As a side effect of this work, it now seems likely that nested classes will be granted access to the enclosing class without the current requirement of being declared a friend of the enclosing class.

Moving on to Java, Sun has replaced its earlier decision to seek a Java Standard from ISO as a PAS (Publicly Available Specification) submitter and asked ECMA (European Computer Manufacturers Association) to take on the development of a Java Standard. The first meeting of TC-41 was hosted by Sun in Menlo Park, California.

The meeting laid down the organisational structures for future work. The biggest problem currently is that, on the advice of its lawyers, Sun has refused to submit documentation to ECMA.

Francis Glassborow

www.dkuug.dk/jtc1/sc22/wg21/

InterBase 5.6, the latest version of Inprise's embedded **database** system, is available for Novell NetWare and Windows platforms and includes updates to **SQL** functions. It's certified on NetWare 4.2 and 5.0, Windows NT 4.0 SP4, and Windows 9x. InterBase 5.6 Server is priced at £130 for a one-user licence and Local Interbase is priced at £30.

www.inprise.com

Omnis Studio for Linux is a **VB**-like RAD environment for Linux. It includes native database support for leading DBMSs, including IBM's DB2 Universal Database for **Linux**. The Omnis Web Client technology now provides for cross-platform development and cross-server deployment to Linux, Windows, and Macintosh platforms.

www.omnis-software.com

ASPEdit 2.05 is an ASP and **HTML** editor. Along with syntax highlighting, features include the validation of documents and **links**, an ADO connection wizard, a SQL Query wizard, and support for WebTV tags. For Windows 9x and NT, it costs \$50 for a single-user licence.

www.aspedit.co.uk

Books received this month

Publisher	Title	Author	ISBN	RRP
Morgan Kaufmann	ASN.1 complete	John Larmouth	0-12-233435-3	£28.95
Morgan Kaufmann	Compression algorithms for real programmers	Peter Wayner	0-12-788774-1	£29.95
Addison-Wesley	Extreme programming explained	Kent Beck	0-201-61641-6	£22.99
Morgan Kaufmann	Industrial strength parallel computing	Alice E. Koniges	1-55860-540-1	£49.95
O'Reilly	Java Enterprise in a nutshell	D. Flanagan, J. Farley, W. Crawford, & K. Magnusson	1-56592-483-5	£18.95
O'Reilly	Java Foundation Classes in a nutshell	David Flanagan	1-56592-488-6	£18.95
Morgan Kaufmann	Linkers & loaders	John R. Levine	1-55860-496-0	£23.95
O'Reilly	Mastering algorithms with C	Kyle Loudon	1-56592-453-3	£23.50
O'Reilly	Mastering algorithms with Perl	J. Orwant, J. Hietaniemi, & J. Macdonald	1-56592-398-7	£23.50
O'Reilly	MySQL & mSQL	R.J. Yarger, G. Reese, & T. King	1-56592-434-7	£23.50
Morgan Kaufmann	OO database design clearly explained	Jan L. Harrington	0-12-326428-6	£24.95
O'Reilly	Programming Internet email	David Wood	1-56592-479-7	£23.50
Morgan Kaufmann	Programming languages pragmatics	Michael L. Scott	1-55860-578-9	£32.95
Morgan Kaufmann	SQL for smarties (2nd Ed.)	Joe Celko	1-55860-576-2	£28.95
O'Reilly	The cathedral & the bazaar	Eric S. Raymond	1-56592-724-9	£12.95
O'Reilly	The Perl CD bookshelf		1-56592-462-2	£39.95
Morgan Kaufmann	Understanding networked applications	David G. Messerschmitt	1-55860-537-1	£49.95

The people who write software – you and I – see it very differently from the people who use it. We work hard to fill our software with features, we agonise over the mathematical and technical problems so the programs run smoothly, and then we streamline the user interface so those solutions run seamlessly. Users, in contrast, see none of this. Users are interested only in their problems; they look through the program's windows onto their problems, and they use the program's controls to manipulate their problems into solutions. If they see the software at all, it means the software is obscuring their view of their problem, and to that extent there's something wrong with it.

These two views mean that it's very difficult to place a value on software. Programmers, who pour their hearts and souls into a piece of high technology, regard the end result as an elegant edifice for which users should be desperate to pay an entrance fee. Users either don't see it at all, and regard licence fees as being extortion akin to road tolls, or they are irritated by it, and object to paying for junk.

Extortion is, I'm afraid, the prevailing model. The software market is pretty decisively divided into vertical and horizontal market products. Vertical market products, which are sold in small numbers and confer a competitive edge on the companies that buy them, tend to have prices that start at £5,000 and rise almost without limit, depending on what the market will bear. Such products tend to be protected by dongles. In a limited marketplace, the effort of removing a dongle is unlikely to be well-repaid, and the copyright owners probably know every possible customer for their product and will spot an illegal copy being used. The limited protection afforded by

present dongle use is appropriate in this kind of market. Customers, in order to retain their perceived competitive edge, have no real alternative but to pay the licence fees, pay more upgrade fees (possibly every second year to keep costs down), and hope that the software supplier is honest in that he does, actually, answer helpline calls. In these very small markets, there's practically no competition acting to drive down prices, and the cost of software is precisely what the customers can stand.

Horizontal market products are exactly the opposite. Here, development costs are largely immaterial, because the very high volumes of sales mean that the development will be paid for many times over, and the major cost to the publisher is publicity. Helpdesk support is, today, largely non-existent, so represents very little real cost to the publisher. Buying horizontal market software doesn't confer a direct competitive advantage but does oil the wheels of the company in which it is deployed. Increasingly, one of those squeaky wheels is communication, and a horizontal market program will derive a lot of its value from the number of other sites it has been deployed at, so enabling direct transmission of primary files. Repeat sales in horizontal programs do not come from ongoing licence fees, they come from upgrades, which means that preserving a revenue stream from such products, particularly in the jaded and mature market in which we find ourselves, relies on swamping the customer with 'benefits' that will probably never be used.

However, both these sectors have something in common; you can stop paying the fees, and continue to run the software, however out-of-date or unsupported it becomes, as long as you want. The licences have, with very few exceptions,

For rent

How would you feel if you knew that all your data could be wiped out, at a stroke, by someone you've never even met? No, it's not hacking. Jules investigates software rental.

been perpetual. But there's a move to make software rental far more prevalent.

Rental works like this. You know you don't own the software, so why does it make sense for you to get usage of it in perpetuity for a one-time fee? Let's make the software more like real products. Let's give it a finite lifetime. When it wears out, you buy it again.

This benefits the vertical market publishers because their customers don't have the option of skipping a year of support, or an upgrade, here and there. It benefits the horizontal market producers a whole lot more – every year you can withdraw a generation of programs, upgrading everybody, saving on support costs (ha!), and anyone using stolen software will be left unable to communicate with the legitimate users (even though thieves are part of the installed base that gives the software its value). It also has the side effect that it's possible to charge a whole lot more for the software, spreading out the real cost over time.

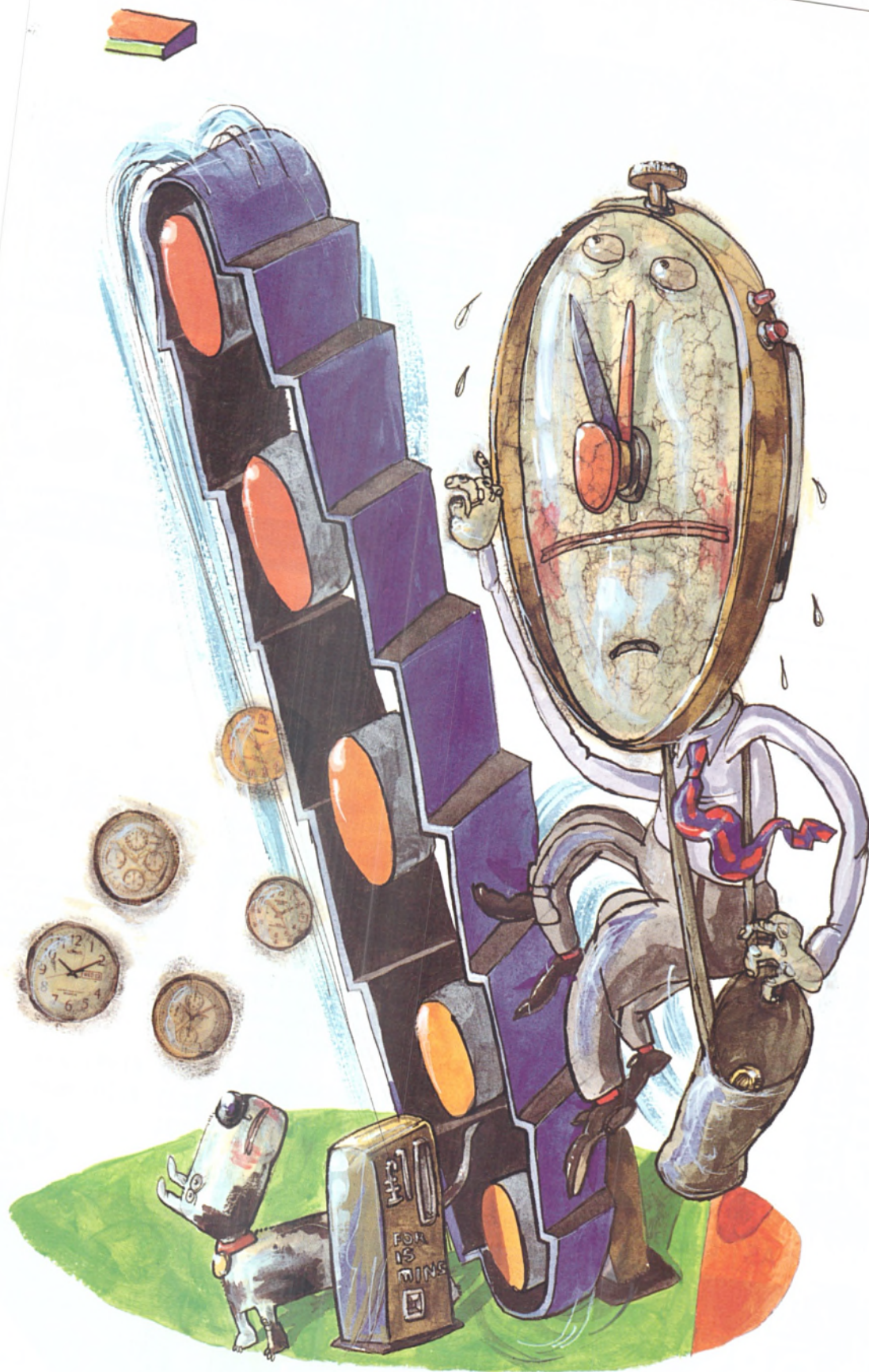
Unfortunately, software rental costs the user much more. It has another effect too – it places control of the user's data, the very lifeblood of the company, in someone else's hands. If your software supplier decides not to renew your licence, or if they go out of business, or if the upgrade is not so good as the old version, you

will be left with possibly your entire intangible assets wiped out – unreadable without the software that has expired. It permits the software producer to ramp up the licence costs without limit, year after year, holding its customers to ransom on pain of erasing their entire database more comprehensively than any virus. When the price for software is controlled only by what the market can be made to pay, why would any producer not raise its prices?

Faced with such an alarming prospect, the economics of cracking will shift. Specialist hackers will be actively recruited by companies to un-expire their software to make their data usable again. And, if they can un-expire spent software, they can duplicate un-spent software with similar ease. Sure, the software producers can fight back, but who wants to be a pawn in the battle between software producers and barely-legal crackers, when the battleground is the company's intellectual property? It will be just the boost that is needed by the open systems suppliers.

Take my advice. If you're a programmer, don't rent your software out. If you're a customer, don't even dream of renting software. It will all end in tears.

You can call Jules on 01707 662698, or email him as mayhem@jules.cix.co.uk.



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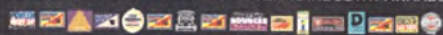
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Of stack frames...

Dear Sir,
I was interested by your recent Delphi 5 review. However, one point has stuck in my mind – there is the sentence: 'And, I think the statically-linked stack frame is one of the most important inventions in computers.' (Jules May, *Delphi 5*, EXE, November 1999). I can't ignore it and at the same time, I'm not sure I really understand it. The way you express it, the reason(s) why it is so important (implying it is so much better) must be obvious.

I did some searching on the Web and couldn't find anything that satisfied my curiosity there, either.

The main point seems to be that since you can't allocate objects on the stack, going up the calling stack you don't have to unwind the stack... But that doesn't seem to be so important. I guess more was meant than that.

I'd appreciate it if you can satisfy my curiosity.

Robert Johnstone
Manufacturing Design

Okay, starting from very first principles.

Every time a procedure starts, it makes some space for itself on the stack. Within a single language, or through a single interpreter, the blocks of memory follow a standard format. Where you're mixing languages, the linker is responsible for massaging the formats so they are compatible. The specific format is the frame, and typically includes the

parameters, the return address, the return value block pointer, and the local variables.

Now, in a language like C, that's all you have (sometimes you don't even need the return value pointer). But in Pascal, procedures exist inside each other, and a procedure needs to be able to see out to the variables defined in the enclosing procedure. Now, there are two kinds of call in Pascal; there's the kind of call where you call a contained procedure, and the procedure level increases by one, and there's the call where you move outward, decreasing the procedure level by any amount, but since you can't ever call out and then in at the same time you always either build stack frames or destroy them.

For that reason, a Pascal stack frame needs more than just the return address. It also needs a pointer to the stack frame representing the next outer enclosing level. By following that link, it finds itself in a frame which contains the outer variables. That frame will have another link of its own. The very outermost level, the global variables, which in C is represented by the DS, in Pascal is represented by a link to the globals block. This chain of links is called the static link. (In the x86, there's an instruction to build a complete list of all the static links on every stack frame. This means

faster access, but a bigger stack.)

Once you get the static link, you know not just who called you, but why. You can see out to other scopes. You can see that this is exactly the problem that exceptions express, and that's why the MSDN warns you not to use them in C++ (because they don't exactly work). But you can also do tricks like this:

```
program test ();
var i: integer;

Procedure primes (first,
  last:integer):integer;
begin ... end;

begin
  for i in primes (10,100)
  do begin ... end
end.
```

That's an example of an iterator – when it returns a value, the calling program does something with it, and then returns to the iterator. The iterator can't stop by returning a value, it has to fall off the end, just like a regular procedure.

Jules May

The study of Studies

Dear Sir,
Following on from the comment about non-Science fields (SoapFlakes, EXE, November 1999), if you want to choose a course which contains little or no serious academic study then look for one which includes the word 'Studies' in the name.

Regards.
Dave Kimber
Davant Technology

Home alone

Dear Sir,
According to Jules 'a homemaker is four times as effective as an office-based colleague' (*Mayhem*, EXE, November 1999). I would be surprised if this didn't seriously under-estimate the efficiency. I would love to swap the 'palatial first-world conditions' of my current workplace for the mini-office I have set up in my own house. However, I fear there is little chance of this occurring with my present company (position: 'software engineer'). To coin a phrase, on such a day Satan will be skating to work. Management are too much locked into the 9-5 mentality to trust their own workers to deliver professionally away from their line of sight.
email address supplied

Surely, there are no intrinsic reasons why software development should be excluded from homeworking. Indeed, IT workers should be at the forefront of this trend, given the technology that makes it all possible. (Aren't the legendary start-up companies, based in garages, a prime example of homeworking?) Are any of our readers – who are in full time employment – already working from home, for at least part of the working week? Let us know. Concrete examples may help strengthen the case for other similarly minded developers – Ed.

The safe path to C++ exceptions

For many developers C++ exception handling is like a dark continent with poor maps and rumours of ferocious beasts. The intrepid Alan Griffiths explores the landmarks and fauna of this region.

In order to discuss exception safety we need to cover a lot of territory. The next section identifies the 'exception safe' mountains in the distance. Please don't skip it in the hope of 'getting to the good stuff' – if you don't take the time to get your bearings now, you'll end up in the wastelands.

Once I've established the bearings, I'll show you a well-trodden path that leads straight towards the highest peak and straight through

a tar pit. From experience, I've concluded that everyone has to go down this way once. Sadly, not everyone comes back; some give up on the journey, others press on deeper and deeper until they sink from sight. I'll show you the tar pit, but having seen the risks we'll return to solid ground.

On our journey I'll tell you the history of how the experts sought for a long time before they discovered a route that bypasses that tar

pit and other obstacles. Most maps don't show it yet, but I'll show you the signs to look out for. I'll also show you that the beasts are friendly and how to enlist their aid.

If you look into the distance, you'll see a range of peaks. These are the heights of exception safety and are our final destination. But before we proceed on our trek let me point out two of the most important of these peaks, we'll be using them as landmarks on our travels...

The mountains (or 'What do we mean by exception safety?')

The difficulty in writing exception safe code isn't in writing the code that throws an exception, or in writing the code that catches the exception to handle it. There are many sources that cover these basics. I'm going to address the greater challenge of writing the code that lies in between the two.

Imagine for a moment the call stack of a running program; function *a* has called function *b*, *b* has called *c*, and so on, until we reach function *x*. Then *x* encounters a problem and throws an exception. This exception causes the stack to unwind, deleting automatic variables along the way, until the exception is caught and dealt with by *a*.

I'm not going to spend any time on how to write functions *a* or *x*. I'm sure that the author of *x* has a perfectly good reason for throwing an exception (running out of memory, disk storage error, or whatever) and that the author of *a* knows just what to do about it (display: 'Sorry, please upgrade your computer and try again!').

The difficult problem is to write all the intervening functions in a way that ensures that something sensible happens as a result of this process. If we can achieve this, we have 'exception safe' code. Of course, that begs the question 'what is something sensible?' To answer this let us consider a typical function *f* in the middle of the call stack. How should *f* behave?

Well, if *f* were to handle the exception, it might be reasonable for it to complete its task by another method (a different algorithm, or returning a 'failed' status code). However, for the moment we are assuming the exception won't be handled until we reach *a*. When function *f* doesn't complete its task, the following objectives apply:

1. If *f* has opened a file, acquired a lock on a mutex, or more generally, if *f* has 'allocated a resource', then the resource may not leak. (The file should be closed, the mutex should be unlocked, etc.)
2. If *f* changes a data structure, then that structure should remain useable, eg no dangling pointers.

In summary, if function *f* updates the system state, then the state must remain valid. Note that isn't quite the same as correct – for example, part of an address may have changed leaving a valid address object containing an incorrect address.

I'm going to call these conditions the *weak exception safety guarantee*. This is the first, and smaller of our landmark mountains. Take a good look at it so that you'll recognise it later. The weak exception safety guarantee may seem daunting but not only will we reach this in our travels, we will be reaching an even higher peak called the *strong exception safety guarantee* that places an additional constraint on *f*:

3. If *f* terminates by propagating an exception, then it has made no change to the state of the program.

Note that it is impossible to implement *f* to deliver either the weak or strong exception safety guarantees if the exception behaviour of the functions it calls isn't known. This is particularly relevant when the client of *f* (that is, function *e*) supplies the functions to be called either as callbacks, as implementations of virtual member functions, or via template parameters. In such cases, the only recourse is to document the constraints on them – as, for example, the standard library does for types supplied as template parameters to the containers.

If we assume a design with fully encapsulated data, then each function need only be held directly responsible for aspects of the object of which it is a member. For the rest, it must rely on the functions it calls to behave as advertised.

We'll rest here a while, and I'll tell you a little of the history of this land. Please take the time to make sure that you are familiar with the two exception safety guarantees. There are other landmarks mentioned in other guides, but we won't be using them today.

A history of this territory

The C++ people first came to visit the land of exceptions around 1990 when Margaret Ellis and Bjarne Stroustrup published the *Annotated reference manual* (ISBN 0-201-51459-1). Under the heading 'experimental features', this described the basic mechanisms of exceptions in the language. In this early bestiary there is a description of one of the friendly beasts we shall be meeting later. It goes by the strange name of 'resource acquisition as initialisation'.

By the time the ISO C++ Standards committee circulated *Committee Draft 1* in early 1995, C++ people were truly living in exception land. They hadn't really mapped the territory or produced an accurate bestiary but they were committed to staying and it was expected that these would soon be available.

However, by late 1996 when *Committee Draft 2* was circulated the difficulties of this undertaking had become apparent. Around this time there came a number of reports from individual explorers. For example, D. Abrahams named the 'weak' and 'strong exception safety guarantee' mountains in his paper *Exception safety in STLPort* (http://www.stlport.org/doc/exception_safety.html).

Some partial maps were also produced by H. Muller (*Ten rules for handling exception handling successfully*, C++ Report, January 96), Herb Sutter (*Designing exception-safe generic containers*, C++ Report, September 97, and *More exception-safe Generic Containers*, C++ Report, Nov/Dec 97), and a little later came a partial sighting of another of the friendly beasts, 'acquisition before release', by Kevlin Henney (*Creating stable assignments*, C++ Report, June 98).

By the time the ISO C++ Language Standard was published in 1998, the main tracks through the territory had been charted. In particular, there are clauses in the standard guaranteeing the behaviour of the standard library functions in the presence of exceptions. In a number of key places, special mention is made of another friendly beast, the *swap* function, which will join us later in our journey.

Okay, that's enough rest, we are going to take the path that heads directly towards the strong exception safety guarantee.

The tar pit

It is time to write an example function, and for this part of the journey I have chosen the assignment operator for the following class:

```
class PartOne { /* omitted */ };
class PartTwo { /* omitted */ };
class Whole
{
public:
    // ...Lots omitted...

    Whole& operator=(const Whole& rhs);

private:
    PartOne* p1;
    PartTwo* p2;
};
```




If you peer carefully through the undergrowth, you can see the first of the friendly beasts. This one is called 'acquisition before release'.

Those of you that have lived in the 'old country' will know the classical form for the assignment operator. It looks something like:

```
Whole& Whole::operator=(const Whole& rhs)
```

```
{
    if (&rhs != this)
    {
        delete p1;
        delete p2;
        p1 = new PartOne(*rhs.p1);
        p2 = new PartTwo(*rhs.p2);
    }
    return *this;
}
```

If you've not seen this before, don't worry because in the new land *it is not safe*. Either of the new expressions could reasonably throw (since at the very least they attempt to allocate memory) and this would leave the `p1` and `p2` pointers dangling. In theory, the `delete` expressions could also throw, but in this article we will assume that destructors never propagate exceptions (see *Destructors that throw exceptions*).

The obvious solution to the problems caused by an exception being propagated is to catch the exception and do some clean up before throwing it again. Let's do that:

```
Whole& Whole::operator=(const Whole& rhs)
```

```
{
    if (&rhs != this)
    {
        PartOne* t1 = new PartOne(*rhs.p1);
        try
        {
            PartTwo* t2 = new PartTwo(*rhs.p2);

            delete p1;
            delete p2;

            p1 = t1;
            p2 = t2;
        }
        catch (...)
        {
            delete t1;
            throw;
        }
    }
    return *this;
}
```

Let's examine why this works...

1. An exception in the first new expression isn't a problem – we haven't yet allocated any resources or modified anything.

2. If an exception is propagated from the second new expression, we need to release `t1`. So we catch it, `delete t1`, and throw the exception again to let it propagate.
3. We are assuming that destructors don't throw, so we pass over the two `delete`s without incident. Similarly the two assignments are of base types (pointers) and cannot throw an exception.
4. The state of the `Whole` isn't altered until we've done all the things that might throw an exception.

If you peer carefully through the undergrowth, you can see the first of the friendly beasts. This one is called 'acquisition before release'. It is recognised because the code is organised so that new resources (the new `PartOne` and `PartTwo`) are successfully allocated before the old ones are released.

We've achieved the strong exception safety guarantee on our first attempt! But there is some black sticky stuff on our boots.

Tar!

There are problems lying just beneath the surface of this solution. I chose an example that would enable us to pass over the tar pit without sinking too deep. Despite this, we've incurred costs: the line count has doubled and it takes a lot more effort to understand the code well enough to decide that it works.

Destructors that throw exceptions

Exceptions propagating from destructors cause a number of problems. For example, consider a `Whole` that holds pointers to a `PartOne`, a `PartTwo`, and a `PartThree` that it owns (ie it must delete them). If the destructors of the parts propagate exceptions, we would have trouble just writing a destructor for `Whole`. If more than one destructor throws, we must suppress at least one exception while remembering to destroy the third part. Writing update methods (like assignment) under such circumstances is either prohibitively difficult or impossible.

There are many situations where an exception propagating from a destructor is extremely inconvenient – my advice is not to allow classes that behave in this manner into your system. (If forced to, you can always 'wrap' them in a well behaved class of your own.)

If you look at the standard library containers, you'll find that they place certain requirements on the types that are supplied as template parameters. One of these is that the destructor doesn't throw exceptions. There is a good reason for this: it is hard to write code that manipulates objects that throw exceptions when you try to destroy them. In many cases, it is impossible to write efficient code under such circumstances.

In addition, the C++ exception handling mechanism itself objects to destructors propagating exceptions during the 'stack unwinding' process. Indeed, unless the application developer takes extraordinary precautions the application will be terminated in a graceless manner.

There is no advantage in allowing destructors to propagate exceptions and a whole host of disadvantages. It should be easy to achieve: in most cases all a destructor should be doing is destroying other objects whose destructors shouldn't throw, or releasing resources – and if that fails an exception won't help.

Apart from the practicalities, what does an exception from a destructor mean? If I try to destroy an object and this fails, what am I supposed to do? Try again?

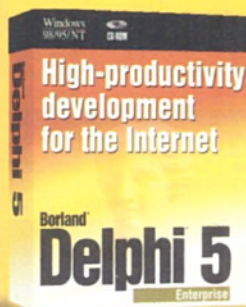
Destructors that throw exceptions? Just say no.



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If you want to, you may take some time out to convince yourself of the existence of the tar pit – I'll wait. Try the analogous example with three pointers to parts or replacing the pointers with two parts whose assignment operators may throw exceptions. With real life examples things get very messy very quickly.

Many people have reached this point and got discouraged. I agree with them: writing code this way is not reasonable. Too much effort is expended on exception safety 'housekeeping' chores like releasing resources. If you hear that 'writing exception safe code is hard' or that 'all those `try...catch` blocks take up too much space', you are listening to someone that has discovered the tar pit.

I'm now going to show you how exception handling allows you to use less code, and I'm not going to use a single `try...catch` block for the rest of the article! (In a real program the exception must be caught somewhere – like function `a` mentioned previously – but most functions simply need to let the exceptions pass through *safely*.)

The royal road

There are three 'golden rules':

1. Destructors may not propagate exceptions.
2. States may be swapped without an exception being thrown.
3. An object may own at most one resource.

We've already met the first rule.

The second rule isn't obvious, but is key to exception safety. The idea is that even if a class owns resources, exchanging the states of

We've incurred costs: the line count has doubled and it takes a lot more effort to understand the code well enough to decide that it works.



two instances should be possible without attempting to allocate additional resources (and throwing an exception if the allocation fails). This isn't true of assignment, which one would tend to assume is a more primitive operation than 'swap'. If you look at the ISO C++ Language Standard (but not the committee drafts), you'll find that the STL containers provide this guarantee by overloading the function `std::swap`. This is the way to approach `swap`, and if you do so consistently it will remain friendly.

The third rule addresses the cause of all the messy exception handling code we've just seen. It was the fact that creating a new second part might fail by throwing an exception that doubled the number of lines in the assignment operator.

We'll now revisit the last example and make use of the above rules. In order to conform to the rule regarding ownership of multiple objects we'll delegate the responsibility of resource ownership to a couple of helper classes. I'm using the `std::auto_ptr<>` template to generate the helper classes here because it is standard, not because it is the ideal choice. (See *The trouble with `std::auto_ptr<>`* for an explanation of the issues with using `auto_ptr<>` in this context.)

```
class Whole {
public:
    // ...Lots omitted...

    Whole& operator=(const Whole& rhs);

private:
    std::auto_ptr<PartOne>    p1;
    std::auto_ptr<PartTwo>    p2;
};

Whole& Whole::operator=(const Whole& rhs)
{
    std::auto_ptr<PartOne> t1(new PartOne(*rhs.p1));
    std::auto_ptr<PartTwo> t2(new PartTwo(*rhs.p2));

    std::swap(p1, t1);
    std::swap(p2, t2);

    return *this;
}
```

Not only is this shorter than the original exception-unsafe example, it still meets the strong exception safety guarantee.

Look at why it works:

1. There are no leaks: whether the function exits normally, or via an exception, `t1` and `t2` will delete the parts they own.
2. The swap expressions cannot throw (second rule).
3. The state of the `Whole` isn't altered until we've done all the things that might throw an exception.

The trouble with `std::auto_ptr<>`

By historical accident, the standard library provides a single smart pointer template known as `auto_ptr<>`. This has what I will politely describe as 'interesting' copy semantics. Specifically, if one `auto_ptr<>` is assigned (or copy constructed) from another then they are *both* changed – the `auto_ptr<>` that originally owned the object loses ownership and becomes 0. This is a trap for the unwary traveller! There are situations that call for this behaviour, but on most occasions that require a smart pointer the copy semantics cause a problem.

When we replace `PartXXX*` with `auto_ptr<PartXXX>` in the `Whole` class we still need to write the copy constructor and assignment operator carefully to avoid a `PartXXX` being passed from one `Whole` to another (with the consequence that one `Whole` loses its `PartXXX`).

Worse than this, if we attempt to hide the implementation of `PartXXX` from the client code using a forward declaration, we also need to write the destructor. If we don't, the one the compiler generates for us will not correctly destroy the `PartXXX`. This is because the client code causes the generation of the `Whole` destructor and consequently instantiates the `auto_ptr<>` destructor without having seen the class definition for `PartXXX`. The effect of this is that the destructor of `PartXXX` is never called. (A good compiler may give a cryptic warning about deleting an incomplete type, but the language standard requires that the code compiles – although the results are unlikely to be what the programmer intended.)

Although the standard library doesn't support our needs very well, it is possible to write smart pointers that do. There are a couple of examples inside the `arglib` library on my website. (Both `arg::body_part_ptr<>` and `arg::grin_ptr<>` are more suitable than `std::auto_ptr<>`.)

Oh, by the way, I've not forgotten about self-assignment. Think about it – you will see there is no need to test for self-assignment. Such a test may be a bad idea: Francis Glassborow suggested a similar style of assignment operator as a speed optimisation in *Overload* 19 (assuming that self-assignment is very rare in real code). Following on from Francis Glassborow's article, Kevlin Henney explored its exception safety aspects in *Overload* 20 & 21 and in *C++ Report* (August 1997).

We are on much firmer ground than before: it isn't hard to see why the code works and generalising it is simple. You should be able to see how to manage a `Whole` with three `auto_ptr`s to `Parts` without breaking your stride.

You can also see another of the friendly beasts for the first time. Putting the allocation of a resource (here a new expression) into the initialiser of an instance of a class (eg `auto_ptr<PartOne>`) that will delete it on destruction is 'resource acquisition as initialisation'. And, of course, we can once again see 'acquisition before release'.

(Yes, in this case we could use assignment instead of `swap` to make the updates. However, with a more complex type `swap` is necessary, as we shall see later. I use `swap` in this example for consistency.)

Before I go on to deal with having members that may throw when updated, I've a confession I need to make. It is possible, and usual, to write the assignment operator more simply than this. I've shown the above method because it is more general and can be applied when only some aspects of the state are being modified. The following applies only to assignment:

```
Whole& Whole::operator=(const Whole& rhs)
{
    Whole(rhs).swap(*this);
    return *this;
}
```

Remember the second rule – `Whole` is a good citizen and provides a `swap` method. Also, I've never implemented a class that supported assignment and not copy construction. Consequently an assignment operator can be implemented using copy construction and `swap` as above. For completeness, I'll show these methods too.

```
void Whole::swap(Whole& that)
{
    std::swap(p1, that.p1);
    std::swap(p2, that.p2);
}
```

```
Whole::Whole(const Whole& rhs)
: p1(new PartOne(*rhs.p1)),
  p2(new PartTwo(*rhs.p2))
{
}
```

One further point about making `Whole` a good citizen is that we need to overload `std::swap` to work through the `swap` member function. By default, `std::swap` will use assignment. The standard allows us to overload existing names in the `std` namespace on our own types, and it is good practice to do so in the header that defines the type.

```
namespace std
{
    inline void swap(exe::Whole& lhs, exe::Whole& rhs)
    {
        lhs.swap(rhs);
    }
}
```

This avoids any unpleasant surprises for client code that attempts to swap two `Wholes`.

Although we've focused on attaining the higher peak of strong exception safety guarantee, we've actually covered all the essential techniques for achieving either strong or weak exception safety. The remainder of the article shows the same techniques being employed in a more complex example and gives some indication of the reasons you might choose to approach the lesser altitudes of weak exception safety.



In bad weather

We can't always rely on bright sunshine, or on member variables that are as easy to manipulate as pointers. Sometimes we have to deal with rain and snow or base classes and member variables with internal state.

To introduce a more complicated example, I'm going to elaborate the `Whole` class we've just developed by adding methods that update `p1` and `p2`. Then I'll derive an `ExtendedWhole` class from it that also contains an instance of another class: `PartThree`. We'll be assuming that operations on `PartThree` are exception safe, but, for the purposes of discussion, I'll leave it open whether `PartThree` offers the weak or the strong exception safety guarantee.

```
Whole& Whole::setP1(const PartOne& value)
{
    p1.reset(new PartOne(value));
    return *this;
}
```

```
Whole& Whole::setP2(const PartTwo& value)
{
    p2.reset(new PartTwo(value));
    return *this;
}
```

```
class ExtendedWhole : private Whole
{
public:
    /* Omit constructors & assignment */
    void swap(const ExtendedWhole& rhs);
    void setParts(
        const PartOne& p1,
        const PartTwo& p2,
        const PartThree& p3);
}
```

```
private:
    int count;
    PartThree body;
};
```

The examples we've looked at so far are a sufficient guide to writing the constructors and assignment operators. We are going to focus on two methods: the `swap` member function and a `setParts` method that updates the parts.

Swapping looks pretty easy – we just swap the base class, and each of the members. Since each of these is a non-throwing operation, the combination of them is also a non-throwing operation.

```
void ExtendedWhole::swap(ExtendedWhole& rhs)
{
    Whole::swap(*this);
```


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```

std::swap(count, rhs.count);
std::swap(body, rhs.body);
}

```

Writing `setParts` looks equally easy: `Whole` provides methods for setting `p1` and `p2`, and we have access to `body` to set that. Each of these operations is exception safe. Indeed, the only one that might *not* make the strong exception safety guarantee is the assignment to `body`. Think about it for a moment: is this version of `setParts` exception safe? And does it matter if the assignment to `body` offers the weak or strong guarantee?

```

void ExtendedWhole::setParts(
    const PartOne& p1,
    const PartTwo& p2,
    const PartThree& p3)
{
    setP1(p1);
    setP2(p2);
    body = p3;
}

```

Let's go through it together. None of the operations leak resources and `setParts` doesn't allocate any, so we don't have any leaks. If an excep-

tion propagates from any of the operations, then they leave the corresponding sub-object in a useable state, and presumably that leaves `ExtendedWhole` useable (it is possible, but in this context implausible, to construct examples where this isn't true). However, if an exception propagates from `setP2` or from the assignment, then the system state has been changed. And it doesn't matter which guarantee `PartThree` makes.

The simple way to support the strong exception safety guarantee is to ensure that nothing is updated until we've executed all the steps that might throw an exception. This means taking copies of sub-objects and making the changes on the copies, prior to swapping the state between the copies and the original sub-objects:

```

void ExtendedWhole::setParts(
    const PartOne& p1,
    const PartTwo& p2,
    const PartThree& p3)
{
    Whole temp(*this);
    temp.setP1(p1).setP2(p2);
    body = p3;
    Whole::swap(temp);
}

```

Once again, does it matter if the assignment to `body` offers the weak or strong guarantee? Yes it does. If it offers the strong guarantee, then all is well with the above. If not, then the assignment needs to be replaced with 'copy and swap' vis:

```
PartThree(p3).swap(body);
```

We have again attained the highest peak, but this may not be healthy. On terrestrial mountains above a certain height there is a 'death zone' where the supply of oxygen is insufficient to support life. Something similar happens with exception safety: there is a cost to implementing the strong exception safety guarantee. Although the code you write isn't much more complicated than the 'weak' version, additional objects are created and these allocate resources at runtime. This causes the program to make more use of resources and to spend time allocating and releasing them.

Trying to remain forever at high altitude will drain the vitality. Fortunately, the weak exception safety guarantee is below the death zone: when one composes operations that offer this guarantee one automatically attains the weak guarantee (as the first version of `setParts` shows, this is not true of the strong guarantee). From the weak guarantee there is an easy climb to the strong guarantee by means of the 'copy and swap' idiom we've just encountered.

Looking back

Before we descend from the peak of strong exception safety guarantee and return to our starting point look back over the route we covered. In the distance you can see the well-trampled path that led to the tar pit and just below us the few tracks leading from the tar pit up a treacherous scree slope to where we stand. Off to the left is the easier ridge path ascending from 'weak exception safety guarantee' and beyond that the road that led us past the tar pit. Fix these landmarks in your mind and remember that the beasts we met are not as fierce as their reputations. ■

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The cost of exception handling

Compiler support for exception handling does make the generated code bigger (figures vary around 10-15%), but only for the *same code*. I have here a comparable piece of code to the final example of this article that has been handed down the generations. (Actually, I've made it up – but I was around back then and remember working with code like this, so it is an authentic fake.)

```

int ExtendedWhole::setParts( const PartOne& p1,
                             const PartTwo& p2, const PartThree& p3)
{
    Whole tw;
    int rcode = tw.init(*this);

    if (!rcode) rcode = tw.setP1(p1);
    if (!rcode) rcode = tw.setP2(p2);

    if (!rcode)
    {
        PartThree t3;
        rcode = t3.copy(p3);

        if (!rcode)
        {
            Whole::swap(tw);
            body.swap(t3);
        }
    }

    return rcode;
}

```

To modern eyes the need to repeat this testing & branch on return codes looks very much like the tar-pit we encountered earlier – it's verbose, hard to validate code. I'm not aware of any trials where comparable code was developed using both techniques, but my expectation is that the saving in hand-written code from using exceptions significantly outweighs the extra cost in compiler-generated exception handling mechanisms.

Please don't take this as a rejection of return codes, they are one of the primary error reporting mechanisms in C++. But if an operation will only fail in exceptional circumstances (usually running out of a resource) or cannot reasonably be expected to be dealt with by the code at the call site, then exceptions can greatly simplify the task.

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GUIs to go

Dave Jewell enjoys an excursion with the Qt portability toolkit.

Qt is the name of a high-level C++ application framework created by Troll Tech, a Norwegian company. The latest version of Qt is 2.02, available for Windows, Linux, and other Unix/X11 platforms. In a nutshell, Qt allows you to create modern looking, state of the art software without sacrificing portability or visual appeal. Unlike MFC, it was designed with portability in mind, and it provides a much higher level of abstraction of the Windows API.

And speaking of abstraction, I'm going to describe Qt using an actual program as an example, rather than trying to describe concepts in purely abstract terms. I chose Troll Tech's 'Hello, World' sample application for this (see Figure 1) because it's of a manageable size and it nicely illustrates a number of Qt's capabilities. What isn't obvious from the illustration is that the text itself is animated, rather like a flag rippling in the wind, and at the same time, the colour rainbow is steadily moving across the text. If you want the program to say something other than 'Hello, World', you can specify a command line argument that will be used instead. In the illustration, the code is running under Linux, but you can compile exactly the same source code for Windows 9x and NT. Quite impressive for a 'Hello, World' application... Troll Tech's description of this program rather smugly states that it didn't bother with a classical 'Hello, World' program because the code would have been too short!

How does it work? First of all, take a look at Listing 1. This source file, `main.cpp`, encompasses the outer level of the application. As you can see, the program begins by creating an instance of the `QApplication` class. Every Qt program needs to create an instance of this class – it's responsible for fundamental operations such as event handling and you can think of it as loosely equivalent to `CWinApp` (MFC) or `TApplication` (VCL). The constructor for `QApplication` receives the standard `argc` and `argv` parameters from `main` so that any Qt-specific command line arguments can be processed at this point.

Once the application object has been created, the code then parses the command line (if this has been used) and uses it to build a string consisting of the concatenation of all command line parameters. From this code, you'll see that Qt has an easy to use string class, `QString`, which greatly simplifies string handling and provides some nice features such as a `+=` string concatenation operator. Again, this is analogous to the `CString` operator in MFC. If no command line parameters were supplied, then the string variable is set to the default value, 'Hello, World', and this string becomes the wavy text that's used in the window. With the recent advent of Qt 2.x, the `QString` class provides direct support for Unicode.

The next job is to create an instance, `h`, of the `Hello` class, the definition of which can be found in `hello.h`, shown in Listing 2. For now, don't worry about what all this stuff means – we'll revisit this class definition later. Suffice it to say that the `Hello` class is derived from `QWidget` and that it corresponds directly to the window that's displayed by

our sample program. Notice also that the wavy text string is passed to the `Hello` constructor where it's stored internally for later consumption.

As you'd expect, the `setCaption` method of `QWidget` sets the caption of the displayed window, which agrees with what we see in Figure 1. The `setFont` method obviously sets the font that's used for display purposes – in this case, the code creates a new `QFont` object with specified typeface, size, and attributes, passing the newly created `QFont` instance to the `setFont` method. The meaning of the `setBackgroundColor` method is also pretty obvious, but the call to `setMainWidget` is less so. Every

Qt application has to have a main widget (for widget – think window or control) and the main widget is special because closing this widget terminates the application's event loop and stops the program. The event loop is started by calling the `exec` method of the `QApplication` object which, of course, corresponds to `CWinApp.Run`, `TApplication.Run`, and so on. Before calling this routine, the window's `show` method is called to make it visible.

Of slots and signals and meta object compilers...

Okay, Dave, so what's this funny-looking call to `QObject::connect` inside the `main` function? More to the point, what are those non-standard section headers in the class declaration of `Hello` (Listing 2)? The answer is that all this stuff relates to the innovative signal/slot mechanism, which forms the backbone of Qt's message handling system. In Qt, an event or message is referred to as a *signal*, while a recipient of that signal (what might more conventionally be called an event handler) is referred to as a *slot*. Qt allows you to build signals and slots that exhibit a one-to-many relationship in both directions. Thus, you might have a single slot that handles multiple signals, or you might have a single signal that is received by multiple slots. When you associate a specific slot with a specific signal, this is referred to (in Qt-speak) as establishing a connection between them.

Troll Tech set out to design an efficient event handling mechanism that was both portable and typesafe. MFC message maps, for example, are not typesafe because they're based on macros. Qt's signal/slot mechanism on the other hand, is both portable and typesafe. Thus, a signal that 'emits' three integers and a string can only be connected



Figure 1 – This is the official Qt 'Hello, World' program.

to a slot that accepts the same number and type of arguments. In the main routine of the program under discussion, we find:

```
QObject::connect( &h, SIGNAL(clicked()),
                 &a, SLOT(quit()) );
```

The function prototype for `QObject::connect` (a static function, callable without requiring an instance of `QObject`) looks like:

```
bool QObject::connect (const QObject *sender,
                      const char *signal, const QObject *receiver,
                      const char *member )
```

The first two parameters specify the object that's emitting the signal, and the signal itself. The second two parameters specify the object that's receiving the signal, and the name of the slot. Thus, in the above code, the call to `connect` could be paraphrased as: 'whenever a `clicked` signal is generated on the application window, `h`, send it to the `quit` slot on the application object, `a`.'

As you might guess, `quit` is a predefined slot belonging to the `QApplication` class. When called, it terminates the program and returns an error code of zero to the operating system. Thus, the overall effect of this `connect` call is that whenever the mouse is clicked in the application window, the program terminates.

As you can see from Listing 2, there are some strange-looking sections in the C++ class declaration with names such as `signals` and `private slots`. And a Qt object declaration begins with the `Q_OBJECT` marker after the opening brace. This is required by `moc` – rather than implementing all this stuff using a proprietary (and non-standard) C++ compiler, Troll Tech cunningly wrote a special compiler called `moc` (meta object compiler). The `moc` program takes the Qt class declarations and generates standard C++, which can then be compiled using an ordinary compiler under Windows or Linux. (C++ veterans may remember `cfront`, a similar concept that was used to host C++ on systems having only a straight C compiler.)

```
#include "hello.h"
#include <qapplication.h>
/*
int main( int argc, char **argv ) {
    QApplication a(argc,argv);
    QString s;
    for ( int i=1; i<argc; i++ ) {
        s += argv[i];
        if ( i<argc-1 )
            s += " ";
    }
    if ( s.isEmpty() ) s = "Hello, World";
    Hello h( s );
    h.setCaption( "Qt says hello" );
    QObject::connect( &h, SIGNAL(clicked()), &a, SLOT(quit()) );
    h.setFont( QFont("times",32,QFont::Bold) ); // default font
    h.setBackgroundColor( Qt::white ); // default bg color
    a.setMainWidget( &h );
    h.show();
    return a.exec();
}
```

Listing 1 – The outer level of the application.

```
#ifndef HELLO_H
#define HELLO_H
#include <qwidget.h>

class Hello : public QWidget
{
    Q_OBJECT
public:
    Hello( const char *text, QWidget *parent=0,
          const char *name=0 );

signals:
    void clicked();
protected:
    void mouseReleaseEvent( QMouseEvent * );
    void paintEvent( QPaintEvent * );
private slots:
    void animate();
private:
    QString t;
    int b;
};
#endif
```

Listing 2 – Definition of the Hello class.

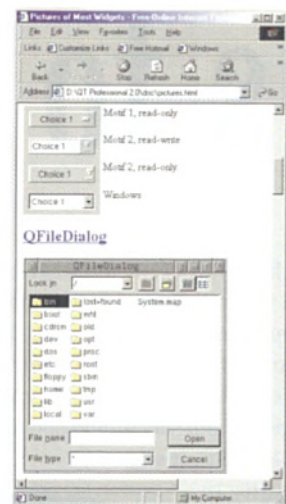


Figure 2 – Qt includes excellent online HTML-based documentation including a document that shows all the various 'widgets' (controls) available to Qt programmers.

In Listing 2, the class declaration tells us that the `Hello` class generates a parameter-less signal called `clicked`. It also has a private slot called `animate`, which is used only within the class itself – another class cannot send a signal to this slot.

Hello there, Qt!

Let's look at the implementation code for the `Hello` class (see Listing 3). For the sake of brevity, I've slightly condensed this listing from the Troll Tech original. The `Hello` constructor saves the passed `QString` text (remember, this is our 'wavy text') into the private `QString` member, `t`. Similarly, the internal counter `b` is initialised to zero. (Yeah, it would be nice if Troll Tech used more descriptive variable names in its sample code...)

The constructor next creates a new `QTimer` object, `timer`. Notice that `this` is passed as the parent object, via the constructor call. As with other application frameworks, such as VCL, implementing a hierarchical arrangement of parent and child objects relieves the programmer from the burden of destroying child objects when the parent terminates. In this case, the `QTimer` is automatically destroyed when the `Hello` instance is released.

Next, an overloaded variation of the `connect` method is used to associate the `timeout` signal (generated by the `timer` object) with the aforementioned private `animate` slot. This means that `animate` will be called every time that `timer` triggers. This happens once every 40 milliseconds (ie 25 times a second), determined by the first parameter to the `timer`'s `start` method. An optional second parameter, not used here, can make the timer behave like a 'one-shot'. Finally, the constructor sets an initial window size and terminates.

We take up the story 40 milliseconds later when the first timer tick is received. This results in a call to the `animate` slot, which then calls `repaint` to redraw the window contents. In turn, this results in a call to the `paintEvent` method, which has been overridden by the `Hello` class – and that's where we get introduced to `QPixmap`, which is the Qt equivalent of a Windows bitmap, and `QPainter`, which you can think of as being somewhat like a device context on steroids.

In this particular case, the 'wavy' text is drawn into an off-screen `QPixmap` object so as to eliminate flicker before being blitted to the screen in a single operation later. As you can see, the code begins by determining whether the string `t` is empty or not (actually, an impos-

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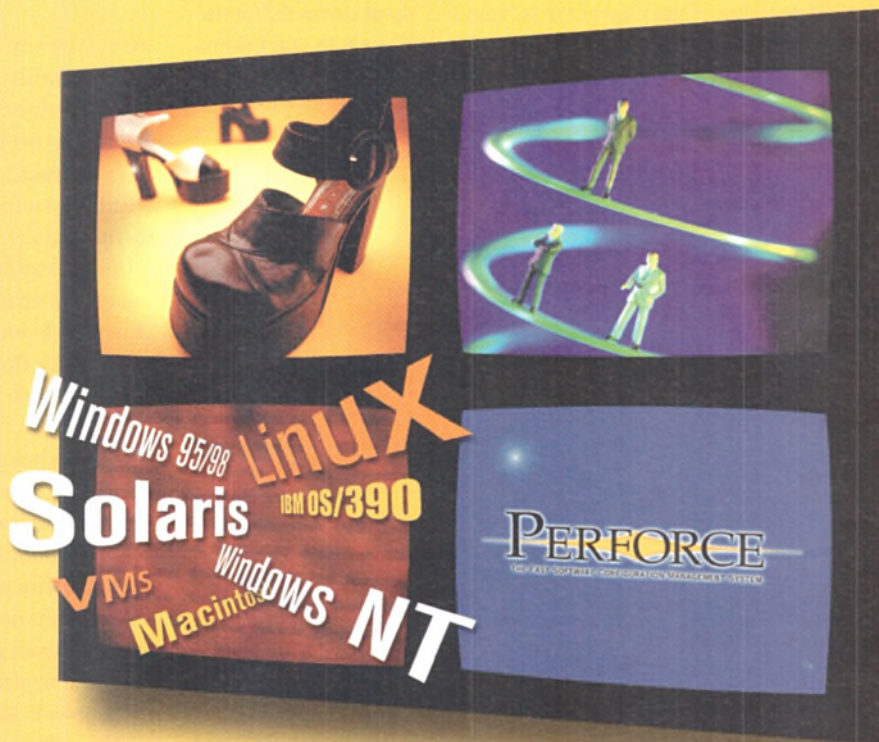
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sibility for this particular program) and then goes on to compute the size of the off-screen bitmap based on the font metrics of the current font. In this instance, `fontMetrics` is a method of `QWidget`, and therefore retrieves information relating to the font that was set up by the `setFont` method in Listing 1.

An initial `QPixmap` object is instantiated and this object is passed to the `begin` method of the `QPainter` object. This is rather like selecting a bitmap into a device context in Redmond-land. The code ensures that the `QPainter` object ends up with the same font that's being used by `this`, and then the code steps through the string a character at a time, drawing each character into the off-screen bitmap. For each character, the colour is sequenced and the vertical position of the character is 'wiggled' up or down using the table of sine values in `sin_tbl`. The initial colour and start point for the sine curve are determined by the value of `b`, which – as

```
#include "hello.h"
#include <qpushbutton.h>
#include <qtimer.h>
#include <qpainter.h>
#include <qpixmap.h>

// Constructs a Hello widget. Starts a 40 ms animation timer.
Hello::Hello( const char *text, QWidget *parent,
             const char *name ) :
    QWidget(parent, name), t(text), b(0)
{
    QTimer *timer = new QTimer(this);
    connect( timer, SIGNAL(timeout()), SLOT(animate()) );
    timer->start( 40 );
    resize( 260, 130 );
}

// This private slot is called each time the timer fires.
void Hello::animate()
{
    b = (b + 1) & 15;
    repaint( FALSE );
}

// Handles mouse button release events for the Hello widget.
// We emit clicked() signal when mouse is released inside
// the widget.
void Hello::mouseReleaseEvent( QMouseEvent *e )
{
    if ( rect().contains( e->pos() ) ) emit clicked();
}

// Handles paint events for the Hello widget.
// Flicker-free update. The text is first drawn in the pixmap
// and the pixmap is then blt'ed to the screen.
void Hello::paintEvent( QPaintEvent * )
{
    static int sin_tbl[16] = { 0, 38, 71, 92, 100, 92, 71, 38,
                             0, -38, -71, -92, -100, -92, -71, -38 };
    if ( t.isEmpty() )
        return;

    // 1: Compute some sizes, positions etc
    QFontMetrics fm = fontMetrics();
    int w = fm.width(t) + 20;
    int h = fm.height() * 2;
    int pmx = width()/2 - w/2;
    int pmy = height()/2 - h/2;

    // 2: Create pixmap fill with widget's background
    QPixmap pm( w, h );
    pm.fill( this, pmx, pmy );

    // 3: Paint the pixmap. Cool wave effect
    QPainter p;
    int x = 10;
    int y = h/2 + fm.descent();
    int i = 0;
    p.begin( &pm );
    p.setFont( font() );
    while ( !t[i].isNull() ) {
        int i16 = (b+i) & 15;
        p.setPen( QColor((15-i16)*16, 255, 255, QColor::Hsv) );
        p.drawText( x, y-sin_tbl[i16]*h/800, t.mid(i,1), 1 );
        x += fm.width( t[i] );
        i++;
    }
    p.end();

    // 4: Copy the pixmap to the Hello widget
    bitBlt( this, pmx, pmy, &pm );
}
```

Listing 3 – Implementation of the Hello class.

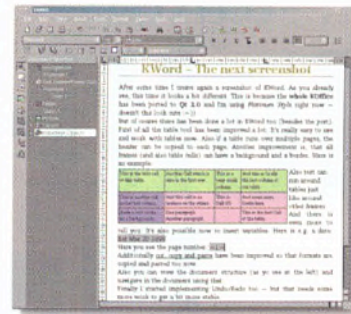


Figure 3 – This screenshot shows Qt's support for toolbars, tree-views, rich-text, and so forth.

we've already seen – varies between 0 and 15, incrementing once every 40 milliseconds.

The only other code worthy of note is the `mouseReleaseEvent` event, also overridden by the `Hello` class. This corresponds to a button-up message in Windows. Provided that the mouse was released within the window rectangle, the Qt-specific `emit` construct is used to 'raise' a `clicked` signal. As with the header code we saw in Listing 2, this gets transmogrified into standard C++ courtesy of the `moc` compiler, thus ensuring that the application closes when the window is clicked. Obviously, the code would be simpler if the user was forced to just click the window close-box in the usual way, but this example gives us a nice little example of how to declare and raise signals.

Under the hood...

For the terminally curious, Listing 4 shows a selected portion of the output of `moc` when compiling the header file from Listing 2. As you'll see, the compiler has converted the Qt-specific stuff into standard C++, adding a hidden method called `staticMetaObject`. This method gets called automatically from the constructor of `QObject`, the class from which all Qt objects derive. Its main job is to initialise the meta-object corresponding to the class. Only one of these static meta-objects is instantiated regardless of how many objects there are of this class.

The main purpose of the meta-object itself is to encapsulate information about the available signals and slots of a particular object. The `clicked` signal, for example, is transmogrified into a private method called `clicked` that calls an internal method of `QObject`, `activate_signal`. This internal method, in turn, is responsible for calling all the slots currently associated with this signal. Clever stuff!

In this tour of Qt's 'Hello, World' application, I hope I've got across something of the elegance of the Qt application framework. However, it's got to be admitted that I've only scraped the surface of what Qt can do for you. The system includes all the usual widgets such as list-boxes, push buttons, checkboxes, radio buttons, menus, and so forth. And it goes far beyond some competing portability toolkits by offering such things as progress bars, track-bars, tree-views, toolbars, status bars, splitters, scrolling views, common file dialogs, tables, tabbed dialogs, and most of the gizmos that Windows programmers are used to finding in the Microsoft-supplied common controls and dialogs DLLs. What's different, of course, is that Qt is portable. If you have a requirement for a widget that doesn't exist, creating your own is a pretty straightforward job.

To Linux and beyond

If you want to get a feel for the real power of Qt, and you're not already using Linux, then I'd recommend that you install Linux and be sure to use a distribution that comes with the deservedly popular KDE desktop. The desktop environment, and its host of supporting appli-

cations are all built on top of Qt and provide an excellent demonstration of what can be done with Qt. Troll Tech's website can be found at <http://www.troll.no>.

Some enterprising individuals have written Linux-hosted development environments that simplify the process of Qt-based development. One such is QT Architect, which you can find at <http://www.qtarch.intra-nova.net>. In fact, if you want to get *really* serious about Qt development, you might cast an eye over <http://koffice.kde.org> where you'll see that a complete Office-style application suite is under development!

If you're about to undertake a major new development effort for Windows, there are very compelling reasons for basing your program around Qt rather than MFC, not least the possibility of a future port to Unix/X11 and Linux. If you can increase your potential marketplace with minimum effort, then why not do so?

Qt comes with superb HTML-based help documentation and a vast number of sample programs to get you started. All of the sample code compiled without a hitch under Windows, using Visual C++ 6.0 and setup was almost as simple under Linux. The official Qt 'Bible' is *Programming with Qt* by Matthias Kalle Dalheimer, published by O'Reilly (ISBN 1565925882). This book is written primarily for Qt 1.x, but includes a chapter on Qt 2.0 and – in truth – relatively little effort is required to upgrade existing source code to Qt 2.0.

The code (and source) for the Unix/X11 and Linux version of Qt 2.02 is freely downloadable from the Troll Tech website. Armed with this code, you can create Linux applications, tools, and utilities without restriction provided that you distribute your code under a GPL-style licence. If you want to create commercial applications, then

```
void Hello::staticMetaObject()
{
    if ( metaObj ) return;
    QWidget::staticMetaObject();

    typedef void(Hello::*m1_t0)();
    m1_t0 v1_0 = &Hello::animate;
    QMetaData *slot_tbl = QMetaObject::new_metadata(1);
    slot_tbl[0].name = "animate()";
    slot_tbl[0].ptr = *((QMember*)&v1_0);
    typedef void(Hello::*m2_t0)();
    m2_t0 v2_0 = &Hello::clicked;
    QMetaData *signal_tbl = QMetaObject::new_metadata(1);
    signal_tbl[0].name = "clicked()";
    signal_tbl[0].ptr = *((QMember*)&v2_0);
    metaObj = QMetaObject::new_metaobject(
        "Hello", "QWidget", slot_tbl, 1, signal_tbl, 1 );
}

// SIGNAL clicked
void Hello::clicked()
{
    activate_signal( "clicked()" );
}
```

Listing 4 – Output of moc when compiling Listing 2.

you'll need a commercial licence for Qt. Troll Tech refers to this as the Professional version of Qt, which includes integrated support for OpenGL and sundry other goodies. For Qt 2.02 it costs \$1,550 for either the Windows or Unix/X11 version.

In a future issue I will continue my look at portability toolkits by considering the Open Source phenomenon that is GTK+.

Dave Jewell is a freelance consultant, programmer, and technical author specialising in low-level systems programming under Windows and DOS. He is the author of Instant Delphi, published by Wrox Press. You can contact Dave as djewell@cix.compulink.co.uk.

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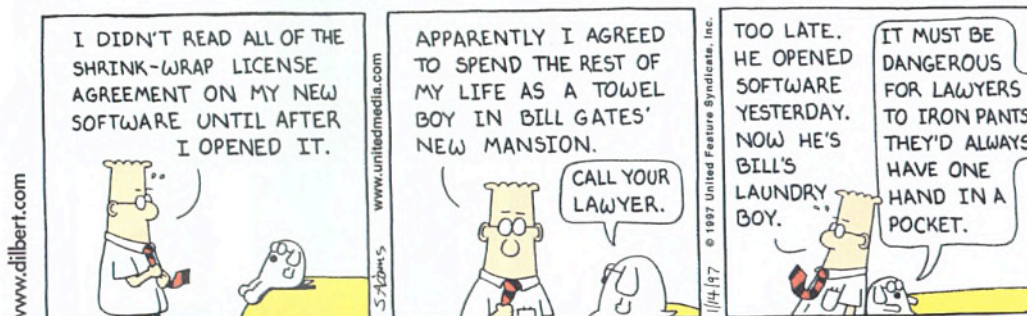
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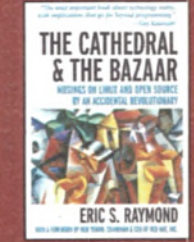
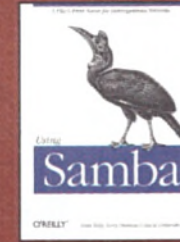
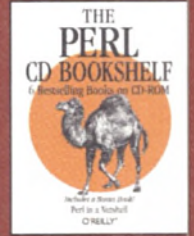
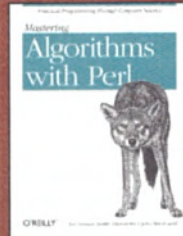
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Surveying on the Web

The brief was to create a questionnaire engine, something that could take in questions at one end and generate usable web pages at the other. Peter Collinson divided the problem.

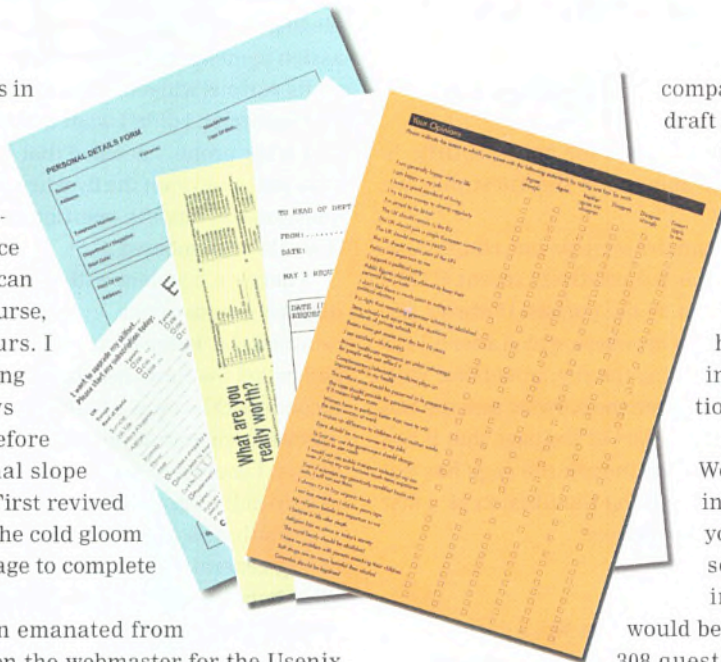
I've always felt that my year starts in September when I get back from my annual sleep break in August. At the end of my year, July seems to flash by. I keep gazing out the window saying 'it's nice out, but sadly *this* needs doing so I can go away on holiday'. August, of course, is drowned by dreadful downpours. I don't care; I spend the time catching up on sleep. The weather always revives a little in September before descending the slippery autumnal slope into winter. I follow the weather. First revived by my holiday, I too descend into the cold gloom of the winter, but hopefully I manage to complete a bunch of projects as I go.

One large project this autumn emanated from the USA. For some years, I've been the webmaster for the Usenix site (<http://www.usenix.org>). Sitting in the UK with a part-time job for this long-running Unix users group with offices in California says something about how the Internet has shrunk the world. It's possible to live 6,000 miles away from the office and get on very nicely, thank you. Regular meetings are a must for trust building, and you do need to realise that you cannot easily make consensus decisions by email. Actually, it's almost a plus that I can change things in the very early morning in the USA. The negative side is that I do seem to find myself working when the people in California leave the office, but then I'm very probably a workaholic or I have too much to do – you choose.

A special interest group of Usenix is SAGE, the organisation for System Administrators. It was SAGE that had prompted a questionnaire as part of some work that's going on to define what system administrators do and what they need to know. I was not expecting the arrival of the job. People often talk vaguely about projects and I don't expect them to materialise. This one was supposed to turn up in June, which would have been hard to cope with, but do-able. When it didn't come, I breathed a hearty sigh of relief and hoped it had gone away. It hadn't. A nearly reasonable brief, encapsulated as a Word document, landed in my email inbox around the second week in September.

The brief

The task was to automate a large survey on how System Administrators perceive their job so that it could be run over the Web. The questionnaire had been constructed by the Human Resources Research Organisation, a well respected US survey and research



company based in Washington DC. The draft questionnaire held 308 questions.

If this sounds mad, it didn't at the time. Nearly all of the questions were 'rate this statement using this scale', others were 'tick all that apply', and some 'yes/no'. Survey organisations have been used to using mark sensing for data capture, and the question style probably reflects that.

Sounds boring? Just save the Word document as HTML, hack it into shape, write a quick script, and you're done? Well, no. This type of solution results in very labour intensive maintenance, and it

would be hard to set up a script to manage 308 questions in a way that you would be convinced there were no bugs. Also, remem-

ber one of my pet aphorisms: 'One off jobs always happen more than once'. At the time I was sent the brief there were mutterings about changing questions and in the end several questions were altered, some were deleted, some were added. Much of the original text was changed, in some cases more than once. These changes happened over a two or three-week development period in late September based on the reality of what I had created on the Web. Had I made a set of static documents, I would have spent ages hand hacking the pages and the controlling script back into shape after these changes were requested.

Changing pages with editors is time-consuming and boring, because of the complexity added by the HTML. Hand editing can also introduce errors and, because some web browsers are too forgiving, these errors can persist in the source. Of course, being an old hacker, I spit on WYSIWYG HTML editors, preferring to hand edit my HTML. I am not sure that this is entirely a macho exercise. HTML editors often don't seem to be able to create good quality compact HTML; their output is often full of extraneous extra rubbish. Some HTML that's generated from well-known programs can be extremely illegal, such that it fails validation suites. You can tell that I've had bad experiences with such output.

HTML editors from Mr Gates' organisation often seem to use bits of the Microsoft world that you wish they wouldn't. The survey in question may attract users who have strong opinions about how the Web should be used, and more opinions on the doings of Mr Gates. Strange as it may seem, in an open software world, people do get on without recourse to anything with 'Office' in its title.



To generate input for the validation phase, the decoder is run from the source data and builds separate lists for each of

the different types of variables that can appear on the page.

Also, browser portability, and hence browser accessibility, is important. We want everyone to be able to see the questions; we want their answers.

In the end, I segmented the questionnaire sections into chunks separated by `<DIV>` (division) tags, which is a relatively recent HTML invention that is sure to be frowned on by the purists. However, the pages were large and I knew that current browsers, which after all are used by something like 94% of people using the site, would deal with `<DIV>` sections in a more friendly way. When the browser sees the end of the section, `</DIV>`, it will render the part of the page that it has collected, so the user can see things even though the page has not loaded completely. This is one way of giving the illusion of a fast response when faced with loads of text to deliver.

Making it happen

As usual, I've digressed away from the plot. The Word document of several paper pages landed in my inbox, and I was supposed to turn it into a questionnaire. There was another whisper that helped to push me in the direction that I went. The whisper said that there would be further questionnaires in the future. The whisper was true; another brief has thudded into my electronic inbox as I write this. Without a doubt, I needed to create a questionnaire engine, something that could take in questions and generate usable web pages at the other end.

Word does one thing 'nearly' right; you can dump files as 'Text with line breaks' and get a Latin-1 file. That's a 'nearly' because Word uses some of the gaps in the Latin-1 encoding for its own purposes, like storing 'smart quotes'. After some experimentation, I have a small Perl script that will turn the output from 'Text with Line breaks' into something that is portable into the Unix world. This is where I began to code the questionnaire engine.

I started with the basic idea that I would create a Perl script that read in the code source for a particular part of the questionnaire, something like:

```
QUESTION: What is your gender?
OPTIONAL: YES
LAYOUT: 2COL
TYPE: RADIO
OPTION: Male
OPTION: Female
```

I like this type of input to programs because it's easy to parse and trivial to create. The 'What is your gender?' text started off in the original Word document, so I was not engaged in retyping the questions. The script knows about a couple of question forms. The first is 'Ratings', which generates a statement and a set of radio buttons

allowing the user to choose whether the statement is 'not applicable' or select a score from one to five ranging from 'slightly' to 'very'. The second form is a general purpose 'Question'. The keywords tell the script how to layout the question on the page. In the example, we have a radio button with two options. We will lay the buttons out across the page (2COL). This question is optional, so we don't complain when the user fails to complete it. The system allows for various types of HTML input that map onto the different types of response that the question may demand, like checkboxes or numeric input in a given range.

This all looked to be an interesting way to go. It was certainly simple to generate the source text data for the system. I needed a way to assign names to each question internally, because HTML uses names on its various widgets when sending the information back to the processing script. I didn't want to do this by hand, because that's tedious and error prone. I decided that the easiest way of numbering questions was to do it on the fly when generating the page, so if the gender question was the fifth question in section 1 of the questionnaire, then it would be numbered S1Q5.

There's a problem with checkbox type questions; each of these needs a unique name, even though they are all logically related. I retained the 'letter then number' flavour of the numbering scheme and called the first checkbox of question 10 in section 2 S2Q10A, the second checkbox was S2Q10B, and so on. There were no questions that needed more than 26 options, but I allowed for 52 by using lower case letters. I wanted to retain the letter/number/letter idea because it's easy to pull such a string apart using a Perl regular expression.

I now have a numbering scheme, and can process the script file on the fly, generating questions, laying them out, and numbering them. What happens when the user presses Submit (or whatever) to send the completed data back to a script for data validation and storage? I have dug myself into an interesting problem. Having generated the numbering scheme on the fly, I need to scan the source file again to work out that S1Q5 is a radio button, or that S2Q10B is a checkbox that hasn't been set by the user.

At this point, I had a working questionnaire decoder and could generate pages easily. I had created the code to confirm my ideas on the source file format. I decided to make the questionnaire decoder retain information about the types of things it had generated, so it could be used to scan the script again to give information to the CGI script that was to receive the results. Actually, it's convenient to use a single script for the whole operation. When the script is first called, it generates the initial page. The script is invoked again when the user completes the page and presses Submit. The script now has to validate and process the results. Once the script has read the data and stored it, it loops back to become a page generator again supplying the next page in the sequence or reshewing the original page pointing out some errors.

For data validation, I needed something that would scan the source to compute what question number mapped onto what type of input object. I had already written the scanning part - it is used to generate the page. It turned out that the most useful way of coding for the new requirement was to make the questionnaire decoder build lists of the objects that it created while suppressing its normal HTML page output. To generate input for the validation phase, the decoder is run from the source data and builds separate lists for each of the different types of variables that can appear on the page. There are distinct lists containing the names of radio buttons, text elements, or boxes that are supposed to contain numeric ranges, and so on.

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The module was used in two places: first, on my machine to compile files of lists, and second, on the website

to generate HTML pages.

It then occurred to me that I could dump these lists to a file, in Perl syntax, and simply compile them into the program as they were needed. If the particular invocation of the CGI script was validating one section of the questionnaire, then it could include precompiled lists that told it all about the data types in that section. The script becomes general-purpose code driven by data from the lists. The code uses a list to derive a name and then applies a set of basic checks on the value attached to that name. Finally, the names in the lists are used to write the data to a file for storage.

As a final step in the idea of precompiling information from the text source for a specific page, I decided to output the original text source as a Perl list, so the page contents for a specific section can be compiled into the CGI program. The benefit here is that the script has all the information that it needs to generate and process one section of the survey in a single file.

I did toy with the idea of naming the lists in each of the generated Perl source files with the same name, so a list of variables that were drop-down menus, say, would appear in the precompiled data files called perhaps `menu`. Each precompiled section would be loaded into the main driver program as and when it was needed. The main program could then talk about `@menu` and have its contents be different depending on the specific form section that was being processed.

In the end, I didn't do this because it wasn't going to work. An invocation of the receiving program always needs to bind to two sets of pages. The first set is accessed when it's processing and validating the user's data, the second set when it's creating the next page. I could have got round this using Perl module techniques, but these are aimed at providing external modules that are linked in when a script is compiled. I wanted to bind the names during script execution. I decided to use the older 'do' syntax, which loads data and routines into a Perl program as it executes. To avoid name clashes, I named all elements separately, so `menu` list in section 1 is `s1_menu`, the `menu` list in section 2 is called `s2_menu`, and so on.

Accessing this data isn't hard. I first set up a reference to the data using something like:

```
my $i_menu = "s1_menu";
```

or more realistically:

```
my $i_menu = "s".$section."_menu";
```

The data can then be accessed indirectly using code like:

```
foreach $i (@$i_menu)
```

The `@$i_menu` is the key Perl hook here. It tells Perl that `i_menu` is a reference to a list that should be used in the loop.

At this point in the project, I had built a Perl module that could scan the text representation of each of the four pages of the questionnaire, and output two distinct types of data. First, it could output an HTML page directly from the source text. Second, it could output

sets of lists that could be fed into the data processing script to interpret the data returned from the pages. One of the lists that it generates contains the data from the source file. This data can be passed into the module to generate the HTML page (or a further set of lists).

The module was used in two places: first, on my machine to compile files of lists, and second, on the website to generate HTML pages. It soon became apparent that using the same module in both environments was a win. It certainly simplified maintenance and updates – I had only to deal with one text source file for each section of the questionnaire. Better, it provided a testbed for any fundamental changes that were needed. If I wanted to create a new primitive, which I did a couple of times, then I had to recompile all the lists for each of the four sections by running the text source files through the module. After I had done this, I'd tested the new additional code by running it on its new source data.

On balance, I like controlling programs from data. With this setup, I could add new questions and have them dealt with appropriately by simply editing a text file. Once code is written, it's good to leave it alone, lest you break it. The method I adopted for coding up the survey meant that what seemed like huge changes in question ordering or content were actually trivial edits to a source text file.

Later, I added a new output list that tied the generated question names to the original question text. This list was used to generate the final output file, which was formatted as one line per survey-response, holding comma-separated values. The ordering of information in this list allows the order of the data to be identified and processed. This CSV file was created when required from the set of files stored on the machine by each survey respondent.

Data storage

Data storage for web transactions poses several interesting problems. The Web is by nature a sessionless medium – each time a user presses a button the web server sees an event that it must process. That event may be one of a sequence, and you as the systems designer must create sessions. I tend to do this by passing information from one page to the next, and then testing that information.

My online booking forms for Usenix don't store anything until the user has reached the end of the form sequence, all the information that's collected is passed from page to page using hidden fields until the final page is reached. For the survey, I wanted to allow people to do a page, go away, and return to do another page. I needed to store data as things progressed. The system remembers where the user is in the page sequence by storing a variable for the data processing part of the script, and moves them along using standard finite state machine techniques.

I've never used cookies as a way of remembering sequences. Cookies can be turned off by the user and some browsers don't support them, so they are not a reliable way of providing sequencing information. Passing a hidden value from page to page works well, while the user is moving from page to page. If you want to allow the user to go away, and return later, perhaps bearing new items in a shopping basket, then you can give the user an ID that can be stored in a file along with their state. If you place this ID into a cookie, then later – when the user returns – the cookie value will identify the data file, and you can automatically return the user to the correct spot in the sequence.

I am actually quite queasy about using persistent cookies for ID purposes. There are too many places where there are shared terminals, like Internet cafes, and a persistent cookie has created a file that is the key to some data. The user is probably unaware that they've left

their key in a public place. So if I use cookies, I'll use them for the duration of the browser session and rely on the user typing some login information to reset things for next time.

I've used this technique in the survey. I've stored a cookie on the user's machine, but I don't rely on it being available. The user can type in a keyword to recover their position in the survey and reset the cookie. For systems where you want the user to be anonymous, like the survey, I tend to use large random hexadecimal numbers (where large is 16 digits) as cookie keywords. I store the user's data in a file that's named the same as the cookie. Alternatively, you can stuff all the user's data into a relational database and use the large hex number as a unique key permitting a later reload.

Most browsers also provide headaches for data storage. As the user presses buttons in the survey, they will create state by writing that information to the file. However, what happens when they use the 'Back' button on the browser? They can press Submit again and will be executing the code that stored the data once more.

There's a subtler problem caused by printing support in browsers. The user presses Submit, and is given a page that they decide to print. The browser will reload the page, sending the previous data and running the storage script once again. Browsers can force a reload to help them with scrolling on some machines, so again the data can be rewritten without the user being aware of what is happening.

Over the years, I've tried various methods to combat this problem. Some of my systems put out a cookie when they write some data, and don't rewrite the information if the cookie is present.

Browsers can force a reload to help them with scrolling on some machines, so again the data can be rewritten without the user being aware of what is happening.



This works until the user has cookies turned off. You can issue `no-cache` directives with your pages, but browsers generally allow the user to pull the information again by pressing a button. I am now trying hard to make the data writing routines to be re-entrant so it just doesn't matter if the data is written more than once. The trick is to choose a sequence number for the data at a different time from when the data is to be written – so the storage operation can be sure to write the same data on every invocation. ■

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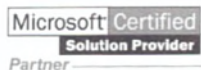
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Protecting against destruction



Looking at the destruction of `const` objects, Francis Glassborow suggests some coding guidelines that provide more than a mirage of safety.

The following code illustrates a relatively late change between the ARM (Annotated Reference Manual) version of C++ and the Standard version:

```
void destroy(T const * me) { delete me; }
```

The ARM took the view that destroying a `const` object was an error and should not be allowed unless done wilfully and with malice aforethought. For many programmers this would seem to be a perfectly reasonable view. However, relatively late in the standardisation process, the Standards Committees decided to withdraw this prohibition. No one will ever know exactly why each member voted the way they did, though the vote was pretty strongly in favour of removal. Certainly some were influenced by the analogy that Andy Koenig made with Unix file handling where you can remove a file that you only have read access to. In fact, this is not destruction in the strict sense because all that you are doing is removing the link between the file and the directory (and you do need write access to the directory). However, consideration of this analogy probably made some people happier with making the above code legal.

At first sight, the ARM's view seems to be reasonable and useful. Surely, destroying an object via `delete` should be considered as modifying it? Well, no. The lifetime of an object – during which it can be modified – starts when its constructor returns and ends when its destructor is called. The rule has to be this way so that `auto` (local) and `static` (global) `const` objects can be destroyed. Why should dynamic objects be treated differently? Even under the ARM rules you can write:

```
void destroy(T const * me) { me->~T(); }
```

However, if the object was not created dynamically, you are in for trouble. Worse still, the following code using placement `new` appears to be valid under both the ARM and the current rules.

```
void destroy(T const * me) { me->~T(); me = new(me) T; }
```

This means that you can change the state of a `const` qualified object without even using a cast. This blows away the argument that the ARM rules allowed you to 'grep' code for a dangerous `delete` because the `const` protection would have to be cast away and such casts would be detectable.

My feeling is that the ARM rule provided a semblance of protection without providing much substance. It did nothing to protect against actual destruction, and very little to help detect such brutal coding from a determined programmer. As C++ does not provide any way to determine that an object has been created dynamically, any call of `delete` on a pointer that has not been created locally is deeply suspect. Even if we had such a mechanism, we would need to enhance it with some way to determine whether a pointer pointed to a dynamically created single object or to an array of objects so that we could call the appropriate `delete`.

By removing this mirage of safety, we are free to focus on coding styles that provide rather more security, which is one of the more per-

suasive arguments for the change. I believe there are three key coding guidelines that should help.

First, *Use good function names*. If you religiously ensure that any function that can destroy objects passed in via pointers is appropriately named, then users will be warned even if they forget to read the documentation.

Second, *Don't use pointer parameters, pass by reference*. If you avoid using pointers as parameters, but use references (`const` or otherwise), you certainly gain as much protection as the ARM rule provided. Of course, determined programmers can still destroy the object referenced, but they can hardly do so accidentally. Any code that takes the address of a reference parameter should be suspect and need considerable justification if it is to pass a code review. The C++ Standards Committees are considering what the status of code such as the following should be.

```
void changeme(T const & me) { (&me)->~T; me = *(new(&me) T); }
```

Though I do not think that it is the job of a language standard to prohibit stupidity.

Third, *Use smart pointers*. The lifetime of dynamic objects is always a problem. Even when the object is created and destroyed in the same scope, exception handling leaves the potential for resource leakage. Application-level programmers should be avoiding unprotected dynamic objects; some local or global object that can manage their lifetimes should always own them. Smart pointers are good candidates for such management objects.

I think it was an awareness that good programming styles did not benefit from the ARM rule that led most members of the C++ Standards Committees to vote to change the rule.

Explicit copy constructors

The C++ Standard allows any constructor to be qualified as `explicit` so that you can prevent its use implicitly. Implicit use can only occur to provide conversion via a constructor taking exactly one parameter, but the general rule does no harm. However, some time ago I expressed an opinion on the subject of `explicit` qualified copy constructors. Those I was talking with opined that this was another example of `explicit` doing nothing. The C++ Standard seems unclear on the issue so it was added to the issues list as a potential defect.

At the Kona meeting of the Standards Committees (see *News*), in late October, the issue was considered and Andy Koenig summarised it as follows. We can make `explicit` qualification of copy constructors:

- (a) do nothing
- (b) do nothing useful
- (c) do something useful

Such a summary rather directs the conclusion to choice (c). We decided to raise the issue to the status of a defect report (on the grounds of ambiguity) and tentatively resolve it in favour of making



an explicit qualified copy constructor unusable for pass or return by value. However, you could use it to clone an object. While I hope this finally goes through, I wonder how much existing code it might break. That would be the only reason for rejecting the proposed resolution.

Last month's problem

Last month I asked you what was wrong with the following header file.

```
#include <iostream.h>
using namespace std;
class Millennium {
public:
    Millennium(){cout << "Happy New Millennium." << endl;};
    ~Millenium(){cout << "This code is full of bugs."
                    << endl; }
}
```

If you are one of those programmers who always like to run code through a compiler, your first problem may be testing it. Several widely used IDEs will not compile bare header files. The trick is to add a plain .c (.cpp, .cxx, or whatever your IDE uses) whose only content is `#include "Millennium.h"` (assuming you use the most natural naming conventions for files). Compiling bare header files can be useful in locating some of the simpler errors many of us make.

Moving on to the code itself, most compilers will give you some – possibly arcane – diagnostic that you will eventually resolve when you notice that there is no semicolon at the end of the definition of the Millennium class.

The redundant semicolon at the end of the constructor's inline definition will most likely go undiagnosed, though I believe that a strict reading of the grammar of C++ shows that an extra semicolon here is an error.

Inexperienced programmers often assume that once code compiles without diagnostics it is clean and ready for use. My major point in setting this problem is that this is far from true. This header file is likely to cause a multitude of problems during its use.

Perhaps you spotted that the file lacks any sentinel to protect against multiple inclusion. But what do you use for your sentinel? This is one case where you should know and abide by the industry norm. In this case it would be:

```
#ifndef MILLENNIUM_H
#define MILLENNIUM_H
as the first two lines of the file and conclude the file with:
#endif
```

Do not follow the example of good compiler implementors and add a leading underscore to the sentinel identifier. They do this because such identifiers are reserved for their use. You should not do it for exactly the same reason – names with leading underscores belong to implementors not users. In addition, ensure that all your header files start with the sentinel code. Some compilers will identify this usage and avoid even opening such a file a second time, which can substantially reduce compile times. If your compiler does not do this, start nagging its implementor – it is easy to do and can be very beneficial in large projects.

The next problem with my published header is `#include <iostream.h>` because there is no such header file in standard C++. While most compilers currently provide a way of dealing with this so that legacy code will still compile, the included file will likely not provide exactly the same results as including the correct one with

`#include <iostream>`. We will eventually see that even including this C++ header is probably very bad programming.

The next line of my header is the real nasty. The `using` directives should never appear in header files outside a namespace, and rarely inside one. Even `using` declarations are suspect in global space in a header file. To understand this, remember that a major motivation for introducing namespaces into C++ was to limit the pollution of the global namespace. Putting a `using namespace std;` into a header file dumps all the names from all standard headers included earlier in any file which includes that header file into that file. Unlike C, C++ standard headers can themselves include other standard headers. You have no way of limiting the damage caused by a single invocation of `using namespace std;`

If you wish to use elements of the Standard C++ Library in your header file, you must get used to giving them in their fully elaborated form (`std::cout` and `std::endl` in the above).

Let me return to the inclusion of the header. Many C++ headers are very large files and their inclusion can result in a great deal of wasted compilation time. In general, you should be very certain that you need their inclusion before doing so. While a great deal of student code includes `iostream` in just about every file, professional code should be more carefully written. The only reason that `iostream` had to be included in my millennium header file was because I wrote an inline constructor and destructor. Apart from the simplicity of having only one file, the cost of inlining code that uses `iostream` functionality is very high and is paid everywhere that header file is included. What makes this worse is that it is inconceivable that your code would gain any measurable performance increase from inlining code that does any form of I/O.

By the way, the C technique of writing into your header files your own prototype for a library function or pre-declaring types that you only use by reference or pointer will not work for items from the Standard C++ Library because there is far too much inter-dependence and subtle implementation detail.

Note: unfortunately the current level of compiler technology effectively requires that all template code be in a header file. This means that templates may add greatly to compilation times even when the code is not instantiated. The inclusion model for template use certainly breaks the C++ dictum of 'You do not pay for what you do not use'.

This month's problem

What is the problem with the following program?

```
#include <stdio.h>
int fn(int i) {return i+1;}
void gn(void) {
    int i = 0;
    printf("%d %d \n", fn(i++), fn(i++));
}
int main() {
    gn();
    return 0;
}
```

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Only connect



As well as including data access components for ADO, Delphi 5 has a set of components for connecting directly to InterBase. Mark Smith gives his

judgement on these 'BDE-free' developments.

For most programmers Delphi database connectivity has meant using the Borland Database Engine (BDE). The BDE is essentially a generalisation of the older Paradox Engine, not really intended for use in a client-server environment. The client-server BDE drivers (SQL Links) that come in the Client/Server or Enterprise versions of Delphi have come in for a lot of criticism for being slow, though this is probably the penalty paid for having a generic architecture. However, apart from a few new minor bugs, the BDE is pretty reliable.

With Delphi 3, the VCL classes that underlie the data access components (TDataSet, TField, etc) had their dependency on the BDE removed. This made it possible for third parties to write database interaction classes that did not rely on the BDE, but that still looked similar to the VCL TQuery, TTable, and TStoredProc components. This allows the visual data controls such as TDBEdit and TDBMemo to connect to classes written by third parties with no knowledge that they are not getting their data from a BDE connection.

This has led to a healthy market in third-party database connectivity libraries, all of them offering some advantage over the BDE and SQL Links. On my last project, we used a third-party library to connect to Oracle since we were not getting the performance we would have liked from the SQL-Links Oracle driver. This worked out very well and it only took an afternoon to replace all of the BDE-specific code in our project with the third-party stuff. A bonus we discovered later was that the components we used allowed us to execute batches of SQL statements together, thus reducing network traffic.

Now, Borland itself has got in on the 'BDE-free' act. Delphi 5 includes data access components for ActiveX Data Objects (ADO), Microsoft's data-access strategy of the week. Also included is a set of components for connecting directly to InterBase, called InterBase Express. This month I want to take a quick look at both sets of components, and try to make some judgement as to whether they are worth investing time and money in.

ADO Express

ADO, like the BDE before it, has come in for a fair amount of stick. Why people assume that a generalised database library based around COM and written by Microsoft will be a better bet than a more mature database library written in C by Borland is beyond me. ADO is based on a lower-level API called OLE DB, which provides a uniform way of retrieving data regardless of the initial format. The promise of ADO is that you will be able to use it to connect to pretty much any sort of data that you can get an OLE DB driver for – email, directories, multimedia files, whatever – and treat them as if they were rows in a database. To me this sounds a lot like the opposite of Larry Ellison's vision for replacing the operating system with a database that holds everything – files, directories, emails. Personally, I'm unconvinced by either argument: SQL is not a pretty language to do a directory listing in.

ADO does have some very persuasive redeeming properties. Chief among these is the fact that it can act asynchronously – that is, you can have many queries executing and fetching data without needing recourse to programming with threads. Second, ADO datasets can save their contents to disk in XML format. The asynchronous properties are perhaps the most interesting. Many BDE applications suffer from the problem that multi-threaded programming is a pain, so most programs load their data from many queries executed one after the other, which can take several seconds. Asynchronous ADO datasets can connect to a server and get their results back in parallel, thus reducing the wait time for the user. Another benefit of ADO is that it is downloadable from the Microsoft website, and will be installed as a part of Windows 2000.

Connection and configuration

The starting point for ADO is the TADOConnection component, which does the same job as the TDatabase component, but without the BDE. Since ADO does not have a separate configuration utility (like the BDE or ODBC ones), you need to specify all of the connection parameters in a single string called ConnectionString. This will be very familiar for anyone who has done much VB database work, and ADO provides an editor that makes it easy to build the connection parameters. However, the fact that this produces a string of over 600 characters when you merely point the connection at an Access database file seems a little extreme.

The ADO components include TADOTable, TADOQuery, and TADOStoredProc. These work pretty much like the DBE components they are named after, and are intended to make it easier to convert your application to ADO. There are two new components that should prove more interesting in the longer term: TADODataset and TADOCommand. TADODataset represents a general dataset, and can be used for the same jobs as the old table, query, and stored procedure components – use the CommandType property to tell ADO what the CommandText contains and away you go. The command text can be a table name, a SQL statement, or something more esoteric, depending on what the underlying data structure is able to do. The TADOCommand component is for commands that do not return a result set – SQL DELETE FROM statements or stored procedure calls, for example. As such, it is analogous to using TQuery.Execute.

Object Pascal wrappers

Looking under the hood, it soon becomes apparent that the VCL components mentioned here act only to provide an Object Pascal wrapper around the COM-based ADO objects, to make them familiar to Delphi programmers. For example, the TParameters class used in the ADODB unit of the VCL reads the underlying parameters from the ADO objects (or OLE DB for text command types) and presents them in a Delphi TCollection, in the same manner as the BDE-oriented TParams. There is little or no code reuse from TParams. Worse, there



The first newbie is TIBDatabaseInfo, which gives you statistics on the database and the frequency with which operations such as insert and delete have taken place in your database session.

is clearly cut and paste reuse of code – look at `TParams.GetParamValue` in `db.pas` and `TParameters.GetParamValue` in `adodb.pas` – the code in these functions is identical. Surely, a common base class might have made sense to someone at Borland?

One of the best features of the BDE is the ability to monitor what your application is doing via the BDE callback mechanism. Unfortunately, ADO and consequently ADO Express does not offer the same level of functionality. If you are getting your data via ODBC, you can use the ODBC trace log to achieve a broadly similar effect.

InterBase Express

The other new database access method is InterBase Express. This is a set of components that connect to InterBase using the InterBase API rather than the BDE. Again, the component set is roughly analogous to what you get for BDE connections – a database connection component and the usual query, table, and stored procedure components, as well as some new ones. Be warned that there is no printed documentation about how to use these components. In fact, there is no online information about how to use them either, beyond the VCL reference. Fortunately, the online InterBase API and programmers' guides (which are in Acrobat format) cover the information you need to be able to work out what the VCL components are supposed to do. As it happens, InterBase Express is based on an older library, 'Free IB Components' by Gregory Deatz, so there is already a body of knowledge on the newsgroups about these components.

Database statistics

The first newbie is `TIBDatabaseInfo`, which gives you statistics on the database and the frequency with which operations such as insert and delete have taken place in your database session. Frustratingly, these operations return a numeric value to identify the table rather than the table name, so you need to translate from the table number to table name. How to do this is not explained in the laughably brief help, and in actual fact you need to query the `RDB$RELATION` table looking for a match in the `RDB$RELATION_ID` column. It would have been the work of only a few hours to provide a wrapper for this sort of functionality, so I'm very surprised that it wasn't done.

Transactions

The second new component is `TIBTransaction`, which you can use to coordinate transactions between multiple InterBase databases. More interesting is the `IBEvents` component, which allows you to receive notification of named InterBase events. Delphi Help on

these is very sparse. Essentially, in InterBase triggers or stored procedures the programmer can log a named event such as 'STOCK_PRICE_CHANGE'. You can register an interest in that event in your Delphi application so that when the stored procedure is called and the event is logged, the InterBase server notifies your Delphi application. This gives you a lot of scope for building highly reactive applications. Since events are just strings, you could make the event names dynamic. For example, in an equity trading application, your stored procedure could post an event that included the ticker name of the stock whenever the stock price moved significantly. Client applications could register exactly which stocks they were interested in receiving a notification about.

InterBase Express supports debugging in a manner similar to the BDE-callback mechanism via a component called `TIBSQLMonitor`. Like the BDE, InterBase Express supports a set of trace flags to allow you to fine-tune the kind of database activity that is of interest. Combined with the `TIBDatabaseInfo`, this gives you a lot of information about your application's database usage.

Since InterBase Express is provided as a package, you have the choice of deploying the 370 KB `vc1ib50.bpl` file or linking the code into your application. You also need to install the InterBase client software.

Commitment

Given Borland's commitment to providing Delphi and C++Builder on Linux with some form of database access, I'm a little ambivalent about picking a winner from the current crop of data access components. Clearly, we are not likely to see ADO appear on Linux, but neither are we likely to see InterBase gain the market share it needs to make it an attractive skill to learn. I've been monitoring the *borland.public.database.ado* and *borland.public.database.interbaseexpress* newsgroups since Delphi 5 shipped, and there appears to be about three times the volume of traffic in the ADO forum – if that's any indication – though InterBase Express (and InterBase) attracts a pretty knowledgeable crowd.

If you are developing for InterBase only, then you can be pretty confident that nobody is going to write you an OLE DB driver in a hurry. If you can confidently predict that InterBase is all you need, then InterBase Express looks like a good bet. I think that in the longer term, most Delphi programmers will be using ADO, and that most development will focus on the `TADODataSet` and `TADOCommand` components, rather than the others. If you're seriously considering the ADO Express components, I would suggest spending some time becoming familiar with the underlying ADO COM objects. Jon Perkins' article on the basic ADO classes from the VB point of view (*Another day, another database technology...*, EXE, November 1998) should give you a good grounding.

Raw edges

If the tone of this article has been (in part) negative, it is because I've felt frustrated at the raw edges that many of the new features have shown. Borland has done far better in the past, and should certainly have done a better job documenting how programmers are supposed to use the new stuff. The Borland staff responsible for the ADO and IBExpress components seem to be pretty active on the newsgroups, offering advice and posting fixes for people to try, so at least they have shown a commitment to improving the situation. ■

Mark Smith is a contractor currently working on a large rail network simulation project for a London-based consultancy. Yes, it does simulate leaves on the line, actually. You can reach him at msmitha@cix.co.uk.

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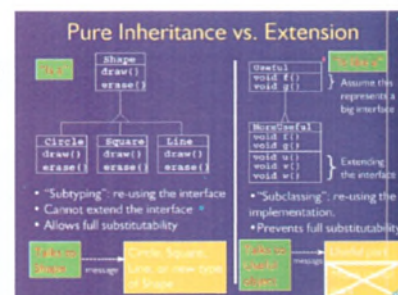
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JavaHelp – your other overlooked friend



It's more than just a 'run anywhere' version of Windows help. Lou Grinzo completes his Java documentation mini-series by looking at a GUI-based cross-platform help system.

Last month I wrote about javadoc, a very useful (but often overlooked) utility that comes with Sun's JDK and creates documentation about your code based on specially formatted comments and your program's actual structure. This month I'll look at Sun's support for the other side of the documentation coin, namely creating cross-platform online help for the users of your programs.

JavaHelp is one of the newer additions to Sun's line-up of standard extensions. It's also one of the potentially more important, as well as flexible and quirky, components. In essence, JavaHelp is a 100% pure Java GUI-based online help facility that is intentionally cross-platform capable. But as we'll see, it's more than just a 'run anywhere' version of Windows help.

JavaHelp provides the user with most of the creature comforts we've come to expect from online help, including a table of contents, hyperlinked topics, and full-text searching. A couple of popular features are conspicuous by their absence, though: browse sequences (series of topics linked together to provide a tutorial) and 'See Also' buttons, but those can easily be added via at least one third-party package (RoboHELP) that I'm aware of.

Since I can only cover the highlights (and lowlights) in a column, let me give you an annotated list of JavaHelp's strengths and weaknesses, as I've seen and experienced them.

The good

First and foremost, JavaHelp really is cross-platform, and it will work with either version 1.1 or 1.2 of the JDK on any GUI-capable system. And it's surprisingly flexible in terms of distributing the help files, since you can optionally leave the online help on a server (either local or accessed via the Internet) and not add it to every user's system. JavaHelp can be used from applets within a browser, of course, and it can be called from programs written in other languages besides Java, making it potentially useful for a much wider range of projects.

Sun's documentation for JavaHelp is particularly extensive, even for one of its standard extensions. Its *JavaHelp User's Guide* is available in HTML and Acrobat/PDF formats, and runs over 120 printed pages. There is also a 76-page JavaHelp specification that includes the format of the various files used by JavaHelp, which repeats some of the information in the *User's Guide*. Most useful of all, Sun provides several example projects that are very helpful for learning about JavaHelp, as well as providing a foundation for your own projects. The IDE, Browser, Merge, and Localised demonstration projects are particularly useful. The documentation does have a few quirks, as noted below, however, so consider yourself warned.

JavaHelp is based on open standards. All the files you create directly for a help project are either HTML 3.2 or XML 1.0 files, and are fully standards-conforming. This makes it relatively easy for

third-party companies to create JavaHelp authoring tools, and there are already several such packages available. As with the documentation, there's a dark side to this situation, which I discuss below.

JavaHelp is also flexible in the types of help it provides. First, it can present information in the familiar standalone help window, with a table of contents pane on the left and a topic pane on the right. Second, it can be used to display help embedded directly within the user interface of your program, in a child control, or use secondary or popup help windows.

Java programmers know what a mixed blessing Sun's love of multiple small files in a project can be. The benefits and burdens of that approach are both present in JavaHelp. A complete online help system for even a modest project can result in a surprisingly large number of files. Each help topic is a separate HTML file, plus there are numerous separate XML files for the overall 'helpset' description, the table of contents, the map file that associates topic names with topic filenames, etc. Luckily, Sun saw fit to make JavaHelp support jar files, making it possible to hide all this complexity from your users and mash the entire help project into a single compressed disk file. The benefit of this multiple file approach is that it allows you to create update files and utilities that can replace just a few small files in the help project to correct errors or add documentation for new features. This can potentially make distributing changes to projects much more efficient and far less annoying for users.

Related to the multiple files issue is JavaHelp's support for merging help projects. This is one of the more intriguing capabilities of the package, in that it allows you to combine the helpsets, as Sun calls them, for several components of a larger project into what appears to the user to be a single online help system.

The bad

JavaHelp is still clearly the first released version of the package. It has numerous documented quirks and outright bugs, many related to how it treats and mistreats various formatting situations. However, to Sun's credit, it spends six pages of the *JavaHelp User's Guide* discussing these issues.

Another '1.0 issue' is that the *User's Guide* isn't in complete sync with the distribution. For example, the guide tells you to start the 'History of the Holidays' demonstration project with the command:

```
javahelp\bin\hsviewer -helpset
demos\hs\holidays\HolidayHistory.hs
```

After this failed and I scouted around the installed files and read the `hsviewer.bat` file, I found I had to change this command to:

```
demos\bin\hsviewer HolidayHistory.hs demos\bin\history
```

Notice that both the location of the `hsviewer` program and the command line parameters it accepts are different from the documentation.



These are arguably minor issues that an experienced programmer will quickly circumnavigate, but they can still be annoying when you're wrestling with a new package and you're not yet confident enough to know whether a failure was caused by your mistake, a documentation

error, or a good old-fashioned bug.

One of the oddest quirks, and one that I sincerely hope they remedy in the upcoming 1.1 release, is that when you search a help project for a word that doesn't appear in the project you get no explicit indication that the word wasn't found. JavaHelp simply does nothing. For successful searches, it displays a list of the matching topics, ranked by perceived relevance.

One surprise is that you have little choice but to use a third-party authoring tool to create your JavaHelp projects. Since the individual files are all plain text XML or HTML files (or files generated from them with a utility Sun provides) you could theoretically create the entire help system with nothing more than the JDK and your trusty text editor. This isn't a chore I would wish on anyone, or at least no one I liked. I note in passing that all the people who claim that XML is a 'human editable' data format have a distinctly colourful definition of 'is'.

Because JavaHelp relies on Swing (the JFC GUI components) you must ensure that the 2.2 MB Swing jar file is available to JavaHelp at runtime. If your online help must be able to run on JDK 1.1 systems, this file adds considerably to the size of the distribution package. (The Swing jar file is over seven times the size of the required jh.jar file, which contains all the other code needed to display JavaHelp, including performing full-text word searches.)

The performance of JavaHelp won't impress anyone, at least not in a desirable way. Loading the sample projects in the JavaHelp distribution with Sun's standard JDK 1.2.2 JVM takes just long enough on a 350 MHz Pentium II running Windows 98 that I started to wonder what the system was doing. Predictably, and sadly, using the jar-format version of the help projects degraded performance even more. This is likely traceable in large part to JavaHelp's reliance on Swing, but whatever the cause, it's a delay that I would prefer not to inflict on my users, especially when they're seeking help and possibly are already frustrated. (Not that users of my software ever find themselves in that position, of course, but the principle stands.)

For some reason Sun has long had a relentless reliance on environment variables. JavaHelp perpetuates that perverse annoyance by requiring an environment value of JHHOME set to the home directory of the JavaHelp installation. Furthermore, Sun makes rather extravagant use of the environment, which can easily trigger an 'out of envi-

ronment space' error under Windows, which its demos did on my default Windows 98 configuration until I edited my config.sys file and rebooted. This is the kind of issue that quickly turns into customer annoyance and support headaches for developers who widely distribute their programs, whether to the public at large or just within the user community at their employer. This behaviour forces you to choose between risking running out of environment space and having the help system malfunction, or forcing users to reboot their system after installing online help. That's a pretty nasty dilemma.

Recommendations

I strongly suggest that you download the JavaHelp package and documentation from Sun's website and experiment with its provided examples. Note that the package is pretty large – the file I downloaded was 7.4 MB in Zip format. See *References* for the URLs for these downloads and related material.

Review the 'Limitations and Bugs' section of the *JavaHelp User's Guide*. Some of the quirks listed there are truly arcane, and this is one instance when a few minutes spent reading the documentation could be well rewarded.

If you have a specific project in mind that might be a good application for JavaHelp, ensure that you understand exactly what it will and won't require of its online help before you commit to using JavaHelp. In particular, define as clearly as possible how you want your program's (or applet's) online help to look and behave. Should it use popup or secondary windows? Should it support full-text word searches? Do you require browse sequences? How should a user request help (by clicking on a 'Help' button or menu item only, or will your program also support F1)?

Next, consider your distribution options. Depending on the number of people who will use your program and how they'll gain access to it (installed on their local system, via an in-company intranet, or over the Internet), you have some decisions to make that don't normally apply to Windows' online help. For example, do you have to ensure that your help system will run under JDK 1.1, or do you have the luxury of knowing in advance that your entire user population will have 1.2 installed?

Once you've clarified the picture I suggest you create a minimal version of your project that includes a small 'do nothing' program and a help system that contains just enough topics to represent the basic structure of the online help. (To save time, use one of Sun's sample help projects.) You can use this mini project to experiment with your build process and packaging. But don't jump too quickly to conclusions about configuration and installation matters; it's worth testing your mini project on as many of the different configurations that it is likely to encounter in the real world as possible. Even better, get some of your users to test the installation. Nothing makes problems rise to the surface quicker than letting someone else run your code.

If JavaHelp navigates this gauntlet and is still your tool of choice, I would then invest in one of the third-party help authoring tools that directly support it. The only one I've used extensively is Blue Sky Software's RoboHELP, which is quite adept at creating online help for various platforms from the same set of project files, and I highly recommend it. ■

Lou Grinzo has been working with and writing about desktop computers for more years than he'll publicly admit. He's currently focusing on cross-platform technologies, including Java, Linux, and XML. His website is <http://www.gizmoDrome.com> and you can email him at lou@gizmoDrome.com.

References

The main JavaHelp web page on Sun's site, including information on the JavaHelp mailing lists: <http://java.sun.com/products/javahelp/>

The JavaHelp package is available in several formats (with and without the Java Runtime Environment), and it includes the *JavaHelp User's Guide* in Acrobat/PDF format: http://java.sun.com/products/javahelp/download_binary.html

A JavaHelp FAQ: <http://java.sun.com/products/javahelp/faq.html>

A listing of the various third-party help authoring packages that support JavaHelp: <http://java.sun.com/products/javahelp/industry.html>

The JavaHelp 1.0 specification: http://java.sun.com/products/javahelp/download_spec.html

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Working hard to keep up



There is a theory that if the true workings of the universe are ever understood then it will automatically mutate into something even more

complex. Jon Perkins sometimes feels the same about Windows.

It seems remarkable how quickly the PC landscape has altered over the last decade. Ten years ago there were no Visual Basic developers, and the now primitive Windows 3.0 was considered by many, with the notable exception of the Apple Mac community, to be leading-edge technology. When Visual Basic did arrive, around 1991/2, it revolutionised the development of Windows applications because it offered an alternative to writing everything in C. The biggest problem that held back even wider adoption from the outset was that the first couple of versions were badly lacking in the core area of database support. Looking back at these early versions, I'm struck by how limited the feature set seems to be.

The functionality available within Visual Basic, or any decent Windows application development tool, is of course a reflection of what's available within Windows itself. Each successive version of Windows has offered more functionality, but has therefore required the Windows development community to adopt a higher base-level of knowledge in order to write anything halfway decent. By the time you read this Microsoft might well have released Windows 2000 to manufacturing and the pace will have been stepped up again. I'm reminded of Douglas Adams' excellent *Hitch Hiker's Guide to the Galaxy* in which he expounds a theory that if the true workings of the universe are ever understood then it will automatically mutate into something more complex (there was a second theory that this has already happened). I sometimes feel the same theory applies to Windows.

The Enterprise edition of Visual Basic is now shipped with a complete copy of Microsoft BackOffice, and there is direct support for Transaction Server and Message Queue Server. Gone are the days when somebody could just specialise in Visual Basic. You now need to work much harder just to keep up. To work on a software development project properly you need to be familiar with installation issues, help file creation, Windows interface guidelines (including the principles of feedback, forgiveness, and consistency), and so on. And of course, the second half of the nineties saw the rapid rise of the Internet. I would be surprised if there are many developers out there who do not at least use it regularly, but how many of you have studied the development issues surrounding it? The Internet is here to stay (at least until it, too, mutates), and the world of e-commerce will be the next boom area. Tony Blair has urged the UK not to get left out in this arena, though I must say I don't think this will happen in the long run. Most companies have now woken up to the potential that the Internet has to offer, and it's likely they will generally make a large investment in e-commerce next year once the millennium-induced inertia starts to wear off. This is where your next area of training should be. I've already devoted a couple of columns this year to WebClasses, and have a few more Internet related articles in mind for next year.

The reason I mention all this is that I'm concerned that some developers still seem to regard it as being some way off yet and therefore not worth worrying about too much. Any such complacency is espe-

cially dangerous if you're likely to be job hunting or, even worse, are self-employed because you will find yourself being unsuitable for an increasing number of vacancies as the year progresses.

The next version of Visual Studio, and therefore Visual Basic, is some way off yet so there is nothing to be gained by speculating what specific features will be present. It is worth mentioning, however, that Microsoft has publicly stated that the next version – which is codenamed *Rainier* – is concerned with closer integration of Windows 2000, COM+, and SQL Server 7. There is very little development taking place right now that is specifically targeted at Windows 2000, but if you want to be ready for this new platform then now is the time to start reading up on it.

CallByName

One of the features introduced into the latest release of Visual Basic was the `CallByName` function. This function was fairly high on some people's wish list, especially to those who came from a Clipper background (a popular dBase compiler before Windows really took off) where they had already been used to a similar feature. The purpose of this function is to let you derive or supply at runtime the name of an Automation object method or property, as opposed to hard-coding a specific method or property as is done most of the time. This isn't something that you'll need to do for most projects but occasionally it can come in useful, for example when you are interactively testing the functionality of a new component through a test harness application. It can also be very useful if you are creating controls at runtime or if you need to write pool managers for pre-created objects.

The syntax is defined as:

```
Reply = CallByName(Object As Object, _
    ProcedureName As String, _
    CallType As vbCallType, _
    Optional Arguments() As Variant)
```

The first parameter simply relates to the object upon which you want to act, while `ProcedureName` is a string expression containing the name of the method or property that you are calling. The `CallType` parameter denotes the kind of procedure that you are calling and it will be expecting one of the predefined constant values, which can be `vbGet`, `vbLet`, `vbSet`, or `vbMethod`. The final parameter is a variant array that should contain the correct number of parameters that would be expected for the actual procedure. For example, you could alter the caption property of a command button in two ways. The normal way would be:

```
Command1.Caption = "Press me"
```

Or you could perform the same thing by using `CallByName`:

```
Dim Reply As Variant
```

```
Reply = CallByName(Command1, "Caption", vbLet, _
    "Press me")
```

The value in the `Reply` variable depends upon what you have called.



In the case of a `vbLet` as shown above there won't be a return value and so `Reply` will be empty. However, if you were to invoke the `vbGet` form instead, such as:

```
Reply = CallByName(Command1, _
                    "Caption", vbGet)
then you will find Reply populated with the
string that was returned from the Caption
```

property, in this case 'Press me'.

Because the invocation of `CallByName` doesn't support the cosy type checking that we normally find with early binding against type libraries, it's very easy to provide an incorrect property name or an incorrect list of parameters. Therefore, it's very important to provide an error handler. It is safer to declare the reply variable as a variant data type so that any kind of reply can be accepted without causing a type mismatch, but care should be exercised in the provision of parameters.

The `CallByName` function isn't something that you're going to use every day, but it can be very useful at times. However, apart from the fact that it's so much easier to make a mistake than an early bound call, you need to be aware that there is a performance hit. Late bound calls are a bit slower because of the extra work that is required to navigate the data structures of the underlying COM objects, but `CallByName` is slightly slower still. For a single invocation a user isn't really likely to notice, but beware if you're intending to call an iterative loop because the delay will be magnified.

More Sheridan products...

I've recently taken a look at the new CodeAssist product from Sheridan. This utility is concerned with generating database access code from a source template. The measurement of how 'good' a piece of code largely depends upon the viewpoint of the individual so I won't offer too much opinion other than to observe that the code that was produced when I tried it seemed fine. Because the overall concept is based around templates, you can easily change the layout in whatever way suits you. The template language also includes a good selection of macros that get resolved at code-generation time. For example, if you are encapsulating a table into a Visual Basic class module, then three lines of macro code will generate an enumeration of each field into pairs of property Get/Let procedures.

I know of several software development companies that have produced their own in-house version of a tool such as this, and to be honest I very nearly did the same thing myself a couple of years back when I was producing a set of middle-tier components for a large database. Because of the flexibility of being able to modify the template code – or even create new templates entirely – I would imagine that this tool could be of use to a lot of development companies, small and large.

To use the tool it is first necessary to connect to a database, and then to choose a table or a data view. Once the required data elements have been chosen the resulting definition is stored in a Data Object, which then forms the basis for the subsequent code-generation operation. This two-stage approach can be useful if you are looking at concurrently creating code for two different languages, for example Visual Basic and ASP.

The supplied templates cover the main data sources such as ADO, RDO, DAO, and VBSQL. There is also support for writing Internet-based components (ISAPI and ASP), and even Microsoft Transaction Server is supported. And there is some support for Delphi and C++.

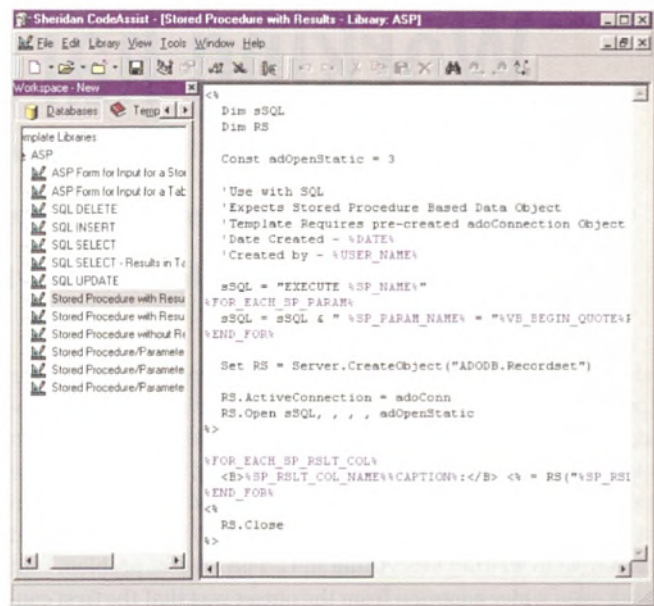


Figure 1 – Sheridan's CodeAssist

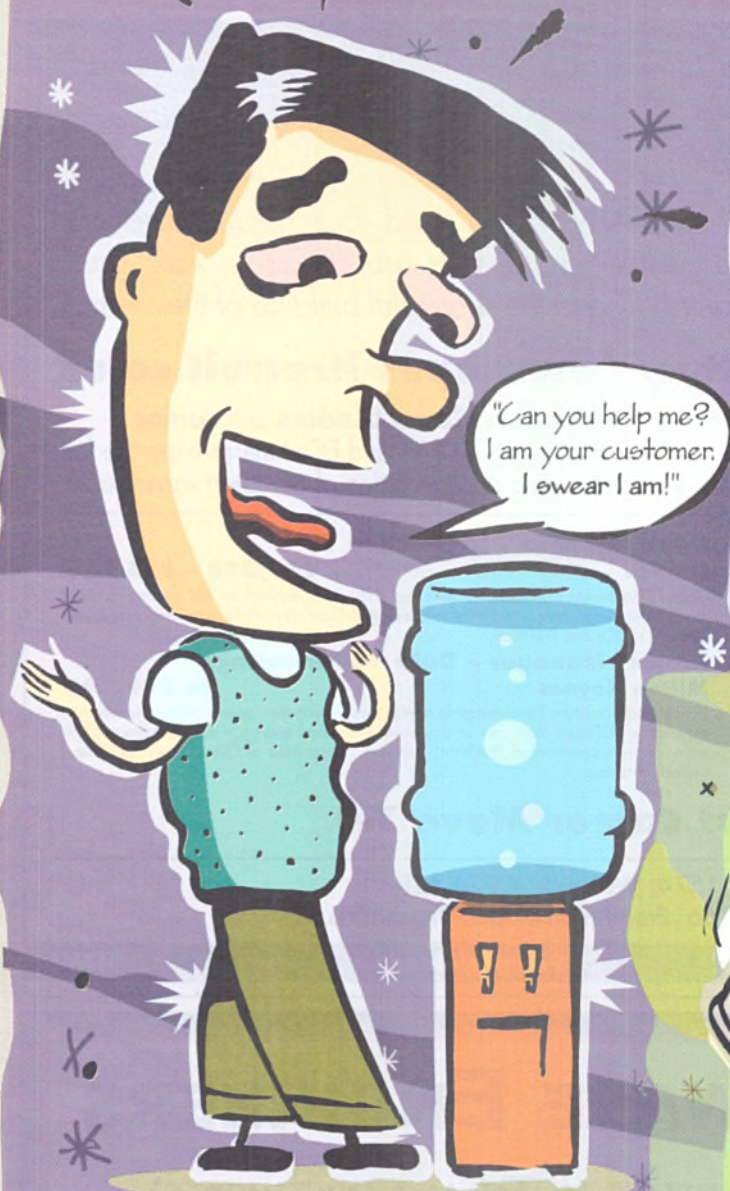
As with other Sheridan products there is no printed documentation, but the quality of the online help makes up for this. There is also a good online tutorial to get you up and running. The product retails at £215, and is available from the main UK software resellers. A demo version is downloadable from <http://www.contemporary.co.uk>.

Last year I reviewed the ActiveToolBars product, also by Sheridan. I'd just like to follow that up by reporting that a new version is available, ActiveToolBars Plus, which also provides emulation for Office 2000 menus. This includes the optional auto-hiding of infrequently used menu items, sliding/unfolding menus, and end-user customisation. Furthermore, there is a new feature called ActiveTabs, which is an alternative to the tab controls already provided by Visual Basic. From what I could see it offers everything that the Microsoft Tabbed Dialog Control does, but it also contains a few visual features that tie in with some of the latest interface doodads to be found in Windows 2000/Office 2000. Specifically, the Microsoft control offers only two display styles, whereas the Sheridan tool offers four styles. And it is possible to place controls within a common area so that they are visible regardless of which tab page is actually being displayed. The review copy that I was sent contained version 2.0, although version 2.01 is available at the time of writing from the Sheridan website at <http://www.shersoft.com>. The full product costs £149, whereas the upgrade cost is £59. My thanks to Contemporary for the review copies.

A bug-free rollover

And so all that remains is for me to wish you all a happy Christmas and a bug-free rollover. I'd also like to take this opportunity to remind you that I'd welcome requests for specific topics to write about. Some of you email me with Visual Basic questions, which I'm happy to answer when I can, but I apologise for the odd occasion when I just haven't had the time – the Y2K problem has kept me very busy this year too. See you on the other side! ■

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



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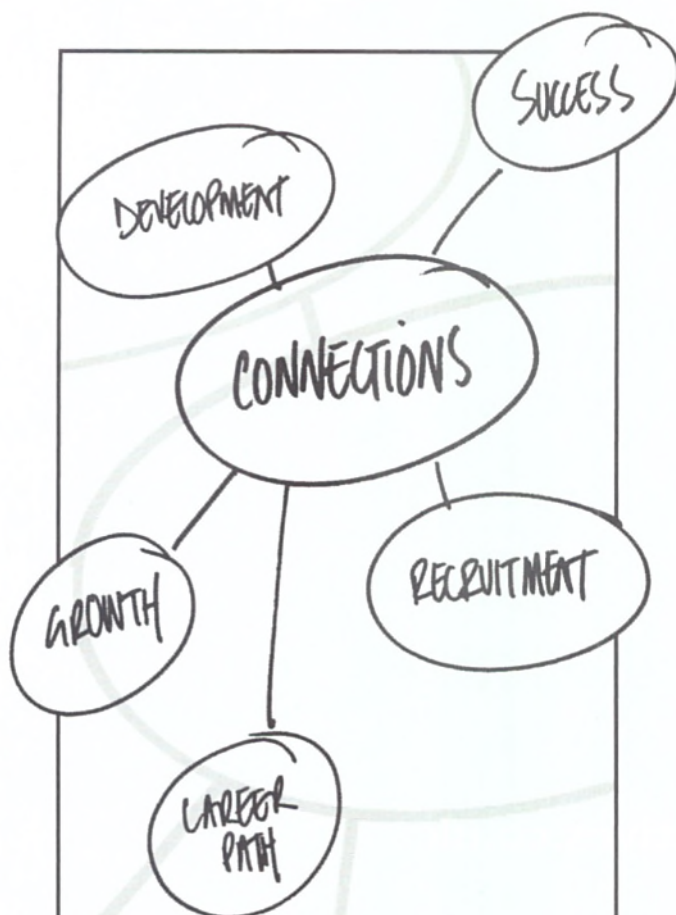
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JaCC 99

JaCC 99 - the software developer's conference

ACCU (the Association of C and C++ Users) and EXE have put together a unique conference for all Java, C and C++ developers over four days at the world-famous Oxford Union, featuring expert speakers including Jim Coplien, Kevin Henney, Barbara Moo, Andy Koenig, Nigel Warren and Bertrand Meyer. Preferential rates are available for EXE subscribers and ACCU members.

Check the schedule at the link below for the latest updates (two new sessions on Wednesday: *Solaris Technology* and *COM as a better C++*, *COM+/MTS as a better COM*; and a swap of sessions between Friday and Saturday).

► Full conference details...

Latest news

Visualising CA

A report from the CA World conference.

Orchestrating an embedded revolution?

Embedded Solutions Ltd (ESL), a spin-off joint venture with Oxford University, was set up to develop and exploit Handel-C, a radical approach to co-design.

► More news...

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WebClasses - extra tuition

Jon Perkins continues his coverage of the WebClass technology introduced in Visual Basic 6.0.

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WebClasses - extra tuition

Jon Perkins continues his coverage of the WebClass technology introduced in Visual Basic 6.0.

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. As before, I will be including fundamental web-development issues because there are still many developers who have yet to make this step into the brave new world of the Internet.

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

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Sewage, lies, and xenophobia

You can't have failed to notice that the French have been in the news a lot lately. If they're not burning our lorries or banning our beef, they're feeding their cattle on the *Collected Sayings of Hunter Rubbish*, erm, sorry, I mean sewage. Makes you wonder what else they're up to across La Manche. Well, wonder no longer, for we have uncovered irrefutable, if entirely fictional, evidence that the French are feeding their computers... Cobol. *Zut alors!*

Yes, it's true. While we have taken steps to ensure that our compilers are fed with only the purest ISO-compliant C++, properly supervised and constantly monitored to detect even the earliest signs of Bugs, Slowdowns, and Exceptions (BSE), our Continental Friends have been letting their machines feast on 20-year old mainframe excrement that was practically septic the moment it spewed out of the terminal. They've been mixing it with assembler, Logo, and various scrag-end macro languages, and feeding it back to the very engines of business that their own public uses. British users, some of whom have been running French code for years, are horrified.



'If I'd known there was Cobol in this stuff, I'd have started buying Danish long ago,' said Random J. Programmer, Head of IT at a major UK bank which we can't name because this is all fictional (lawyers take note). 'Thanks to Bjarne Stroustrup, they feed their compilers only on the best STL and ISO-approved source.'

Some people believe that buying processed, homogenised, off-the-shelf code is the problem.

'I've been telling them for years – you don't know what goes into any of this stuff. Now, if you buy only fresh, organic GPL code, you can see what you're getting. And you have Uncle RMS's personal guarantee of quality. It's all about self-sufficiency, man,' said Neil, a 45 year-old hacker and hippie who bears no resemblance whatsoever

to Nigel Planer, yesterday.

Meanwhile, still others have been criticising our reporting style.

'Pathetic. It's just offensive racial and political stereotyping,' said Mr G. Whinger, 33, of Islington. 'You're having a go at the French, at Open Source, not to mention Dr Rubbish. Besides which, everyone knows all French software is written in Lisp.'

Well, it had to happen

We're well on the way to our goal of proving that all the 'bad' things software developers habitually consume are actually good for you. Not content with fixing the reputation of chocolate, we can now reveal that caffeine – found principally in Jolt cola and that other drink... what's it called? Oh, yes. Coffee – makes you smarter!

You see, up there in your hippocampus – that's the bit of the brain that Einstein had a particularly large specimen of – you have *dendritic cells*. These cells respond to a heavy caffeine load by growing up to a third bigger, allowing them to make many more connections than they otherwise would be able to. Since the hippocampus plays an important role in both memory and general intelligence, the net effect of this seems to be to make the subject cleverer. Cool, huh? Of course, this effect only lasts for

a while, so to get the true benefit you need to consume large amounts of caffeine on a regular basis. Which is not a problem for your average software developer.

This leads to all kinds of interesting ideas. Since smarter developers are generally better developers, you can sell the idea of buying large vats of Jolt to your bosses on the grounds of improved productivity and less bugs in your code. Which means you get *free* Jolt. Or coffee, if you insist.

So far, the phenomenon has only been demonstrated in rat brains, but boffins reckon the effect will work in humans as well. We heartily recommend that you *do* try this at home.



Sleight of policy

Those wacky Government ministers are at it again. Not content with issuing stern warnings about the failure of UK business to take advantage of e-commerce, the Chancellor, Gordon 'Prudent and Sensible' Brown, has been telling the great British public – that's you and me – off for not enough of us being connected to the Net. Apparently, we should all be surfing for Britain, and to make sure that those who can't afford brand spanking new PCs will be able to do just that, Our Gordon is going to allow 100,000 families to rent – yes, rent – a second-hand model for just £5 a month. Now, this is a good deal even for a Pentium 90, but is it really going to persuade The Man on the Clapham Omnibus to buy all his shopping online? Methinks not.

What Gordon and chums should be doing is encouraging and – heavens forfend, subsidising – the development of alternative access methods like Net-on-TV and cheap broadband connections (are you listening, Mr Valance?), so that people can use a medium they're already comfortable with

and that it doesn't break the bank to get decent streaming video, which everyone knows is the killer app just waiting to happen. This will push up salaries for Web developers no end, being A Good Thing for the readers of this august journal.

Of course, you have to remember that this is all happening in the land that wants to pass legislation to allow the Police and Security Services to monitor your email and Web traffic without the need for messy things like, say, a court order, or indeed any oversight at all. And the land that wants to send people to prison for not possessing decryption keys to encrypted data that happens to be in your possession; remember, it's up to you to prove that you don't have the key, not up to the Police to prove that you do, and if you can't... then refer back to our *CtrlBrk Jailbird Special* (July 1999) for more details. Forewarned is forearmed, as they say.



Cave canem

The Editor commissioned Ms Stob to write a piece about AIBO, Sony's new robot dog. A strange choice: unlike the other journalists assigned this task, Verity Stob is not a 'doggy' person.

'At least it won't make a mess on the carpet,' I laughed, as I caught my first glimpse of [Ed: Insert your choice of Cutesy Doggy Name here. I'm damned if I'm going to give it one - VS] struggling to take its first trembling steps across the kitchen floor. I should explain that ____ is no ordinary dog, but is in fact the creation of the ingenious Japanese: this is their latest follow-up to the electronic egg thing that dies and the screensaver with the small sheep that pees. ____ is an AIBO, so-named because 'AIBO' is the Japanese word for [Select one: a) poodle b) pooch c) flat battery d) gullible round-eyes - VS].

'Oh, and isn't ____ sweet!' I chuckled as it knocked over the flip-top bin for the third time, amusingly scattering rotten food all over the floor. 'I do so wish I could take it home.' Think of the money, Verity.

'I've got some good news for you,' said Charles, the impulsive, charming and slightly eccentric early-technology-adopting owner, who is certainly nothing to do with the PR company, oh no. 'I'm going on a business trip for a few days, and I need someone to dog-sit for me.'

'But surely if you are going away, it would make more sense to switch the mutt off?' I riposted sweetly.

'If I did that you would have some difficulty writing a fluffy and light-hearted yet serious article about ____,' he quipped lightly. 'Anyway, I'm not really going away - I've got too much organising to do. I've got *lots* of whimsical adventures and spontaneous Michael Palin-style meetings booked up for you. An interview with Roy Hattersley and Buster on Wednesday, and in the afternoon we'll meet the man who used to be backup voice of K9 in *Dr Who*. A heart-warming appearance at the Battersea Dogs' Home on Thursday with ITN's Cute Animal correspondent doing a semi-serious piece to camera climaxing with the solemnly intoned words "the difference is that ____ is here for a visit. The other dogs here are forever, victims of human wickedness. Unless you help." And a guest appearance on the *Jerry Springer Pet Special* (subject: My dog loves its own vomit) on Monday.'

'What about the techie side?' I asked. 'Can I cover some more technical details? After all this is supposed to be for a programmers' magazine.'

Charles charming smile dropped faster than average data throughput on a free ISP. 'You'd do much better to stick to what it says on the handout datasheet, Miss Stob. You'll find everything you need to know there.'

At the heart of ____ is some sort of computer processor, powered by electricity. Unlike most other dogs, its eyes are LEDs, it sees through his nose and it stores its RAM in a hole in its bottom. An internal speaker allows it to make a wide selection of dog-like noises, such as electronic bleeps and the Microsoft Sound wav file. Its 'coat' is not made of hair, but actually some sort of paint. Its legs

have articulated joints, but they are not particularly powerful. For example ____ finds it impossible to move away if someone balances a three seater sofa on top of it.

'You're late!' screamed Charles as I pulled over at the kerb of the Famous Street With More Lampposts Than Any Other In The World. 'What the Fido do you think you are playing at? I've got both Peter Purves and John Noakes here, you can't keep artists of their calibre hanging around - my God, it's like another Beatles reunion - and we can't start because of a wretched cur... Where is he? Don't tell me you've lost him!'

'Hear it is', I said, unclipping the bungies from my roof rack, and pulling away the plastic sheeting. 'I won't have dogs inside the car - it's just a little rule of mine.'

'My God!' said Charles again. 'What's happened to his lower jaw?'

'Came off in the pull strength test. It's all right, I picked up the pieces and put them in a carrier bag. I've got it on the back seat, you can have it now if you like.'

'And what's that filth on ____'s legs?' It was true that ____ had picked up what looked like the debris of a conventional canine, probably when I dragged it through the park at 25mph tied to my rear bumper as part of my 'walkies' test.

'It happens,' I said complacently.

Unlike most computers, and like a real dog, ____ responds to being touched - it has a special touchpad on top of its head which allows one to stroke it. Apparently, if one strokes it on this pad when it has done something good or amusing, the software is sufficiently sophisticated to reinforce the behaviour that immediately preceded the event. This is supposed to be a very rewarding and enjoyable aspect of owning an AIBO, but I have no idea whether this part of the design works, as I didn't get around to testing it. Another behaviour which I have read about is that the robot is supposed to get lonely if left by itself all night, and will stumble into your bedroom at 2am, touch your hand affectionately with its little metal nose and whine until it is petted. Again, I am unable to confirm this as, forewarned of this behaviour, the one night I had it I kept it locked up in the boot of my car.

'Not much of a swimmer, is it?' I was back outside Charles' offices, with ____'s remains in a cardboard box, which I thrust into his arms.

'My God you are a sadistic bitch!' He poked around in the box with his finger. 'Not even Rolf Harris will be able to put this right. What have you been doing to ____? What has happened to the poor little creature?'

Given such an opening, how could I resist using one of my favourite lines in the English language?

'The dog it was that died,' I said.



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