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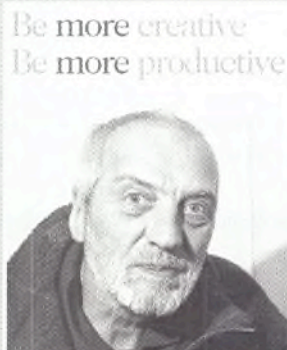
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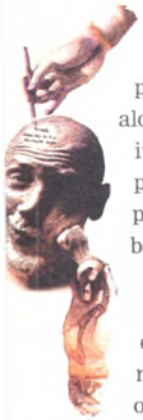
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# Templates in excess



Every decade or so, a fashion in programming comes along and announces itself the successor to previously discredited paradigms. Again we believe that from now on software will be more reliable, cheaper to build, and more fun to make. (No one believes it will be smaller or faster.) In the 70s it was Structured Programming, in the 80s Object-Oriented Programming, and as we approach the end of the 90s, Generic Programming. Inevitably, conflicts occur with the discipline of software engineering, which has learnt to be conservative the hard way.

Parameterised classes and functions (templates) are very useful beasts. A function `sqr` can be written that will square anything that defines the multiplication operator – complex numbers, matrices, whatever. The standard container classes like `list<>` are templates – one doesn't have to rewrite them for every new type. This was a genuine pain in plain old C++. And the standard library implements strings and `iostreams` as templates – they are parameterised by a 'character traits' object. This means that the same class definition can generate ASCII strings, Unicode strings, and Martian Tribyte strings, if necessary. But it does not make sense to do everything using templates, simply because it is elegant and fashionable. There is sometimes a price to pay in performance, readability, and the detailed control implementors have over their applications – and these are good solid software engineering virtues that outrank language paradigms.

Some experimentation (using MSVC 6.0) illustrates the problem. The test program was about 200 lines, each writing out 10 variables to `cout`, which I recompiled using standard and classic `iostreams`. What is most striking is the compilation speed: it took 12 seconds using the standard library versus 3 for the classic implementation. Twelve seconds is a lot of time; one can cram a whole, highly irritating commercial into that kind of break. Executable size was 115 KB for standard and 70 KB for classic. Your mileage may vary, but the overall picture is of slower builds and larger executables when using the new `iostreams` library. We are told

## Stroustrup tells us that using explicit loops is 'tedious and error-prone'.

that executable size is not as important as it used to be, but these days the fastest growing class of programmable devices consists of handhelds, cell phones, smart refrigerators, Bluetooth-enabled espresso machines, etc in which memory will remain at a premium for the next few years. I did not mention speed of execution in this example mostly because the speed of I/O is dominated by slow operations like disk access. Another sin encouraged by using templates in this case is wholesale inlining, which makes it hard to fine-tune crucial operations without the infamous (and usually unnecessary) C++ code bloat.

The implementation of the standard string class is highly ingenious, but not pretty for those debugging the application. They are faced with compiler and debugger messages using the fully expanded name [cut for

space – Ed]. And as for the useful `map<string, string>`, I leave it to your imagination. The name is so long that one gets dozens of compiler warnings about the internal name being truncated. While there are indeed applications that need the kind of flexibility offered by `std::string` (usually programs that use both ASCII and Unicode), it seems unfair to burden application implementors with the general machinery. The general templates can always be available.

The standard algorithms can be very useful. If I have a vector of integers, then `sort(v.begin(), v.end())` will sort it. Because the

comparison is inlined, this generic algorithm will be faster than the old-fashioned `qsort`, as well as being easier to use, especially if this was a vector of a user-defined type. The cleverness, however, does get a little overwhelming:

```
copy_if(v.begin(), v.end(),
        ostream_iterator<int>
        (cout), bind2nd(
        greater<int>(), 7));
```

(To be pedantic, each name should also be qualified with `std::`.) This example from Stroustrup (*The C++ Programming Language*, 3rd Edition, p530) can be more conventionally expressed in a form that makes it obvious that all the integers are going to run together on the output:

```
vector<int>::iterator li;
for (li = v.begin();
     li != v.end(); ++li)
    if (*li > 7) cout<< *li;
```

Stroustrup tells us that using explicit loops is 'tedious and

error-prone', but I cannot see any advantages in using the first version. Obviously, one can get used to this notation; humans are very adaptable and as professionals we have to learn the new lingo. But it is certainly not less tedious, and is arguably much less readable and flexible. Also, it can constrain design decisions. For example, given that we have a list of `Shape*` pointers, we can tell them all to draw themselves with either:

```
for_each(ls.begin(),
        ls.end(), bind2nd(
        mem_fun(&Shape::draw),
        canvas));
```

or:

```
ShapeList::iterator li;
for (li = ls.begin();
     li != ls.end(); ++li)
    (*li)->draw(canvas);
```

If I wanted to modify this so that I only draw shapes matching some criteria (and specifically didn't want to put that behaviour into the shapes themselves), then I would just have to add an `if` statement to the latter. The first version would get very hairy indeed.

C++ is a marvellous language, found in everything from cell phones to continental switching networks. It supports all three of the modern programming paradigms, and no doubt will support the next. Just as English ranges from the Teletubbies to Microsoft COM documentation, one has freedom to pick an appropriate idiom, suitable for the needs of newbies or members of the C++ Standards Committee. All that is required is recognition of this fact, and less manic indulgence in new styles that drive out the good together with the bad. Otherwise, the newbies will abandon the camel because they were never shown how to make it a horse. Java, which makes a virtue out of its limitations, will be happy to give them a home. ■

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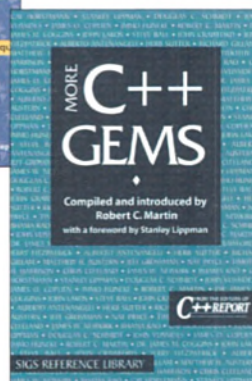
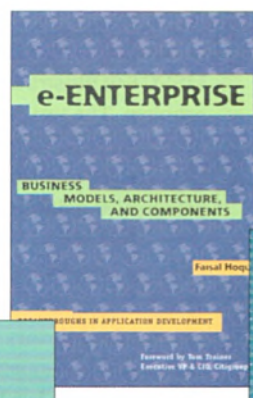
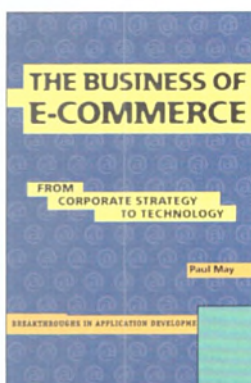
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Henry Balen

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352pp 2000

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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

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# VisualCafé 4 – the latest Java by adaption

VisualCafé 4 fully supports the new Java 2 platform standards from Sun, including multi-server EJBs, Java ServerPages, servlets, and multi-tier distributed debugging. Available in three Editions, the release of the Enterprise Edition will follow that of the Standard and Expert Editions.

The Expert Edition supports the Java 2 Standard Edition (J2SE) platform (including JavaBeans, JFC/Swing, JDBC, RMI, customisers, JARs, and JNI). It allows you to quickly configure your environment to edit, compile, and debug for Java 2 or JDK 1.1. (The new interface will let you drop in JDK 1.3 beta, to support the latest Java.) There is automatic conversion of Swing 1.0.3 projects to Swing 1.1.

In terms of compilers, as well as a high-performance Java 2 compiler, the Lightning JIT 4 compiler is optimised for the Java 2 VM (including an improved garbage collector and a new persistence cache). There is also native Java 2 compilation for the x86 platform,

which supports the use of dynamically loaded classes.

The visual debugger has full expression evaluation capabilities, conditional breakpoints, and support for incremental debugging. JDBC-based components and Wizards support database app development and connectivity to the major database vendors. The Expert Edition includes a 100% Pure Java relational database from PointBase.

Wizard-driven deployment includes support for CAB, zip, JAR, and signed applets. An open SCC API provides integration with PVCS, SourceSafe, Starbase, and ClearCase among others. Built-in SCM support lets you view current status information including file owner, version number, filename, and location.

Moving on to the Enterprise Edition, the new Sun Java 2 Enterprise Edition (J2EE) platform is supported. Advanced JSP capabilities include a drag and drop WYSIWIG environment and a visual JSP source editor with syn-

tax highlighting, checking, and suggestions for Java, HTML, and XML. The remote debugging of JSPs, in their deployed environments, helps provide real world test conditions.

The system includes integration with the BEA WebLogic Application Server, IONA's Orbix middleware, Oracle 8i, and PointBase Mobile Edition (which provides a 100% Pure Java database that supports SQL-92/99, JDBC, and XML). EJB support for IBM WebSphere and Oracle Application Server is available through Tendril StructureBuilder, which is integrated with VisualCafé.

System requirements for the Expert Edition include Windows 9x or NT, 128 MB of RAM (recommended), and 375 MB of hard disk space.

VisualCafé 4 Standard Edition and VisualCafé Expert Edition are available immediately at \$99 and \$799 respectively. The Enterprise Edition will be available this quarter for \$2,799.

www.visualcafe.com

Sun is withdrawing its proposal to formally **standardise** the Java 2 platform, Standard Edition (J2SE) from the standards body ECMA. The reason is to 'protect the integrity of the **Java** technology and the investment made in it by the worldwide community'.

java.sun.com/pr/1999/12/pr991207-08.html

Sun and Inprise have released a Linux version of the **Java 2** platform, J2SE, based on the work by the Blackdown group. Earlier this year, **Inprise** announced a free download of the beta JBuilder JIT compiler for **Linux**. Sun is licensing the JIT from Inprise to complete the Java 2 SDK for running Java on Linux.

developer.java.sun.com

Version 3.2 of the **Progress App-activity** application server and development environment features enhanced page caching, **database** connection pooling, and page merging features for better **performance**. Server prices start from \$10,000.

www.progress.com

**XMetaL** 1.2 is a free upgrade for SoftQuad's **XML** authoring system. It includes improved table handling, **CSS** rendering, and spell checking. For developers, it tracks a broader range of user events through scripting, and you can automate the creation and use of entities through scripts.

www.softquad.com

Tao's **J-Engine**, the Java Technology Edition, has been ported to the QNX 4 RTOS. It will run **Tao's** implementation of **PersonalJava** and EmbeddedJava. Including all the class libraries and AWT to support Java 1.1.6, the footprint is under 2 MB.

www.tao-group.com/2/tao/product/java.html

## Beyond HTML with JViews

**ILOG JViews Component Suite** builds on the company's **ILOG JViews** 2.0. It's delivered as a set of components: pre-built JavaBeans, class libraries, and editor applications, together with a full API. It enables you to construct platform-independent, fully-interactive GUIs (**ILOG** claims that the suite can cut development time by one third for web-based applications). Being 100% Pure Java, it runs on any Java platform and any browser that supports JDK 1.1. It has been designed to complement the lower-level GUI components found in Swing and AWT.

Features of the suite additional to JViews include: a **Business Graphics Objects** package allowing the point and click connection of graphics to application data; an enhanced graph layout package for visualisation of work flows, process flows, or management displays; a **Gantt Chart** module for viewing resource- and task-oriented schedules in a Web-based display; a **Map Manager** with an interface to Oracle's **Spatial** database extension, which enables custom screen objects to sit over map data; and finally, 30 pre-built JavaBeans.

Delivering the **Business Graphics Objects** package, which creates JavaBeans from graphic objects, to the end-users provides a means for them to customise their **ILOG JViews**-based interface.

A development licence costs £3,900.

www.ilog.com



## SNiFF+ 3.2

Greater efficiency at addressing large code bases is the key feature of **SNiFF+** version 3.2, the source code engineering tool from TakeFive: multi-language code navigation, analysis, and management is available to projects involving millions of lines of code. The development behind this is 'Rapid Reference' technology, which speeds up symbol queries such as 'method referred by'. For Java users, **SNiFF+** J 3.2 incorporates a RAD-style platform-independent GUI builder.

For searching and changing text strings in source code, the **Power-Change Tool** enables you to review and change variables, methods, or objects based on context.

**SNiFF+** 3.2 is available for Windows 9x and NT, Solaris, HP-UX, Linux, SGI Irix, and AIX. For C/C++ only, TakeFive has also released the **SNiFF+** Penguin IDE for Linux.

www.takefive.com



# HomeSite's collapsible XML

**e-TEST** suite 4.0 tests large scale web applications. As well as the ServerStats and e-Reporter utilities, it is extensible through a programming interface and from Visual Scripts. The suite starts with e-Tester, which costs £4,596.

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

Mabry's **Tree/X** component provides check boxes, radio buttons, different images for open/closed nodes (selectable on a per-node basis), as well as other 'standard' tree features, such as sorting. It is an **ActiveX** container itself – ActiveX components can be placed in any **node** of the tree. It costs \$129.

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

VideoSoft's **VSFlexGrid Pro 7.0** is for building front-ends for database apps running on Windows or the Web. V7.0 includes a Light version (eliminating the need to distribute ADO DLLs), support for standalone printing, and 'frozen' rows and columns that remain visible during scrolling. The RRP is £215.

[www.contemporary.co.uk](http://www.contemporary.co.uk)

**CodeWarrior Professional** for Windows is Metrowerks's development system for C/C++ and Java on Windows 9x and NT platforms. It includes compiler optimisations for AMD 3DNow! extensions and MMX extensions on Pentiums. The customisable IDE features procedural and C++ class browsers, remote debugging, and ANSI-compliant C and C++ compilers.

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

**viewONE 1.1** is a Java applet to extend browsers so that you can view, zoom, pan, rotate, and print image files with ease. It works with Java 1.1.5+. Available as a **Java-Bean**, there is a comprehensive API for Java developers, as well as JavaScript and HTML interfaces.

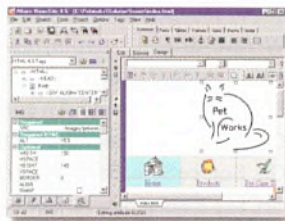
[www.daeja.com/pub/viewone/](http://www.daeja.com/pub/viewone/)

**WYSIWYN** (what you see is what you need) is the interface model followed by HomeSite, Allaire's HTML editing tool that has been upgraded to version 4.5. Aimed at professional Web developers, who are maintaining as well as developing sites, this release includes some support for XML, a more flexible project management system, and a scriptable site deployment system, together with UI productivity enhancements.

The UI enhancements comprise a number of features. As well as auto completion for user-defined strings, and split-window editing to see tops and bottoms of the same file, there is a Universal File Resource Pane to manage local and remote files. This version helps improve page readability by supporting the collapsing of sections of text in the main editing window. Finally, function arguments for ColdFusion are automatically provided as dropdown menu items.

In terms of web technologies and tools, v4.5 will let you open, edit,

and save XML and XSL files. The CodeSweeper tool, which enables you to verify and format your HTML, is included (this also supports HTML Tidy, an independent Open Source HTML verifier and formatter). And note that the Allaire CSS editor has been replaced with a Lite version of the TopStyle CSS editor. An image map editor is now integrated with HomeSite.



The concept of virtual project folders, for handling files and resources, has been introduced to help with the management of multiple development projects. For versioning control, you can also map projects to a source control project folder. An auto-inclusion facility

enables you to setup the automatic inclusion of files within projects.

To address website deployment issues, including where multiple servers are involved, the scriptable site deployment system is designed to simplify the process. First of all, there is a Site Deployment Wizard, which creates a deployment script as it deploys a site. You can run this script (JavaScript or VBScript) to re-deploy the site or to deploy to another server. The scripts can be customised, for tasks such as archiving deployed sites, and they can be shared across a development team.

HomeSite 4.5 runs on Windows 9x and NT. The RRP is £75, while upgrades from version 4.0 are £21.

If you purchased and registered a new license for HomeSite 4.0 after August 1, 1999, and before the release of HomeSite 4.5, you qualify to receive a free electronic upgrade to HomeSite 4.5.

[www.allaire.com/products/homesite/](http://www.allaire.com/products/homesite/)

## Extending the web to PDAs

There you are, developing some great Internet site, problem is you want people on the move to be able to access it. They can always go to a cybercafe nearby, but that's not ideal. Another possibility is to make it accessible from palmtops and eventually WAP-equipped mobile phones. Enter AvantGo. Felix Lin, its CEO, defines the company's products as 'extending the reach of the network far beyond the desktop'. There are three main pieces in the equation: the AvantGo Enterprise 3 server, MAL (Mobile Application Link) – a connectivity- and device-agnostic Open Source communication layer for synchronising palmtops, and the AvantGo browser.

When you synchronise your palmtop directly to your desktop, or through a mobile link, MAL gets all the updated pages for the URLs you've registered on the AvantGo server. Forms can be filled in when disconnected; they will be transferred back to the web server the next time you synchronise.

The AvantGo server acts as a gateway between the back-end Web servers and the palmtop devices. It can deliver standard HTML pages and also adapted content. The server also offers central management functions (for configuring and installing software on the devices connecting to it), security and authentication (SSL & HTTPS), an interface to any data, server based sync-ing, and real-time wireless access. The browser is an extensible HTML browser with support for JavaScript and Portable On Devices Services (or PODS). The pricing of the server is per named user. A general gateway service and all the clients (currently for PalmOS and WinCE, soon for EPOC and WAP) are freely available.

[www.avantgo.org](http://www.avantgo.org) [www.mobilelink.org](http://www.mobilelink.org)

## Visio's shapes

Visio 2000 Professional Edition has shipped and the Enterprise edition should be available when you read this. Improvements for Professional include database reverse-engineering, UML reverse-engineering from VisualStudio, advanced dataflow diagramming, support for directory services, improved web mapping, and new shapes.

The Enterprise Edition adds collaborative database design (merging database diagrams worked on by several team members), UML code generation (VB, VC++, and Java programs from class diagrams), UML reporting design specs, integrated business rules (extracting a conceptual level from databases), transfers from one database to another, extended network auto-discovery and reporting tools, support for ActiveDirectory, NDS and LDAP, and more new shapes.

The Professional Edition costs £279 and the Enterprise £699.

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





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## Tab Pro 3:

- ▶ Bind the Tab Pro controls to ActiveX Data Objects (ADO) 2.x using OLE DB technology [still supports data binding to Data Access Objects (DAO) and Remote Data Objects (RDO)]
- ▶ Implements apartment-model threading
- ▶ Design time support for setting pictures, plus metafile support
- ▶ Many colour properties default to system colours
- ▶ Tab ActiveX control provides optimised intelligent scanning and loading of child controls

**£99**



## Input Pro 3.0

makes it easy to create precise and accurate data-entry screens. Input Pro provides eight custom controls that display monetary values, integer and floating-point values, date and time values, and text. All eight custom controls can link to your database or work in standalone applications.

### General Features:

- ▶ Support Year 2000 in your projects
- ▶ Create your own custom appearance or choose from predefined styles
- ▶ Provide full clipboard support for memo and formatted edit controls
- ▶ Bind the Input Pro controls to ActiveX Data Objects (ADO) 2.0 using OLE DB technology, Data Access Objects (DAO) and Remote Data Objects (RDO)
- ▶ Support for ATL (Apartment Threaded Library)

**£99**



## List Pro 2.0

is unlike any other listbox or combobox you've ever seen. These extremely robust controls give your users a powerful way to view data. List Pro's extensive property set breaks the 64K boundary and enables you to display information in single or multi-columns, search and sort list items, merge cells for easier viewing, or group headers for multi-line viewing of single records. Easily design the controls' layout with our included List Designer to increase your productivity.

### Custom Appearance Properties:

- ▶ Supports up to 2 billion list items by using the custom InsertRow property
- ▶ Prevent your user from selecting any rows by putting the listbox into ReadOnly mode. The arrow keys and mouse will quickly scroll through the information, making it a powerful database viewer
- ▶ Display data in single or multiple columns
- ▶ Insert bitmaps or icons into any columns or rows. Assign different pictures for both the selected and unselected states
- ▶ Assign a specific three-dimensional effect for any row, odd rows, even rows, all rows, spacing of rows, or the text
- ▶ Includes over 200 properties for customising the look and feel of the control
- ▶ ActiveX control is digitally signed for full Internet and Intranet development

**£180**



## Spread 3

You and your team can quickly create powerful database front-ends, easily manage the display and entry of up to two billion items, print flexible reports, perform complex calculations, read and write files, sort data, or simply take advantage of its unsurpassed cell-level formatting. All of this is included in one control. Unmatched power, flexibility, and speed combine to make Spread the perfect complement to any application.

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- ▶ Import and export spreadsheet files in Microsoft Excel 97 format (BIFF 8): 32-bit versions only
- ▶ Export spreadsheet files as HTML (version 3.2 and greater) files: 32-bit versions only
- ▶ Use the new Print Preview control to see how your printed spreadsheet will look
- ▶ Use one of 74 functions (includes 61 new ones) in your formulas
- ▶ Query the list of, retrieve information about, or remove custom functions
- ▶ Calculate the number of pages to print based on the current print settings
- ▶ Fire events when the user changes text while in edit mode, when the list drops down in a combo box cell, when the combo box closes, and when the user selects another item or reselects the same item in a combo box cell

**£259**

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# Let there be speech-enabling



Developers can bestow upon their applications the power of being speech-enabled, courtesy of Dragon Systems and their Dragon NaturallySpeaking Developer Suite 4.0. Based on the Dragon NaturallySpeaking software, the suite includes an SDK with ActiveX controls, the Dragon NaturalVoc tool (a vocabulary builder), development runtimes, code examples, and documentation. The features enable your application to include speech-driven data entry, command-and-control, and form completion capabilities.

Through the use of ActiveX controls, the SDK is available for Delphi, VB, and VC++ developers. NaturallySpeaking dialogs such as New Command Wizard, Editor Command Wizard, Voc Editor, and Mobile

Training can be accessed. It supports SAPI 4.0a. The components include DgnEngineControl for general training (including the New User Wizard, which initiates the NaturallySpeaking voice recognition training), DgnVoiceCmd for general voice commands, and DgnMicBtn to control a Microphone button (which enables the user to turn the microphone on and off, and includes a meter to show whether the microphone is picking up sound).

Dragon NaturalVocTool 4.0 is an enhanced version of the Dragon NaturallySpeaking Vocabulary Builder, for the development of redistributable custom vocabularies. The tool can analyse source text when building vocabularies, which should result in better language models and improved recognition performance.

Also in the suite is a development version of the Dragon Natu-

rallySpeaking Runtime (which is based on the feature set of Dragon NaturallySpeaking Standard) together with an Enhanced version. There are also development tools to help integrate the runtime setup program into your own installations. A scripting language supports the use of macros.

Finally, the Dragon Systems Developer Den is a website that includes articles, product updates, and technical notes.

To use the developer Suite you will need to buy version 4.0 of Dragon NaturallySpeaking Standard, Preferred, or Professional editions, for which pricing starts at £50. The Developer Suite itself costs £30, but the SDK can be freely downloaded from the Web. System requirements include 64 MB of RAM, and 265 MB of disk space.

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

**Raima Database Manager 5.0** is Centura's small-footprint, cross-platform **embedded** database, which is targeted at **Information Appliances**. V5.0 sees enhanced cache synchronisation, improvements in the Lock Manager for self-management, and the introduction of re-entrancy on all platforms. [www.centurasoft.com](http://www.centurasoft.com)

Raleigh Group's **Visual Source-Format** automatically reformats **C/C++** source code to suit a style preference. Features include seven predefined C++ styles, the creation of your own **style**, and the specification of over 30 coding style traits. A viewer lets you view source in any style, without saving it. It costs £209. [www.componentsource.com](http://www.componentsource.com)

**Linkbot Pro 5.0**, Watchfire's **web-site** testing system, features interactive 3D site mapping and expanded scanning and maintenance functionality. It helps maintain the reliability and **integrity** of websites by testing, editing, and repairing broken links, problematic syntax, and performance issues such as slow loading pages. [www.watchfire.com/products/](http://www.watchfire.com/products/)

A flexible delivery of content to **web** servers is provided by MKS **Web Integrity** 2.5. Content updates can be made according to a publishing schedule as well as immediately upon approval of the **content**. V2.5 also sees improved handling for larger websites and the changes travelling through an approval cycle. [www.mks.com/products/wi/](http://www.mks.com/products/wi/)

The Institution of **Analysts** and Programmers is starting a scheme to place Computer Studies **students**, who are Student Members of the IAP, in employment with more senior members of the Institution during their industrial **placement** year. [www.iap.org.uk](http://www.iap.org.uk)

## How stressed are you?

Check up on the health and performance of e-business applications with Segue Software's **SilkMonitor**. Setting system resource thresholds for checking performance and scalability, its monitoring functions work alongside Segue's load testing product, **SilkPerformer**.

Used with **SilkPerformer**, **SilkMonitor** 1.0 can measure the performance of servers carrying out millions of simulated transactions a day. Scalability can be evaluated by identifying memory leaks and runaway processes. Data collected by monitors can be viewed in **SilkPerformer's** Performance Explorer.

Alarm conditions are provided to create system performance thresholds associated with alerts or triggers. These alarms and their actions, such as console messages and emails, can provide round-the-clock notification of the status and performance of a system.

Segue assert that a platform-independent core (Java) enables **SilkMonitor** users to monitor varying platforms from one console. Extensible agents can be installed on any server with a JVM and they automatically register themselves and collect performance data. Each agent can record a variety of performance measurements and **SilkMonitor** can display real-time graphs as data is collected.

Reporting capabilities include support for **Windows NT Performer** (IIS, SQL Server, MTS), **Solaris** (vmstat, netstat, and mpstat), and **Network Data Collection**.

Pricing for **SilkMonitor** starts at £4,500.

'To be successful in today's Internet economy, e-business systems need to be able to perform, scale, and operate as expected,' said Steve Butler, CEO of Segue Software. 'We've delivered **SilkMonitor** as a complement to our other products so e-businesses can have a non-intrusive tool to gain valuable access to the visibility and viability of an Internet application before it goes live.'

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

## JaCC 2000

Make a note in your diary for the Spring JaCC, taking place at Oxford over 24 and 25 March – the C++ and Java experts are already lined up. On the Friday, James Coplien will present the keynote *Teaching Design*. For the C++ stream, 'Guru of the Week' Herb Sutter will cover *Exception Safe C++* and Dietmar Kuehl will tackle *OO Programming vs Generic Programming*. For Java, Andy Longshaw will be *Creating Web-based Systems with Java ServerPages*.

On the Saturday, Herb Sutter will be presenting the keynote *Programming in the Distributed Millennium* and Leen Ammeraal will be giving an *An Introduction to Function Objects*. The Java stream will feature Russel Winder's workshop *Using Patterns in Java*. Saturday also sees a third stream: Design and Development. Kevlin Henney will cover *A&D, an Alternative Perspective*, and Frank Buschmann and James Coplien will do *Development with Patterns*. Further speakers and workshops will be announced shortly.

[www.exe.co.uk](http://www.exe.co.uk) [www.accu.org](http://www.accu.org)



# A new visual studio

**A quiet revolution is under way. Publishing, which had remained virtually unchanged for a hundred years, is presently being shaken to its roots. Nobody seems to have noticed but Jules.**

In Yorkshire there is a small town called Haworth. It's famous because it is the place where the Bronte sisters grew up, and wrote, and eventually died. You can visit the parsonage where they lived, read Emily's letters as she desperately sought a publisher for the sisters' writing, and then wander around the narrow, Victorian streets that are virtually unchanged from those days, except for the tourist shops.

I was there to witness a bizarre custom called 'Scroggling the Holly', which involved a brass band of quite astonishing lack of talent (for the North of England), a band of Morris dancers, and a jolly fat man in an ancient cape who yelled good wishes to the assembled onlookers. After a procession up the main street, he gave the key for the gates of Christmas to a thrilled local child, who then used it to admit Santa to the town.

The streets were, of course, packed with sightseers. Some had cameras, some had handycams, but one person stood out. She was carrying a small video camera that was equipped with an enormous, fluffy microphone, and she was wearing headphones. Between filming the laid-on entertainments, and after interviewing the local shopkeepers, she would approach some of the tourists. 'I'm doing a documentary for Channel 4, I wonder if you'd mind being interviewed...'

Only five years ago, a person making a film for broadcast would have needed a three-man

film crew (and men it would almost certainly have been). There would have been a cameraman, a sound man, and probably a director, all lugging enormous – and heavy – lumps of equipment. But today, one person was able to hold in her hand enough technology to create broadcast-standard pictures and sound. Modern cameras contain all kinds of exciting tricks to make using them easy – they have noise cancellation schemes and anti-shake systems to make handheld camera work look and sound as good as studio shots, and the tapes are recorded in digital error-correcting codes that can squeeze so much quality into tiny cassettes that they reproduce their stuff as well as professional formats.

Back home, the technology continues. Instead of a multi-machine editing suite, the video producer of today probably has a £1,500 computer. The tapes are recorded onto hard disk, edited inside the machine, and eventually distributed in digital form, ready for broadcast. It's even possible to master a DVD disk entirely at home.

Compared with the television industry of ten years ago, this is truly amazing. Though it was originally motivated by the needs of electronic news gathering, now anyone – anyone at all – can make their own TV programme, and with more channels springing up, desperate for content, it is going to become easier than ever to get it broadcast.

Television is not the only thing that has been affected.

Almost every kind of media has been democratised in this way. Publishing on paper, which used to be expensive and difficult, involving typesetters, printers, and loads of stock stuck in the garage, has become a much easier thing to do at home – fast lasers capable of printing at high speed onto A3 paper have made just-in-time book publishing a reasonable possibility. Music publishing has been practical for a few years now, whether that means assembling simple compilations or a band mastering its own recordings and self-publishing its albums.

Perhaps it's because there hasn't been a revolution, or perhaps it's because this stuff doesn't permit anything fundamental that couldn't have been done before, but nobody seems to be taking notice of the fact that all publishing, all media, have been democratised. No longer do you need access to jealously-guarded distribution channels, or massive development budgets. It is now possible, at home, to make almost any media production to professional standard, at a cost that makes it a reasonable proposition for either an amateur or hobbyist, or a self-employed professional.

Forget, for a moment, about the Internet (though the sales and distribution channels opened by the Internet can only help this movement). What is happening in media technology will change the face of publishing. Large book publishers, which by their conservatism exclude new writers from exposure, will

suddenly find their source of talent evaporating as writers find they get a fairer deal, and better money, through self-publishing or working through small cooperatives. People with unusual, distasteful, or unfashionable political opinions will find that by making their own films, they will be able to air their views on television. Experimental films and programmes with tiny audiences will get made, and some will become the classics of tomorrow.

But, in order to use this technology, to gain a voice, ordinary people will need to become literate. Writing, the core skill of communication, will not be enough. In the future it will be necessary to be skilled in a range of techniques, from photography and illustration to cinema and music – even the arrangement of visual elements on a page or screen will affect whether something is read or discarded. When making a film is as easy as writing a book (as it nearly is today), and technical problems are entirely absorbed by cheap and available technology, style and technique will be as important as the message. Because a keen amateur can make a job as good as a professional, such demanding standards will be expected of everyone. A basic education, alongside reading and writing, will include photography, design, and cinematography. ■

*You can call Jules on 01707 662698 or email him at [mayhem@jules.cix.co.uk](mailto:mayhem@jules.cix.co.uk).*







## MFC free

Dear Sir,

I have just discovered [www.exe.co.uk](http://www.exe.co.uk), and I've been reading the articles for the past couple of hours. I've been really enjoying them. However, I have to comment about *MFC* – my favourite code (*Mayhem*, EXE, January 1999). I quote: 'I do know about tools such as MFC, ... I decided it was probably fine if you were writing word processors for an employer called Microsoft, but not much cop for anything else.'

Actually, Microsoft's word processor; and the entire MS Office package for that matter; is, get a load of this – MFC free. In fact, most of the development tools are MFC free as well. Visual C++ isn't, but Visual Basic, Visual J++, and Visual InterDev are. I knew some of that all along, but the plain MEF (Massive Existence Failure) came up as I was having an argument with a colleague the other day about the use of STL in production code. He preferred MFC's containers, while I opted for the STL's way of doing things. The argument turned nasty occasionally (programmers are like that, as you know) and at one moment I pointed out that not even Microsoft uses MFC in their key products. He, to put it mildly, had some doubts about that. He even said that Windows NT wouldn't boot without MFC DLLs. So, we removed them all, and hola – every MS product was alive and happy (except for the Visual C++ and Visual SourceSafe).

Name and email address supplied

## Delphi 5

Dear Sir,

I was unimpressed with Jules May's review of Delphi 5 (EXE, November 1999). As a committed Delphite I must take exception.



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

I am not sure which version of Delphi 5 he used to review, but it could not be the trial version given away the previous month with your magazine. He asserts that there is no explanation in the online help for creation of event-handlers. If you don't know how to use a language, the first thing to do is to look for a tutorial in the online help. The 'Quick Start Tutorial' supplied is an excellent introduction to Delphi (and covers databases, action lists, event-handlers).

Okay, Delphi does not come with MSDN – so if you need it, either look online or buy the Standard Edition VC++ upgrade (the cheapest legal way to buy the MSDN library).

If you need a free modern windows API, look at the Jedi project (<http://www.delphi-jedi.org/>). Delphi freeware is readily available to patch the gaps that Borland has left.

Okay, Delphi 4 was buggy. Most Delphi developers stayed with the very stable earlier versions of Delphi. Hardly a reputation for being buggy.

Delphi has supported COM since version 1 (look in `ole2.pas` in the Delphi 1 sources, if you don't believe me). It gained variants and basic automation support in version 2 and direct interface support in version 3.

Delphi is ideal for larger scale development – its VCL design makes code reuse easy. Chris Eyre  
[chris@chris-eyre.demon.co.uk](mailto:chris@chris-eyre.demon.co.uk)

Normally, I'm not a fan of online tutorials. They don't allow you to flick backwards and forwards through the text, and they take up valuable screen real estate,

obscuring the program they're supposed to be illuminating. Generally, I don't even look for them unless I'm told to.

The Quick Start manual did contain a tutorial. It was very brief, showed only one way to add an event (to a menu item), and that way did not generalise to other kinds of control. (There was no mention of the online tutorial, and it turned out that the online tutorial was identical to the one in the book.) Right at the end of three pages of description, there was a sentence explaining about double-clicking – I confess, I missed it. In general, the tutorial was far from excellent – what on earth are you comparing it with?

Apart from the note about the Jedi project (thanks for that, by the way), I think I made all the same points you're making. However, few of my comments are directed towards you – you know the system, you know your way around the maze of third party products, and your experience and enthusiasm will make up for much of the product's weaknesses. You are, by your own admission, unable to be objective. In contrast, I'm not a committed Delphite, and I was writing to an audience who also aren't. I haven't used Delphi since V3, but nevertheless I actually tried to forget everything I knew – the question in my mind was 'Why should anyone base their new development on Delphi instead of MS?', and it's not an automatic choice. Jules May

## Off site but still earning

Dear Sir,

I am writing in response to the letter that appeared under the title of *Home alone* in the December issue of EXE.

For almost 7 of the last 8 years I have been able to work from home as a software engineer developing CAD/CAM software for use in the aerospace industry. I visit my employer's offices once or twice a month for face to face discussions, but most exchange of information is over the telephone or by email. I work as part of a small team whose size has varied from six down to three and is currently four.

Even when I worked on my employer's premises in one city, my manager was based at another location 50 miles away and I eventually became the only member of his team working on this site. When the city centre site was closed, I spent a year commuting 1.5 hours each way every day to another company site. I eventually persuaded my manager that I would be more productive working from home instead of sitting on buses and trains for 3 hours a day.

I am happy with this arrangement and I believe my manager is too. As we have never worked on the same site he must have grown accustomed to my doing what was required without constant supervision. I believe he had to persuade his superiors that I would still earn my keep working from home. I think they are getting very good value for money!

Name and email address supplied



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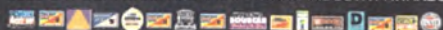
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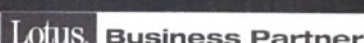
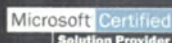
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# A Sterling range

**TI's Composer and Cayenne's ObjectTeam are just two of the tools swallowed by the ever expanding COOL product range. Ian Murphy investigates Sterling Software's application development tools.**

Lots of companies claim that their tools are all you will need for development. Some of them, such as Rational Software and Microsoft, actually have the depth and variety of products to make such a claim even if the quality sometimes falls short of what is required. Many of these companies have gained their positions through acquisition and for their customers and staff these have often proved painful and, in a few cases, almost more trouble than they were worth. The problem about growth through acquisition is that you keep changing the core focus of the company and this is then reflected in the offerings that you put together.

Sterling Software is a company that has been heavily involved in the acquisition market over the last few years but the focus has been on purchasing tools that will fit into the categories that Sterling sees as being its core competency. In the development area, and in particular the COOL family of products, that has meant looking at process-based tools that fit the Sterling methodology. That development methodology is firmly rooted in software engineering and Sterling has been very careful to ensure that all of its products have an engineering bias. This has placed Sterling very firmly in the Enterprise market although recent acquisitions have provided them with a toolset that now encompasses the SME (small or medium-sized enterprise) market. Despite this high-end focus, Sterling has a very strong appeal to Microsoft shops because when it acquired Texas Instruments (TI), it gained a very powerful fit into the Microsoft Repository.

TI was the major third-party involved in designing the Microsoft Repository and this meant that large development shops that had traditionally used TI's IEF (Information Engineering Facility) for their business process engineering and software design were able to move to Composer for their PC-based development. At the same time, this meant that TI were finally able to move away from being labelled a CASE vendor and reposition themselves as a Visual Design tool vendor like so many of the other CASE vendors had already done. Sterling's other recent acquisitions, such as Cayenne and Synon, are the main reason that they are now putting up such a strong showing in the SME market.

Yet Sterling is involved in a number of other areas that are likely to be of extreme interest to programmers. While Rational Software has been concentrating on the core development cycle from design, through



SCM, and into product testing, Sterling has focused on different streams of development and management. One of those is the darling of 1999, Business Intelligence. While there seems to be no let up in the vast sums being spent on client/server development, there has been a recognition that such systems are too slow to respond to user needs. One solution was to build smaller Data Marts and these have been around for quite a while now, slowly moving to the PC networking environment as operating systems and hardware became more powerful.

Yet this has still failed to truly open access to the vast amount of corporate data, so user-controlled query tools have appeared that allow better access with processing maintained at the server rather than the client. More importantly, the design tools have been simplified to allow business analysts to specify the construction of various flavours of Olap cubes, moving the construction of these out of the IT department's full control. Sterling has been aggressively purchasing vendors in this area, as well as in the closely related network management and data storage management arenas.

## All in the family

Before diving into the selection of tools that I have been looking at, it is important to consider the different families and what each contains



(see *Sterling families and tools*). Sterling maintains that it does not expect any customer, particularly on the development side, to take all the products in any given family because there is a necessary overlap. In addition, some of the tools are very focused on the US Government business, and with its tools becoming increasingly common in UK Government projects we may see a toolset marketed in the same way over here. Apart from the Federal Systems Group, relevant only to the US, Sterling breaks its offerings down into six groups: COOL (application development), EUREKA (business intelligence), VISION (information management), SOLVE (network management), SAMS (storage management), and VM (web functionality for legacy systems).

Many products potentially overlap between the different families. Unlike Rational Software and Computer Associates, who have done a lot of work to create a coherent line through their product offerings, Sterling is happy to leave an overlap as it sees different groups buying into its products. This has been lucrative for Sterling because it means that when the legacy customers want to downsize developments or implement user-driven Business Intelligence solutions, rather than a traditional client/server solution, they can reuse the software engineering knowledge they have already developed.

What are obviously missing here are specific tools dealing with Software Testing and Software Configuration Management (SCM). That said, COOL:Teamwork does provide some SCM functionality. There are also some very serious issues over round-trip engineering that are not fully dealt with and much of this goes to the underlying repository structures of the various COOL family members. This is one area where vendors of the size of Rational Software or Microsoft have an advantage over Sterling. They have enough money and developers so that when they take over a company, they can immediately focus on how to integrate the functionality with their other products. This helps to provide a common underlying structure and greatly enhances the appeal of such products.

The primary reason why Sterling has not reduced the COOL products to a single repository is that they have all come from very different backgrounds where the products were seen as being highly engineered. Part of this meant that they are so tightly wedded to their own repository structures that it would take not just a major upgrade but effectively a complete rewrite to effect any such change of repository. Sterling is looking at providing an infrastructure layer between its tools that would simplify the passing of information between the different repositories. Yet the jury is still out on how it expects to achieve this and Sterling puts this down to general uncertainty in the wider software development market. It sees the final choice as being between XML and UML, but this is likely to be subject to customer feedback.

This waiting for customers to express their needs is something that allows Sterling to retain control over the products and provide customers with good feature set stability, but it does have the potential downside of not reacting quickly enough to new technologies. With so much development moving to the e-commerce space where speed is critical, this may force Sterling to change its approach. It must be noted, however, that this is not necessarily a view shared by the current user base, which remains extremely loyal to Sterling (something that not every development tools vendor can lay claim to).

My primary focus is to look at the COOL family and what it can offer to software developers. As mentioned earlier, Sterling sees this family of tools as covering both the Enterprise space and the SME market, with the latter split between small and larger medium sized enterprises. Irrespective of which of these three you are in, at the heart of this family is COOL:Biz, Sterling's key modelling tool and one that I'll take a close look at.

### The enterprise space

Staying with the Enterprise to begin with, once you have done your requirements specification through COOL:Biz, you then transfer the output to COOL:Spex. This product concentrates on doing component-based development, but with a difference. Unlike many of its competitors, Sterling has concentrated on how the interface is displayed and handled. Many component-based development tools allow you to define your interfaces but then do little with them, instead they simply use stereotyping (stereotypes are a UML extension, enabling an instance of a modelling element to be classified as a particular type). The COOL:Spex interface manager only allows you to reference available components based on the way the pre- and post-conditions are defined. In doing so, it ensures that you take the interface as a first order construct, thereby ignoring the stereotyping approach.

Why is this important? We've been doing component-based development for some time now and despite the vast sums spent on tools, training, and development, corporate IT departments are no nearer being able to simply plug components together and build a system. The COOL:Spex approach puts the design tool in the position of managing the component and its interaction with other components. The result is that time spent doing design is not wasted or at best peripheral to the interaction of components. The modeller can now begin to build systems from a complex library of components with a real expectation of creating a workable result. During 2000, Sterling intends to add XML functionality to the Component Manager, which will be used to strengthen the links between different repositories. Ironically, this move second-guesses its dilemma from earlier as to whether XML or UML is the preferred solution.

While it is likely that you will drive COOL:Spex from COOL:Biz, COOL:Spex (unlike some tools, such as COOL:Jex or COOL:Plex) is just a design tool and doesn't generate any code. The link between COOL:Biz and COOL:Spex does not extend to a shared repository, although there is a mechanism for transferring information between them if you want round-trip engineering. To build code from your design specification, you will need to use either COOL:Gen, COOL:Jex, or COOL:Joe. The tightest of these links is with COOL:Joe and this is the preferred mechanism for developers. COOL:Gen and COOL:Jex are normally proposed as direct downstream tools from COOL:Biz with each targeted at a different market, as we will see.

COOL:Gen is the latest revision of TI Composer and is seen as being the legacy and client/server development tool with the main O/S focus being Unix and MVS. COOL:Gen is used to build entire applications, from database to end-user interface, and one of its strengths is that it allows you to build your database at an abstracted level. This ability to allow business analysts to build databases is often



Figure 1 - COOL:Plex's Model Editor.



# Developer Tools? - Look No Further.

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talked about by the Business Intelligence vendors. The result is that the development does not need DBA focus during the early stages, although with any tool that creates databases you should always ensure DBA approval before moving to the physical construction. The drawback of this approach is that people build database tables based on database views in their source data. Not only does this seriously impact performance but it also has the potential to seriously compromise database security. This is where you need that DBA knowledge of how the original database was constructed. COOL:Gen is a good example of how Sterling has sought to create hooks in different tool families that make it easy for IT departments to grow their use of Sterling products into different parts of the business.

Like other tools in this market, there is ample support for referential integrity through stored procedures and triggers, although COOL:Gen is designed to use external procedures. Many of these are likely to come from your business rules, and one advantage of coming from a legacy system background is an understanding of how to work with TP Monitors. To show its commitment to COOL:Gen, Sterling has decided that when Windows 2000 ships, COOL:Gen will be directly supporting the next release of MTS (Microsoft Transaction Server). At this point, however, Sterling is not saying if this will be on ship date, or what the delay is likely to be.

COOL:Gen automatically creates all the required application code, including the JavaBeans or COM components that are required, the latter through the COOL:Proxy add-on. COOL:Gen will provide round-trip engineering with COOL:DBA and this means that COOL:Gen and

COOL:DBA can share the same repository. To use COOL:Gen, however, you must have MS Visual Studio already installed.

The last of the tools for this Enterprise breakdown is the newest from Sterling Software, COOL:Joe. At present, COOL:Joe is still a beta product but you can download it direct from the Sterling website. COOL:Joe is a wizard driven tool to build EJBs and has been built for very tight integration into COOL:Spex. Both products use the same repository and command set. The product was due to be released during December 1999, although it will be single-user until at least September 2000. If you want to download the tool, you will not be able to install it unless you have already installed JDK 2.0, as the installation routine checks the Registry.

#### Small to medium

Moving into the SME market, Sterling has two offerings, one for the high-end medium-sized companies and one for the rest. In both cases, the design tool of choice is still COOL:Biz yet it is the next-level tool that makes a significant difference.

For the high-end market, the link is COOL:Biz to COOL:Plex. This tool is designed to model application behaviour and uses the software modelling technique known as patterns. (For anyone interested in patterns, take a look at *Pattern Languages of Program Design* by James Coplien and Douglas Schmidt, ISBN 0201607344).

The low-end of the SME market is dealt with by COOL:Biz and on into COOL:Jex. I looked at COOL:Jex last year (see *Simplicity by design tools*, EXE, March 1999) and since then it has carved out a significant reputation for itself. One key issue for many organisations is

## Sterling families and tools

The key area for this review is the Application Development tools and this comprises the **COOL** product family. These tools range from specification tools through to design tools and even encompass code generation tools. The latest to join this family is COOL:Joe, which is focused on the Java market. The full range is as follows:

- COOL:Biz (business modelling and requirements specification, *formerly KEY:Model*)
- COOL:Spex (component-based development)
- COOL:Gen (code generation, *formerly Composer*)
- COOL:Proxy add-on (an add-on for creating COM components)
- COOL:DBA (database administrator toolset, *formerly DataTeam and Terrain for DB2*)
- COOL:Jex (diagramming and code generation, *formerly ObjectTeam*)
- COOL:Joe (in beta, for creating EJBs)
- COOL:Plex (model application behaviour via patterns, *formerly Obsydian*)
- COOL:BusinessTeam (a data and process modelling tool, *formerly BusinessTeam*)
- COOL:Teamwork (real-time and embedded systems, *formerly TeamWork*)
- COOL:2E (AS/400 application development environment, *formerly Synon/2E*)
- COOL:Enterprise (OS/2-based tools suite, *formerly KEY:Enterprise*)
- COOL:Xtras (Advise, COOL:Qwik, COM Proxy, Webview, and BusinessTeam.net and DBA.net)

Business Intelligence products are grouped under the **EUREKA** product family and this particular group is heavily focused on user-data access, web portal design, and reporting. This is also an area that is likely to see more input from the development community as more organisations look to develop their own portals as part of both an e-commerce strategy and an attempt to use the corporate intranet to improve access to information.

Information Management products are in the **VISION** family and this is where Sterling has been most active this year. These are a mix of development tools and end-user tools, a number of which work with MVS Cobol and IBM AS/400s. Much of this activity is related to Y2K issues and while part of this business will slow down next year, the introduction of both Solaris 8 and Windows 2000 should see a lot of interest in tools allowing applications and data to be ported away from the IBM AS/400 market.

Network Management is probably the second fastest growing market after Business Intelligence and Sterling groups these products under the **SOLVE** family. Despite the popularity of these products, Sterling is not yet one of the key players in this market.

Next year's expected killer apps are likely to be in the Storage Management space as FC-AL (Fibre Controlled - Arbitrated Loop) systems start to be stable enough to interoperate. The Storage Area Network (SAN) market will also take a boost when, as already mentioned, Solaris 8 and Windows 2000 are launched in March and February respectively. The **SAMS** family are storage management products and Sterling is working hard to sign up partners in this area.

The **VM** family is targeted at legacy systems and for allowing IT departments to add web functionality to these systems.



that COOL:Jex does not have to integrate with other product suites in the same way as Rational Rose does.

Let's look at COOL:Biz and COOL:Plex in more detail.

## COOL:Biz

COOL:Biz is a requirements and business modelling tool. Installation is relatively simple but it does take up a significant amount of resources. In addition, if you are installing on an NT Workstation, make sure that you are connected to the network and have the relevant Registry editing permissions. It is possible under Windows NT to install most products without worrying about Registry access, but the ObjectStore Server component will fail if it cannot write to the Registry. In addition, you may well find yourself having to modify the environment variables on your notebook if you intend to use COOL:Biz while not connected to the corporate network.

The entire installation took around 20 minutes to complete and you will need to check the readme file. It was a fairly irritating installation because having told the installation routine the directory to start installing in, it promptly decided that I needed to re-enter this every time it needed to add another directory. Most products remember the start location but COOL:Biz always defaults to the C: drive. The total amount of disk space required was 95 MB and there were two services installed: the ObjectStore Cache Manager that took 1.7 MB of RAM and the ObjectStore Server that required 2.6 MB. Both can be set to start at boot time, but if you don't intend to spend all of your time using COOL:Biz or if memory is scarce, you will need to remember to go to Control Panel, Services and start the services before every session.

One very annoying feature is the error messages that I got when using the documentation and help files. I had Adobe Acrobat reader v4 installed and every time I opened one of the Adobe-format help files it said that some components were missing. Worse still, I encountered problems following the links in the traditional Windows Help file – I was told that the page didn't exist and I should contact Sterling for an updated help file. If the machine had contained an earlier version of COOL:Biz, then perhaps this could have been blamed on a problem in the installation routine, but as it was a clean system to COOL:Biz this indicates sloppy CD manufacturing. Sterling doesn't provide an SCM tool within its offerings but perhaps one is required, if only when preparing the customer CDs.

Using COOL:Biz was very straightforward with the primary starting point being the Model Manager. From here, you can manage existing models, start a new model, and run the entire toolset. There are two

types of models – populated and empty (temporary models) – although you might want to start by looking carefully at an existing model and adapting it the first few times you work with COOL:Biz. Every model has two different aspects. The diagrams themselves are stored in a folder not surprisingly called Diagrams but the contents or details of the diagrams are stored in another folder called System Package. It is this second folder that holds the different objects and is where I would expect most programmers and serious analysts to spend a significant amount of time. Like many of my other assumptions about Sterling's products, this is the opposite to what Sterling itself expects. It believes that most people will operate through the diagrams themselves.

The diagram options are quite extensive as far as different diagram types are concerned (although there are packages that go much further). The ten different types of diagram available to you include Activity Flow, Class, Data Flow, Decomposition, Use Case, and Workflow Diagrammer. Despite the high number of alternatives, Sterling points out that you should try and restrict yourself to using between three and seven different diagrams. This is because the built-in integrity checking (Association Matrix) takes an increasing amount of processing power as you add more diagrams. Using the diagramming side is extremely interesting and the properties for each object in a diagram are very powerful. I was extremely impressed that the tool keeps a check of where your objects are and handles the context without you having to edit whenever you move an object. Like most other development packages, COOL:Biz assigns internal unique identifiers to each object.

At a more detailed level, COOL:Biz has as many as 25 different object types, such as Goals, Entities, Organisational Units, Jobs, Activities, Operations, Data Stores, States, Data Flows, Classes, Components, Component Stores, etc, that are stored in the file and can be viewed in a diagram. These are all part of the System Package folder although they are equally accessible and manageable through the diagramming interface. At the same time, when you create an object and place it onto a diagram, it is automatically added to the repository. This I believe is important as it means you don't need a programmer or senior business analyst spending a considerable amount of time seeding the repository with objects that pertain to your business. This means that you will soon develop a repository that deals with all the objects in your organisation with the benefit that you can re-engineer your organisation relatively easily. The result is that you can simply get started with limited problems. To find out what type an object represents simply double click on the icon, go to the General tab, and look at the heading type. Sterling believes that users are not confused by the fact that its icons may be very similar to those in similar products where the icon is used for another purpose. Once you get used to the context, it makes sense.

To keep your diagrams and objects under control, COOL:Biz uses something called an Association Matrix. This was developed as part of Sterling's experience in software engineering and the need to ensure that as you move from high-level diagrams (such as Organisation Flow) into more detailed diagrams (like Workflow and Activity Flow) you do not want to keep redefining objects and their changing relationships. More importantly, this allows you to validate the role of your objects. For example, if you were defining a job function that grew to the point where it spanned multiple departments, the Association Matrix will recognise this, highlight it as a potential problem, and then allow you to decompose that job into multiple jobs.

Another example of the integrity checking is that if you have defined a goal you will need an organisation to meet that goal, and ultimately processes to make it happen. If you have processes, you will

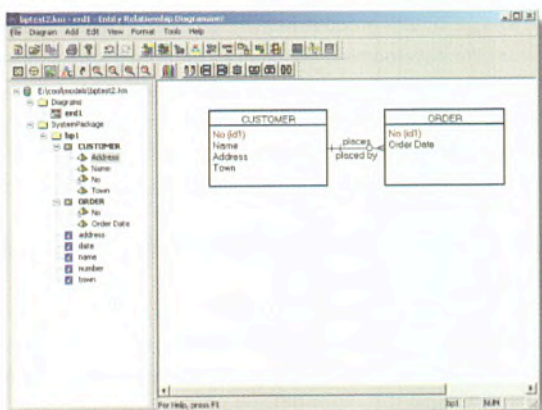


Figure 2 – COOL:Plex's Entity Relationship Diagrammer.



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need to capture what information a process needs to do its work, how it works, and then how it meets the goal. Once you have linked those pieces together, COOL:Biz maintains that linkage so that if you extend one part of the model, the integrity checking monitors the impact elsewhere. This is done through a set of internal rules where you can change the degree of coupling from loose to tight, depending on how rigid you are trying to make the system. Unfortunately, this is all you can do because the integrity checking is so deeply integrated with the underlying engine. Allowing you to add, delete, or modify rules would have a significant impact on the entire product.

As a result of this integrity checking and the Association Matrix, Sterling has developed a reasonable market in COOL:Biz with customers who use it simply for better business understanding. They use COOL:Biz to document their organisation and Sterling is keen to point out how important that has become in an era of constant corporate mergers.

### Analysts

The current user base for COOL:Biz ranges from the dominant users, who are analysts with an IT background including system analysts and analyst programmers, to non-IT business analysts, who are beginning to use the tool in ever increasing number. This is probably a result of both the need to model organisations after mergers or takeovers and the fact that after a few modelling exercises you should have a fairly comprehensive repository of objects about your business. Sterling is now seeding the university market to put the COOL products into the teaching arena for degree-based students. The company expects students to be capable with COOL:Biz after a two-day course, but they don't offer mentoring per se.

Sterling's courses deal with COOL:Biz as a tool, as a technique, and as a support for business modelling. And there is another course that enables organisations to create a centre of competence in order to train their own trainers who would internally teach staff to use COOL:Biz. There is also a consultancy arm that offers mentoring and it is the consultancy arm that would be involved in any project where you wanted to integrate COOL:Biz, or any other Sterling product, with another competitor. This package is tailored to the individual customer's requirement, although Sterling believes that the mentoring/consultancy market has actually matured to the point where most customers actually understand the techniques of business modelling. Therefore, most mentoring is about how to use specific parts of the functionality available. Sterling prefers to call this 'status checking' rather than mentoring. In addition, for those customers coming to COOL:Biz for the first time, Sterling would expect its consultancy arm to be involved in getting the customer started by developing, along with the customer, the first few models.

### COOL:Plex

COOL:Plex is a tool where you model an application's behaviour. Unlike COOL:Biz, it is not a Business Process Re-engineering tool and nor is it an OO tool, even though there is a significant amount of OO features in the tool. More importantly, it is not a CBD (component-based development) tool, although there are customers who choose to use it as such. COOL:Plex uses patterns to model the behaviour of an application and then generates the code to create that application.

Let's look at the initial issues over installation first. Although the product will install without MS Visual Studio being present, you will need to apply some patches and updates before using COOL:Plex. Importantly, Sterling warns that you will need to install Visual Studio and then

load and save at least one model before using COOL:Plex. Unfortunately, the installation notes then point you at a directory that doesn't exist and this caused a little bit of thought. You will need 17 MB for Application Integrator and 65 MB for COOL:Plex and its associated files, in addition to the space for Visual Studio and the Sun JDK 2 should you want to generate Java code. Note that Sterling does not certify all its libraries, so if you want to be sure that the final code is 100% Java-compliant then you may have some issues going through the certification process.

If installing on a Windows NT Workstation, you will need to allow a further 4 MB to install a couple of services (and rather than this being made an option you need to start a separate installation routine). Like COOL:Biz, the installation routine does not remember what you set for the initial directory. Furthermore, COOL:Plex does not scan for other Sterling software products during installation and when I had a go with COOL:Joe and then re-installed COOL:Biz, I discovered that this is a common problem with Sterling Software installations. All in all, the installation routines appear sloppy, as if someone has yet to finish them off. With the imminent arrival of Windows 2000 it is to be hoped that Sterling finally bites the bullet and moves to MSI for installations. Be warned, after a quick look at the beta version of COOL:Joe, a product due to ship around Christmas, they have yet to do so and are unwilling to commit to when they will be MSI-compliant.

### Specifications

The starting point for COOL:Plex is your business specification from COOL:Biz. Once you've done your initial specification within COOL:Biz, you import the data model into COOL:Plex. Ideally, you do this by acquiring a separate tool called Application Integrator (it came on the CD that I received), which takes a range of different imports and matches them against the patterns used by COOL:Plex. Other products that Application Integrator will work with include Synon 2e, DB2 database structures, and native RPG. COOL:Plex has three key target platforms: Java, Windows NT, and AS/400 at the server end. You can generate clients for all of these platforms, and with the AS/400 it is a 5250 client.

One of the reasons why people are looking at COOL:Plex is that as they move from their AS/400 platform to Windows NT there is a huge skills gap. Within the programmer market, that not only means language retraining but also operating system training. The complexity of Windows NT has caused many organisations problems over the last few years and with the new complexities within Windows 2000 the problems get worse. Sterling sees this as a key market for COOL:Plex because its existing mid-range systems customer base can take their existing models and begin that porting process very quickly.

COOL:Plex takes the model and generates the initial code for the application. An important issue here concerns your experience with code generation tools. Having worked with several tools on different platforms my own experience is that they are all very clever at the first cut, generic-applications approach, but they don't create quality code. This was the case with System Builder on Pick and is still the case if I look at building systems with RAD tools such as Centura, Magic, or PowerBuilder. In all these environments, you end up building an outline system and then often making significant changes to the code for tuning and additional features.

Sterling believes that this is where it scores heavily over other tools in the market: it expects the analyst programmer to use the built-in interface to not just model the application behaviour but to make any relevant changes. By doing so, it believes that you actually validate the model and improve long term manageability of your code. From actually spending some time with COOL:Plex, but nowhere near





as much as I would have liked, I'd have to begin to agree with them. Unfortunately, I lacked the time to really try and port one of my Centura applications and that would have been a real test.

As for the use of patterns in COOL:Plex, I would say that patterns are about encapsulating behaviour in an abstract fashion, and this is important. Many people confuse patterns with classes and this is something that Sterling has done itself, with the pattern libraries from earlier versions of COOL:Plex being described as class libraries.

There are two starting points with COOL:Plex: the Object Browser, which acts as your view on the repository, and the Model Editor, from where you create your application. Whenever you specify the relationship between two objects, you do so by declaring the source verb (object one), the verb (how it relates to object two), and the target (object two). For example, if I have two objects called bank and bank account I would define the relationship as 'bank holds bank account'.

There is a significant overlap in much of the general approach of COOL:Plex to products such as Centura and PowerBuilder where you are specifying tables and their entities in great detail. You place the relevant conditions on the various entities, such as type and length, and then you build validation controls straight into the entity. As the information grows, you begin to see that the information contained is very specific to that object and this is how the patterns build up. As you create bigger objects, say an address block containing many fields and validation components, you simply reference it in your model as an address. The usual rules of inheritance apply to patterns as well as to components and classes, thus in one way adding to the confusion as to what constitutes each one yet creating a familiar feel to building your application.

I found that putting together a simple application in COOL:Plex was quick and relatively painless. Certainly, I would have been pushed to have used Delphi, Centura, PowerBuilder, or several other tools so confidently in so short a space of time.

### Certification

Overall, there are some good things about where Sterling Software is in the market. Its spread of tools across platforms is a good enough reason to at least look at them for porting a project in the first instance. In the short term, however, I have reservations over its speed of commitment to Windows 2000 and its readiness across the board for certification of its products as well as certification of the code generated by its applications. It needs to be well on the way to integrating MSI into its products so that when customers build applications they can complete the job by building the deployment package as well. Sterling also needs to make a serious decision on where it is going with linkage between the different repositories and how it expects to move forward over the next year. Simply waiting for customers to say 'I want' doesn't work with large, complex, integrated application suites because your time from specification to finished system begins to take significant amounts of time. Time that your competitors will be looking to use to overtake you in the market. ■

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

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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).  
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**Orchestrating an embedded revolution?**

It's not often that we write about hardware in EXE. We are, after all, a *software* developer's magazine. But recently we got a preview of a new technology which threatens to blur the line between hardware and software permanently.

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 (see *Co-design: where hardware and software meet*, EXE, December 1995). The aim of Handel-C is to bring the flexibility and reconfigurability of software to hardware, using Field-Programmable Gate Array (FPGA) technology. FPGAs contain large numbers of gates - as found in microprocessors and RAM chips - whose logical arrangement can be reprogrammed on the fly. In effect, it's possible to write and rewrite different circuits onto the FPGA at will.

Handel-C itself is a subset of C that is tailored to doing the job of writing hardware. Programs in Handel-C translate *directly* into circuitry on the FPGA. A device using an FPGA doesn't need a microprocessor, or support chips. Functions like driving a display or taking input can be performed by hardware written onto the FPGA itself. ESL uses a demo board consisting of an FPGA and DRAM chip, with some connectors.

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**Notes**  
We're sure that you'll be hearing a lot more about FPGAs - and Handel-C - in future. Meanwhile, you can get your hands on a Handel-C toolkit for £3,500 per seat from ESL direct.  
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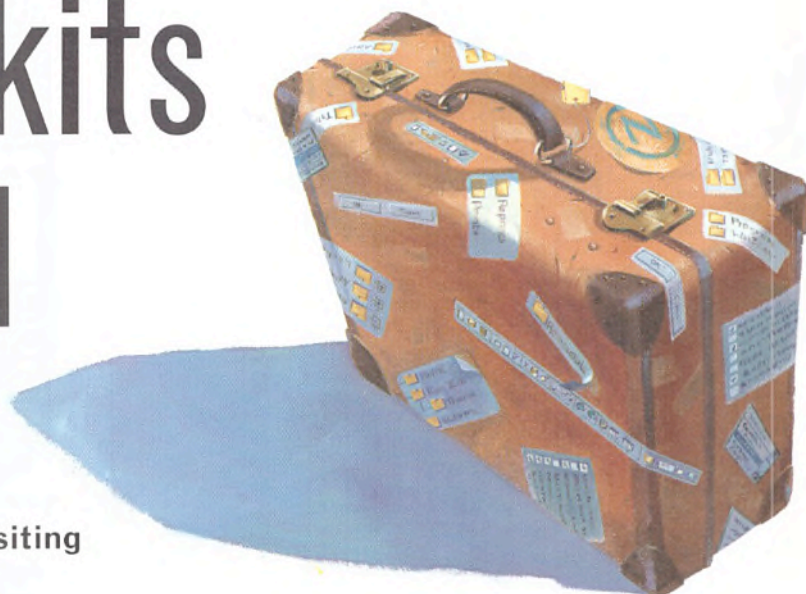
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# Have toolkits will travel

Are you restricting yourself to Windows? Dave Jewell continues his excursion with portability toolkits by visiting the Open Source GTK+.



GTK+ is another interesting portability toolkit that deserves consideration. Unlike Qt, which I covered last month in *GUIs to go*, this isn't a commercial package but a purely Open Source phenomenon. And unlike Qt, GTK+ wasn't (as far as I know) designed with portability as a specific goal, although it seems to have weathered this transition remarkably well. GTK+ stands for 'Gimp Tool-Kit' and the library was originally developed to assist in the creation of 'The Gimp', a popular image-manipulation program that runs under Linux and Unix/X11 systems. See Figure 1, and visit <http://www.gimp.org> for more details on The Gimp.

In recent times, GTK+ has been ported to Win32, as a result of which The Gimp has also appeared on the Windows desktop. This is quite an impressive feat and demonstrates the validity of using GTK+ as a portability vehicle. Still more recently, work is under way on a port of GTK+ to BeOS. This is still at a very early stage, but progress so far has been impressive. Ardent Qt zealot though I am, it's got to be admitted that support for BeOS is a major 'plus' for GTK+ if you want to cover as many bases as possible with one portability toolkit.

Oh yes, did I mention 'plus'? Judging from the name of this toolkit, you might be forgiven for thinking that GTK+ is a C++-based application framework. In fact, this isn't the case. GTK+ is written in straight C, but it's been written in what the authors refer to as an object-oriented manner. Personally, I would strongly dispute this; all it *really* means in practice is that the various identifier names have been 'flattened out' so that, for example, `gtk_container_border_width` is a routine that sets the border width of a container 'object':

```
gtk_container_border_width (GTK_CONTAINER (window), 35);
```

There are several things that need to be said about this style of coding, aside from the obvious observation that identifier names rapidly become very long. If this were a true OOP API, then a far more natural procedure declaration would be something like `GtkContainer::SetBorderWidth`, allowing you to do something like this:

```
window->SetBorderWidth (50);
```

Typing this is obviously preferable to the first example! Moreover, in the GTK+ world, every type of 'widget' is generally declared as a pointer to `GtkWidget`, so that a window, a button, and a radio-button would all be declared like this:

```
GtkWidget *window;
GtkWidget *button;
GtkWidget *radio;
```

Different objects (I'm using the term loosely because this isn't true OOP) are created by calling the appropriate 'new' routine in order to retrieve a pointer to a dynamically allocated data structure. Thus `gtk_window_new` will create a new window object whereas the not so snappily named `gtk_radio_button_new_with_label` will give you a radio button with associated label, and so on. Because each of these routines returns a `GtkWidget` pointer, you need to cast your widget references to a specific pointer type when calling a routine that only accepts that type. For example, notice the way in which the window variable previously passed to `gtk_container_border_width` had to be cast through the `GTK_CONTAINER` macro first. My overall feel for the GTK+ coding style is that it's extremely verbose, requiring a large amount of coding and casting in order to accomplish even very simple tasks – from time to time I've amused myself by translating chunks of GTK+ code into Qt, Delphi, or whatever.

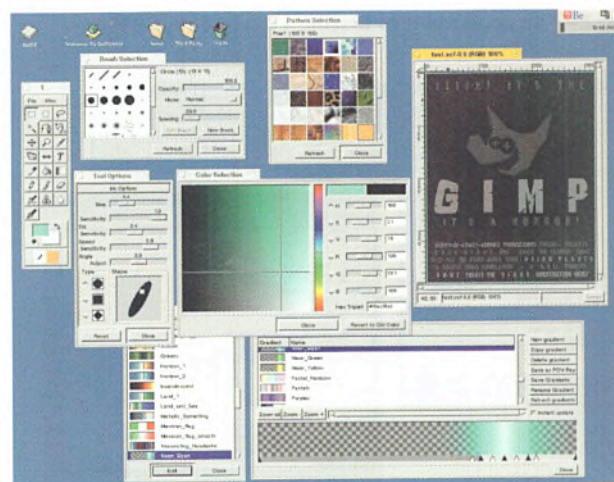


Figure 1 – This is The Gimp – the image manipulation program that started it all off – at least as far as the development of GTK+ is concerned. This shot shows The Gimp running on BeOS thanks to the new (but not yet complete) port of GTK+.



```

GtkWidget *win, *box, *table, *text, *button, *sb;

void main(int argc, char *argv[])
{
    gtk_init(&argc, &argv);
    win = gtk_window_new (GTK_WINDOW_TOPLEVEL);
    gtk_widget_set_usize(GTK_WIDGET(win), 400, 200);
    gtk_signal_connect (GTK_OBJECT (win), "delete_event",
        GTK_SIGNAL_FUNC(exit), &win);
    gtk_window_set_title (GTK_WINDOW (win), "Hello World");
    gtk_widget_set_uposition (GTK_WIDGET(win), 100, 100);
    gtk_container_border_width (GTK_CONTAINER (win), 0);
    gtk_widget_show(win);

    box = gtk_vbox_new (FALSE, 0);
    gtk_container_add (GTK_CONTAINER (win), box);
    gtk_container_border_width (GTK_CONTAINER (box), 2);
    gtk_widget_show (box);

    table = gtk_table_new (2, 2, FALSE);
    gtk_table_set_row_spacing (GTK_TABLE (table), 0, 2);
    gtk_table_set_col_spacing (GTK_TABLE (table), 0, 2);
    gtk_box_pack_start (GTK_BOX (box), table, TRUE, TRUE, 0);
    gtk_widget_show (table);

    text = gtk_text_new(NULL, NULL);
    gtk_text_set_editable (GTK_TEXT (text), FALSE);
    gtk_text_set_word_wrap(GTK_TEXT (text), TRUE);
    gtk_table_attach_defaults (GTK_TABLE (table),
        text, 0, 1, 0, 1);
    gtk_widget_show (text);

    sb = gtk_vscrollbar_new(GTK_TEXT(text)->vadj);
    gtk_table_attach(GTK_TABLE(table), sb, 1, 2, 0, 1,
        GTK_FILL, GTK_EXPAND | GTK_FILL, 0, 0);
    gtk_widget_show(sb);

    gtk_text_freeze(GTK_TEXT(text));
    gtk_widget_realize(text);
    gtk_text_insert (GTK_TEXT (text), NULL, NULL, NULL,
        "Hello World!", -1);
    gtk_text_thaw(GTK_TEXT(text));

    button = gtk_button_new_with_label ("Close");
    gtk_signal_connect_object(GTK_OBJECT(button), "clicked",
        GTK_SIGNAL_FUNC(exit), GTK_OBJECT(win));
    gtk_box_pack_start(GTK_BOX(box), button, TRUE, TRUE, 0);
    gtk_widget_show(button);
    gtk_main();
}

```

Listing 1 – A GTK+ example.

```

#include "easygtk.h"
GtkWidget *win, *box, *text, *button;

void main(int argc, char *argv[])
{
    gtk_init(&argc, &argv);
    win = e_window_create ("Hello World", 400, 200,
        100, 100, exit);
    box = e_box_create(win, E_VERTICAL, 2);
    text = e_text_create(box, FALSE, "Hello World!", E_NO_FUNC);
    button = e_button_create(box, "Close", exit);
    gtk_main();
}

```

Listing 2 – The equivalent of Listing 1 using EasyGTK.

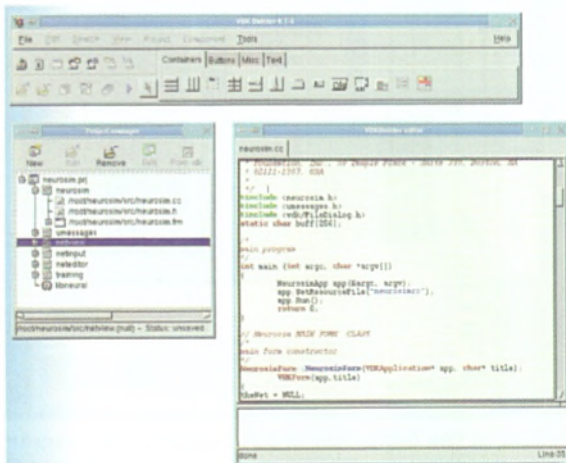


Figure 2 – VDKBuilder is one of many RAD-style development systems that are appearing for GTK+ and for Qt.

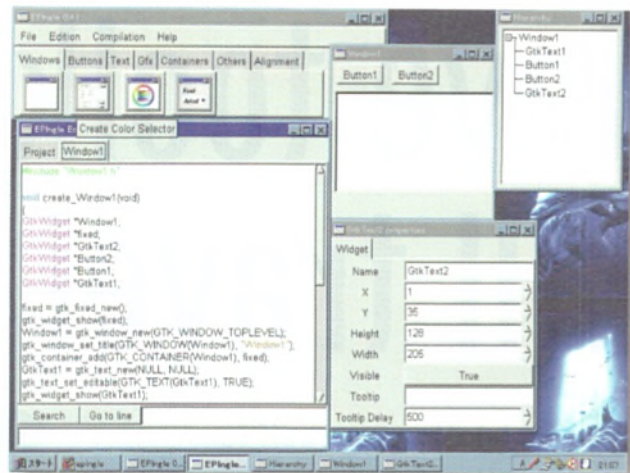


Figure 3 – EPIngle on Win32.

Having said all that, there is one (but maybe only one) compelling argument for sticking with a plain-vanilla C implementation. By so doing, GTK+ makes it relatively easy to write other language bindings capable of working with GTK+. This arises because (on Linux, for example) a plain-vanilla ELF (Executable and Linking Format) library containing the core GTK+ code will be linkable to any development system capable of working with standard libraries. If you check out the official GTK+ website at <http://www.gtk.org>, you'll find that a number of alternative language bindings are on offer, including Perl, Python, Eiffel, Ada95 (yes, really), Objective C, and the ability to create GTK+ programs using Free Pascal, a popular Delphi 'clone' compiler that you can find at <http://www.freepascal.org>.

For those of you who would rather die than use the standard GTK+ coding style that I've discussed so far, there are alternatives. For starters, there's a small library called EasyGTK. This was written by a developer who (like me) realised that the GTK+ coding style has a very low signal to noise ratio, and he set about creating a set of wrapper functions that encapsulate some of the most frequently needed sequences of GTK+ calls. You can see the proof of the pudding in Listing 1 (before!) and Listing 2 (after!), which illustrate the impressive degree of code reduction that he managed to achieve. You can catch up with the current version of EasyGTK at <http://users.linuxbox.com/~drow/EasyGTK/> although I'm not totally convinced that further work is being done in this area. At the end of the day, though, EasyGTK is still straight C, and other, more interesting possibilities exist...

### Barefoot GTK+

Just as nobody in their right mind would create a modern application using only the barefoot Windows API, I hope I've demonstrated the folly of trying to do anything serious with GTK+ alone. Unlike Qt, it's much too low-level for productive work, and shouldn't be used for anything significant by itself. A much better approach is to regard GTK+ as a foundation, and build a set of higher-level C++ classes on top of it. There are at least three different libraries around that do just that.

First, there is the somewhat quixotically named GTK-. The name suggests that this is GTK+ with bits taken away, but it's actually a set of over 100 C++ classes that wrap the underlying GTK+ architecture. At the time of writing, the most recent version of GTK- is 1.1 and you can find it lurking at <http://lazy.ton.tut.fi/terop/iki/gtk/gtk-.html>.



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## Confessions of a jaundiced Windows programmer

'Dunno about you, but I'm still young enough to remember clearly the excitement that I felt on first encountering the Apple Macintosh, Apple II, PET, BBC Micro, Acorn Atom, and many other notable microcomputers, most of which are now long dead. It was always great fun to explore a new user interface, discover the foibles of each machine and then start up a new learning curve, figuring out how to program, and ultimately tame, your new toy using assembler code, Basic, Pascal, C/C++, or whatever.

About a year or so ago, I suddenly realised that it had been far too long since I'd had that sort of excitement. Windows was just becoming...well...boring. If I had a quid for every new filesystem or database technology that Microsoft has tried to foist on us in recent years, then I'd be a rich man. But it's not just ADO, ODBC, DAO, RDO, OLE DB, etc, which send me into a deep slumber. There are other more serious issues, such as Microsoft's apparent inability to get its act together in the QA and design departments. For example, take MFC...please!

Microsoft would be the first to admit that MFC began life as a relatively low-level wrapper around the Windows API. At the time MFC was first conceived, the latest hot new technology had nothing to do with the (then) embryonic Internet. At that time, the 'in-thing du jour' was the C++ language itself. Accordingly, Microsoft was very keen to jump onto the C++ bandwagon, and they did so by creating a set of thin – in some cases, very thin – C++ wrappers around the API. It's notoriously easy to be wise with the benefit of hindsight, but it's clear that Microsoft wasn't thinking in terms of future portability here. Its whole mind-set was focused on the task of making Windows programming into a C++ activity.

Notice that I said 'C++ activity', not 'simpler activity'! Although the software giant can certainly be forgiven for not having the foresight to design MFC in a portable manner, it's much more difficult to be charitable regarding its overall design of MFC. Looked at objectively (pun strictly intentional), it's quite evident that Microsoft's only real design goal for MFC was to get programmers using objects as quickly as possible. Getting those objects to do real work on behalf of the programmer was apparently much less of a priority, as far as the MFC designers were concerned.

If you think I'm being over-critical here, then take a look at the VCL framework, as used by Delphi and C++Builder. Let's suppose you want to draw a series of lines using a custom drawing tool, such as a red, two pixel wide pen. With MFC, you have to create yourself a new object of type `CPen` with the desired characteristics, select that pen into the `CDC` device context you're using, and perform any drawing that's required. Then, you have to deselect the custom tool from the device context, putting the original drawing tool back in, and finally you can safely destroy the custom `CPen` instance. This sequence of events, of course, is directly equivalent to the steps that a barefoot API programmer would have to use. Net benefit to the C++ developer: nil.

Compare this to the situation in VCL-ville. A C++Builder/Delphi developer need only set the `Width` and `Color` properties of the permanent `TPen` object that's built into `TCanvas` (the equivalent of MFC's `CDC` drawing surface representation) and he's ready to roll. The VCL library takes care of creating a custom API-level pen object, selecting it into a device context, and deselecting it afterwards; the whole thing is completely transparent to the developer. When using MFC, programmers are still much too close to the Windows API, and it really shouldn't be that way.

At the time MFC was introduced, Microsoft argued that it had designed MFC this way so that there was a minimal learning curve for experienced API developers. But that's a bit like Ford saying they've developed a new car with no engine or floor so that experienced pedestrians will feel at home as they pedal off to the local Sainsburys...

The still-rising popularity of Linux suggests that I'm not the only one who's getting a bit fed up with massively bloated, bug-ridden operating systems and unproductive development environments that do little, if anything, to help you. For example, in recent discussion threads on Cix, a number of Linux enthusiasts have bemoaned the fact that Ameol – the Cix offline reader software – isn't available on their favourite platform. Suggested solutions have included (a) the possibility of making Ameol into Open Source software and (b) having someone create a Linux Ameol clone from scratch, which would also be Open Source, natch. It's undeniably true that many folks equate Open Source software with 'free software', and if they can dictate what software is ported where by massed ranks of unpaid, penniless (but boundlessly enthusiastic) developers, then what a wonderful world it will be...

wxWindows can be found at <http://www.freiburg.linux.de/~wxwt/> and this takes an altogether different approach. wxWindows is not GTK-specific, but aims to provide a standard programming API on top of GTK+, Motif, Apple Mac (beta), OS/2, and Windows. The GTK+ version of wxWindows is called, unsurprisingly, wxWindows/GTK and can be downloaded from the aforementioned website. A big advantage of wxWindows, of course, is the large number of platforms that are supported.

Finally, there's the VDK or Visual Development Kit. When I'm not wearing my Qt zealot hat, I'm a big fan of Delphi, and I find VDK particularly interesting because it has a very VCL-style feel to it. Like GTK+ and wxWindows, VDK provides a set of C++ wrapper classes around GTK+. You can find the VDK toolkit at <http://www.guest.net/homepages/mmotta/vdkhome/index.htm>. However, what's particularly notable about VDK is that it comes with a complete IDE of its own called VDKBuilder (see Figure 2). This does its best to be as much like Delphi/C++Builder as possible, providing a RAD-style approach to application development

complete with speed-bar, component palette, project manager window, source editor, form designer, and an inspector window for examining and editing the properties of the currently selected widget. You can find VDKBuilder at its own website: <http://www.programmers.net/artic/Motta/vdkbuilder/index.htm>.

### GTK+ projects

There are several other Open Source projects around that represent the union of GTK+ with an integrated development environment. One such is the fragrantly-named Glade at <http://glade.gnome.org> and another is EPingle at [http://www.epita.fr/~theber\\_s/epingle/epingle.html](http://www.epita.fr/~theber_s/epingle/epingle.html). As with VDKBuilder, these tools all provide a RAD-based approach to programming, using GTK+ as a basis (see Figure 3).

As with Qt, GTK+ includes all the basic controls, together with additional widgets that encompass tree-views, progress bars, tabbed dialogs, and some common file dialog functionality. However, Qt has a somewhat richer set of user interface widgets than GTK+ and – in my opinion – the Qt widgets are visually more appealing.



If you want to find out more about GTK+, you might care to cast an eye over the GTK Reference Documentation Project at <http://www.gtk.org/rdp/status.html>. This is an attempt to create a set of comprehensive API documentation for GTK+ programming, although it doesn't appear to be progressing especially rapidly. Another interesting URL is at <http://www.gtk.org/beos/> where you'll find details of the aforementioned alpha port of GTK+ to the BeOS operating system.

There is a standard 'Bible' for GTK+ that you can buy: *Developing Linux Applications with GTK+ and GDK*. Written by Eric Harlow, it's published by New Riders (ISBN 0735700214). In keeping with the free-ware nature of GTK+, there's a freely downloadable electronic book called *GTK+/Gnome Application Development*, which has been written by Havoc Pennington. Again, this has been published in treeware form by New Riders (ISBN 0735700788), but if you point your Browser at <http://developer.gnome.org/doc/GGAD/> you'll find a link to an online HTML version.

#### What you pay for

Although my introductory tours of the Qt and GTK+-related portability toolkits were never intended as a head-to-head review, I can't deny that the primary emphasis has been on Qt, and for good reason. There's an old adage that 'you get what you pay for' and whereas GTK+ does a great job of providing a low-level portability layer across a wide range of platforms, I doubt many would disagree that Qt represents a very full-featured application framework that's ideal for program development 'as is'.

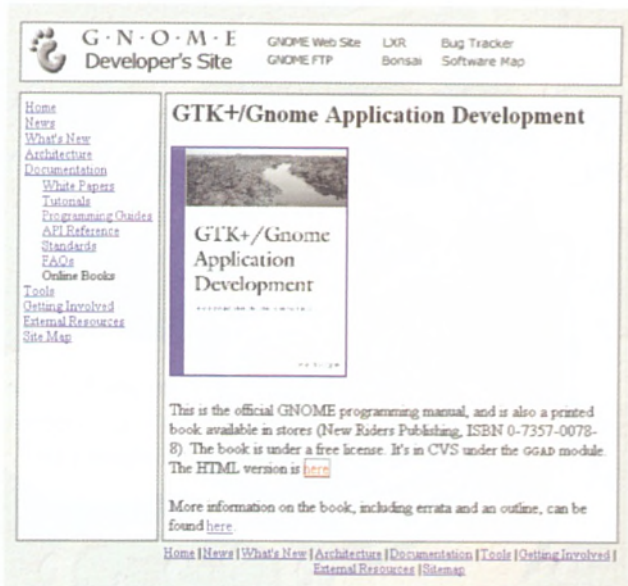


Figure 4 – The GTK+/Gnome Application Development book is freely available on the Internet in HTML form, but you might want to get a hard copy for bedtime reading...

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 at [djewell@cix.compulink.co.uk](mailto:djewell@cix.compulink.co.uk).

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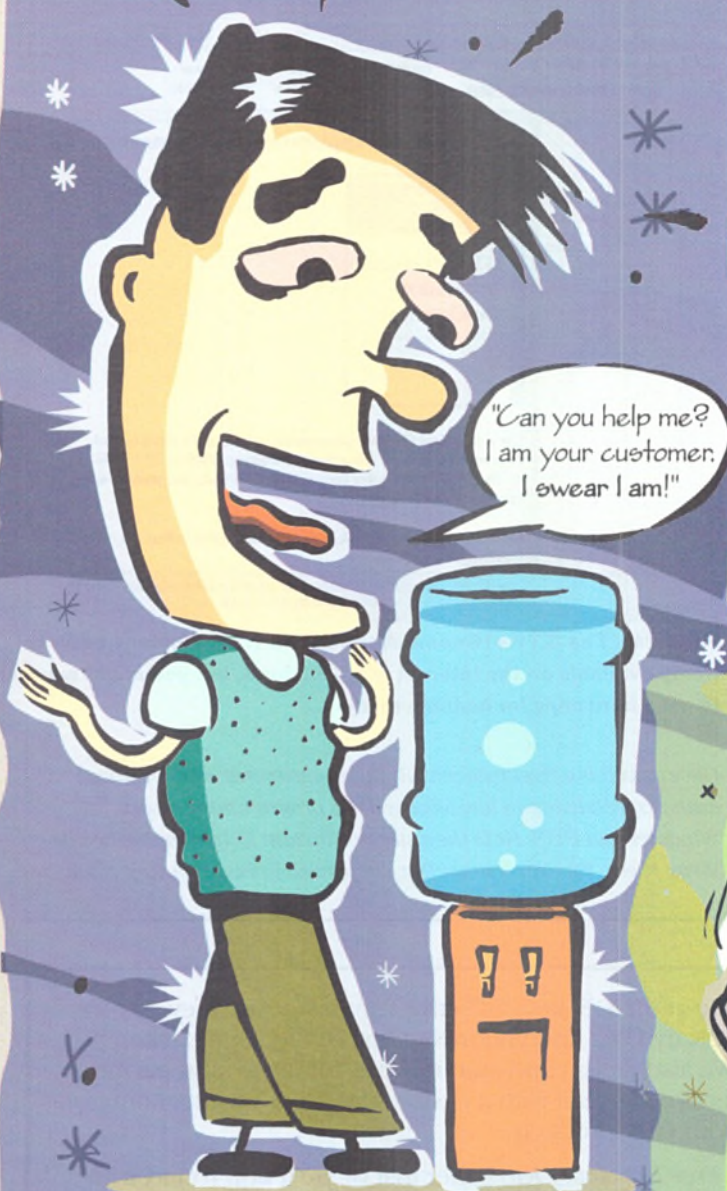
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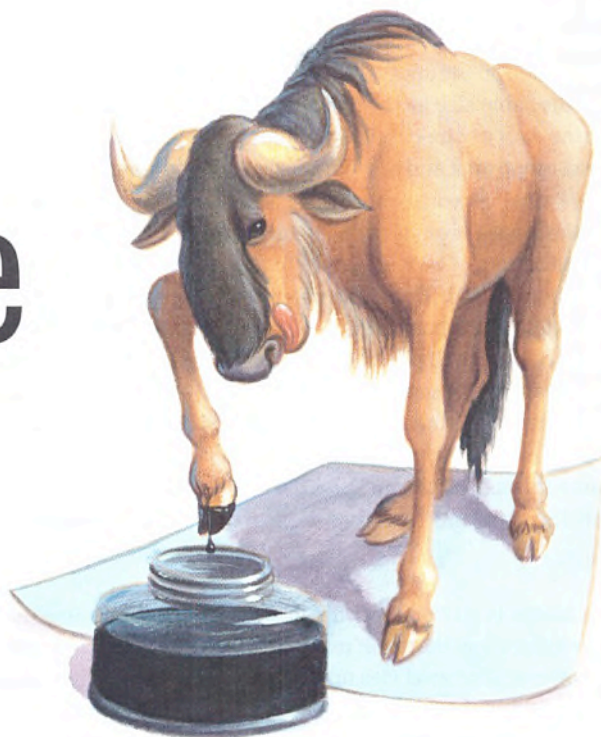


**Despair.** The final straw is the conglomerate's utter indifference to the future of database tools. Upon seeing that their vendor is now more interested in making numbers than it is in advancing technology and developing productive new toolsets, many DBAs simply surrender all hope.



# GNU in an editing mode

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I found that I didn't have a great deal of space to discuss the Emacs editor in my recent article on editors (*The programmer's favourite*, EXE, September 1999). It's a big program and a big topic. I am sure to only manage to scratch the surface of the topic even in this article. If you are learning or already using Emacs, it is always worth investigating and following things up from time to time to improve your capability with the program. Even seasoned Emacs users will tell you that they keep finding new ways to make their life easier.

I did give a potted Emacs history in the September article, and if you are interested in the background then you can always find it on EXE OnLine to catch up. I should also say at the outset that I use GNU Emacs and not Xemacs. Xemacs is a recent 'split' away from GNU Emacs. It is optimised for the X Window system, and provides many more clickable actions in its button bar than GNU Emacs. If you have Linux, then you'll probably find that GNU Emacs will be preloaded as standard and you will have to pull a package or the source to obtain Xemacs.

I had no problem installing the relevant binary version of Xemacs for my Red Hat 5.2 Linux system. However, I didn't manage to get it compiled for the Sun Solaris system that I mostly use. I could see that it would compile with some work but I decided not to bother: I want to be able to use Emacs over the Internet in a terminal connection to a machine some 6,000 miles away. X is runnable and usable sometimes across the Net at this distance, but not always. Also, they have Emacs but not Xemacs, and it's rational to use the same editor wherever you work. What I will cover in this article should apply to both editors, anyway.

## Wherefore art thou, Emacs?

Why is Emacs my editor of choice these days? Around 15 years ago, I took a conscious step away from `vi`. However, I decided that our systems at that time wouldn't support Emacs, and opted for Jove, a lightweight Emacs clone. I've used this program for some time. Originally, I moved away from `vi` after some considerable thought about how I was using an editor and what I really wanted. First, I decided that I didn't like the line-based nature of `vi`. Second, I never liked the way

that `vi` uses the keyboard: it has a command mode and to enter characters into the file you move into text-entry mode. When you are done, you press the escape key to return to command mode.

With Emacs editors, when you type the character 'a' it will be placed in the file that you are editing (unless you've changed its default action). Control keys are used to move around the file. Key sequences augment the basic control set. Most of all, I realised that I wanted to use an editor that had the flexibility to display and edit more than one file at the same time. These reasons made me switch to Jove. I started to use Emacs about a year ago, and the reasons for that change can be found in a section below, which covers the particular features I am attracted to.

## Buffers, frames, and minibuffers

Emacs permits you to split the current display area into two and display different parts of the same file in each half. You can edit each half independently. Once you have divided the window, you can load a new file into one of the new sections. If you have more horizontal space, then you can split one of the halves again and load a further file. On the same terminal, you can see parts of two or more files, or cut and paste between them, or search each of them for relevant strings. Emacs can also split the display area vertically, allowing file display 'side by side'.

In the days when my window into the computer was a single glass terminal, the ability to handle multiple files was a huge win. It meant that I could finally dispense with program listings. The ability to cut and paste between files, or between different parts of the same file, reduces typing considerably. Incidentally, files in Emacs are loaded into 'buffers', and most Emacs documentation covers the ability to deal with 'multiple buffers'.

I find that I still use the multiple buffering capability, splitting my editor window into two or more sections, even now when I use a windowing terminal and could theoretically open a new window. This is pure ergonomics. It's much easier to type the few keystrokes that are needed to split the current window into two and load a file into the 'other' half of the window than it is to remove my hands from the key-



board, locate the mouse, move the cursor into some other window on the screen, type some stuff, find the mouse, move it back, etc.

Emacs can create another 'frame', which is another window on the screen the same size as the first. This new frame behaves in exactly the same way as the original window, and you can cut and paste between any frame and any buffer. There are a bunch of Emacs keystrokes that allow you to move from frame to frame, so you don't need to use the mouse (even if my body has not quite learnt them yet).

At the bottom of each displayed buffer is a status line that tells you things about the file that is being edited, and is used to split up the screen. Right at the bottom of each frame, underneath the bottom status line, is a single line. This is the 'minibuffer'. The minibuffer is used to display messages that either provide help or complain that you've done something wrong. It is also used as an input area to allow you to add information into commands. For example, when you want to search through a file, you'll use the menu or the relevant keystrokes to start the search and will type the search string into the minibuffer.

### Using the editor

I don't intend to go into great detail about which keystrokes do what, because Emacs does that itself reasonably well (check out the online tutorial). However, it's a good idea to get a handle on the way that commands are organised so that you can understand the documentation and have some idea on how to get help. Of course, Emacs is a very mature program and expedience has sometimes got in the way of the organisation.

You will need to learn the basic default movement keys, and actually this is no bad thing for your body to know because the key sequences are used widely in other Unix applications. The Korn shell, *bash*, and every X type-in box, supports the Emacs keystrokes, allowing you to edit input into GUIs.

Primary file movement in Emacs is made with control keys that are somewhat mnemonic (the following *C-n* notation means 'Control-n'). We have *C-b* for Backwards one character, *C-f* for moving Forwards one character, and so on for Previous and Next line. Control keys are mostly used for movement around the file, but they do have other functions. It's useful to know that *C-g* is used to say: 'Stop what you are doing, and get me back to normal input mode'.

However, we soon run out of control keys for actions, and Emacs extends the control set by using the 'Meta' key. The original Meta key allowed the user to add the top bit into a character coding. Pressing 'Meta' and *x* (shown in Emacs documentation as 'M-x') generated the character value for 'x' but with the top bit set.

You can create Meta sequences in two ways. Originally, many keyboards didn't have a Meta key so another mechanism is used. Pressing the Escape key and then *x* is understood by Emacs to mean M-x. X Window systems have allowed the re-invention of the Meta key. My Sun has a key with a diamond printed on the plastic, which does the job. My Linux system allows you to use the Alt key as a 'Meta' key. The keys are in the same position on both keyboards – next to the space bar – so things just work.

The key choices for Meta sequences often map onto the key choices for the Control characters but do something that involves a larger movement. For example, *C-f* moves forward one character, and *M-f* moves forward one word. *C-a* moves to the beginning of a line, *M-a* moves to the beginning of the sentence. *C-e* moves to the end of a line, *M-e* moves to the end of a sentence. Sometimes the Meta sequence does the inverse operation, so *C-v* scrolls down one screenful (moving the data up), *M-v* scrolls up one screenful (moving the data down).

Emacs has several other standard 'introducer' characters that are used to create other classes of commands. *C-x* followed by another key-stroke or key sequence mostly provides buffer and frame management commands. It's always useful to know that the *C-x C-x* sequence will get you out of the editor. *C-c* is used as an 'application' prefix, permitting applications within Emacs to introduce their own keys for their own purposes.

*C-h* is important for novices and experienced users alike – it allows access to the Help functions that are extensive. They are not too good at telling you how to use things, but are good if you have an inkling that a feature is available and want to know how to use it.

### Binding and customisation

Emacs is actually a Lisp application. The core of the editor is in C, but many of the functions are written in Lisp that is bound into the core either dynamically or at compile-time. All keys are really 'shortcuts' to a set of named functions. When you load the editor it loads a set of default bindings between the keystrokes and the actions that they make. At any time, you can type *M-x*, and a colon will appear in the minibuffer. You are then expected to type a command name. Command names are mostly words separated by hyphens. For example, *C-f* is usually bound to the command: *forward-char*. Emacs will perform command expansion for you in the minibuffer, so you can type some portion of a command, hit 'space', and Emacs will complete the command for you, assuming what you have typed is unique. If not, Emacs will offer a list of options.

There are a great many commands that are not bound to any key in particular and you will find yourself typing:

*M-x command*

to access them. However, the big win is that you can set up a binding between a keystroke sequence and an action very easily. For example, I found myself wanting to go to specific lines in files, probably because I am not using some of the advanced programming tools yet. To go to line 50 of a file with the default settings, you have to type:

*M-x goto-line 50*

I soon got fed up with this and have added:

```
(define-key global-map "\C-c\C-j" 'goto-line)
(define-key global-map "\C-cj" 'goto-line)
```

to my *.emacs* file on my home directory. It's read whenever Emacs starts and will establish a binding between *C-c C-j* and *C-c j* and the *goto-line* command. I chose *j* and not *g* because it allows me to use both hands to type the key sequence. The new binding works in every buffer because I've told Emacs to put the binding into the 'Global Map'. You can use this technique to remove bindings or to rebind keystrokes to different meanings. You do need to be careful with making new bindings or radically changing the default bindings. In a short time, your body learns the bindings and you forget the default values or even the command names. You are no longer portable out of your home environment.

The ability to rebind keys has given rise to a huge number of 'modes' inside Emacs. For instance, when you are editing a Perl source file, you can enter 'Perl-mode' and the same keystrokes will have a different effect. Usually, the new binding make sense, so 'goto end of sentence' becomes 'go to the end of the next function'. You can enter a mode automatically depending on the suffix attached to a file, so Perl-mode is entered when you are editing a file that ends in *p1*, HTML-mode is entered when you are editing a file that ends in *html* or *htm*, and so on.

Modes are used considerably to give context for editing actions, and to permit Emacs to do sensible things for you. For example, if you are editing something that has a regular bracketing and quoting structure, Emacs will track opens and closes for the brackets and quotes. When you





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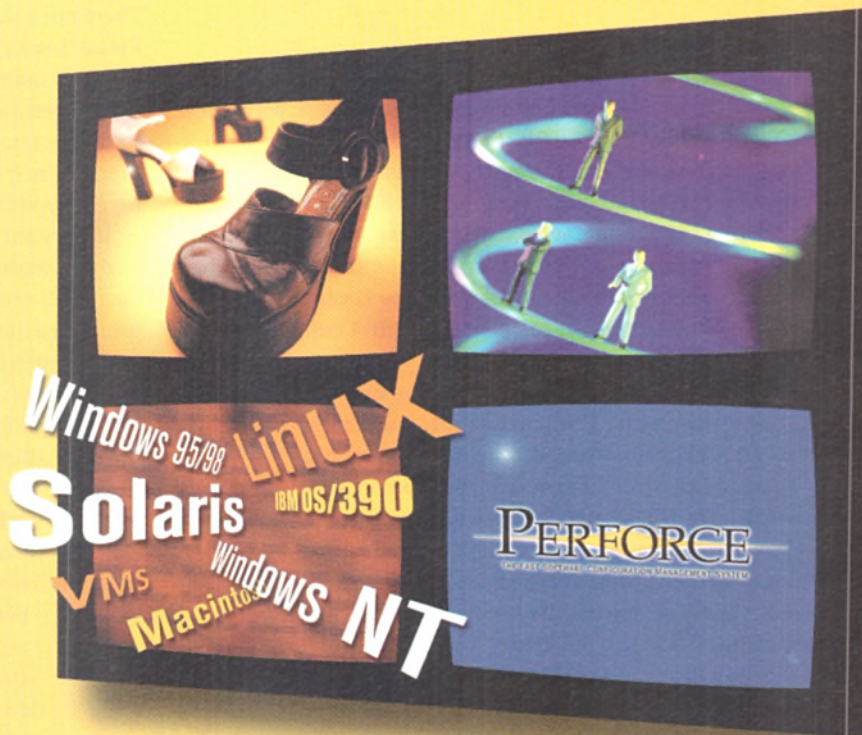
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type a closing bracket, Emacs will briefly highlight the opening bracket so you can see that the correct match has been made. Also, in the modes for programming languages, Emacs will provide 'correct' indentation automatically depending on your bracket level. I find that Perl's zillions of different bracketing options can fool the program sometimes.

Because Emacs uses Lisp, you can write your own functions and place them into your `.emacs` file. Alternatively, you can train Emacs to perform a set of commands, name that sequence as a command, and use it. Later, you can edit this new command to change the actions. You can save the command to a file and incorporate the command definition into your `.emacs` file. It's also possible to make such learnt commands ask for input from the minibuffer should that be desirable.

### The good

I want to cover some features of Emacs that I particularly like. First, it will deal with binary files, and this means that it can cope with some text files that don't 'look' like text files to other Unix editors. Specifically, it can cope with text files with extremely long lines and this is a boon when editing the HTML produced by certain WYSIWYG editors.

I really like the 'undo' facility that allows you to backtrack through all the edits you have done to get to some known point. This is great in an editor where sometimes I mistype keystrokes intending to do one thing but obtain some other result. I really miss this when I revert to Jove.

Emacs has the ability to show different colours and different fonts for the data that it's displaying. The font colouring is not stored with the data, but is applied as you edit the file or when it's loaded into a buffer. Again, the colouring is dependent on the mode of the file. I find that it's a huge win to have the different elements of the source coloured differently when programming or writing HTML. For example, in Perl-mode, the language keywords, string contents, comments, and variable names are all coloured differently. The ability to detect that you have not terminated a string saves oodles of time with the Perl compiler.

Emacs has a 'rectangle' editing feature that can be used to pull columns from other data, so you can run a command in a shell window and pull columns of text from the command output into another buffer. I am still wondering quite how to make this happen, and having to look up the appropriate commands, but I can see that this will save me time.

Finally, Emacs has a 'compile' command that writes all the currently edited files, and then runs `make` or some other command that you can enter. The output from the `make` command is captured in a buffer and can be interpreted by Emacs, placing you in the correct file at the point of error; for example. You can then step through the errors correcting them.

### The unused

Emacs contains a huge number of subsystems that allow you to operate in world where 'editing' is the model of how things are done. Among other things, Emacs can be used to read and write email, handle news, browse the Web, manage an appointments diary, create formatted text, and handle files in the filesystem. For example, you can 'edit' a directory and 'delete' a line that is a file, and have the file disappear from the filesystem. Most of the Emacs books concentrate heavily on these features and miss out somewhat on some of the basic editing ideas that are supported. I doubt that I will ever get into these modes, because I have adequate programs to carry out the tasks anyway.

But I want to mention two features, in particular; that I do not use myself. First, Emacs has a bookmarking system where you can store references to files. The bookmarks are retained in a private file that survives the editing session. With a bookmark, you can jump instantly to a point in a file. I haven't got into using this yet, but I can see that I might.

Second, Emacs has a word abbreviation system where you can type some short word, press 'space', and have the editor change what you have typed into something else. I could define 'pc' to be 'Peter Collinson', for example. I suspect that you need to choose your original text carefully. I do sometimes want to type the word 'PC'.

### And the undecided

There are a number of Emacs features about which I am undecided. Emacs has an interesting view on file context. When you open a file, then that buffer has a 'current working directory' associated with it. If you want to open another file in the same directory, you can split the buffer into two and just type the filename of the file that you want to open. Emacs will perform filename completion for you, so you don't have to type the full name of the file.

If you want to open a file in another directory, then Emacs will recognise that you are typing a slash at the start of the filename, or `..` to go up a level, or a tilde (`~`) to mean open the file from a path starting in your home directory. It will open the file, but will assign the current working directory of that new buffer to be the directory in which that file lives. You now have two files in different buffers on the screen that have different working directories. If we now want to open a third file in one of the two directories, we have a choice of starting in one of the two extant open files. If we start in the buffer whose working directory is the same as the new file, then we just need to type a name. If we start in the other buffer, we will have to type a full pathname. This sounds okay, but can be counter-intuitive.

Incidentally, if you open a shell window, Emacs will attempt to track directory changes inside that shell window and will allow you to open a file in the directory that you are looking at by simply typing its name. This is intuitive and seems to work well with the shell that I use normally.

When using Emacs, I do often find that 'odd things happen'. These are usually due to hitting the wrong key and finding that it's bound to some esoteric command. After a bit, you get used to this, and begin to define out the aspects of the system that you don't use often.

There are several different Emacs subsystems that plunge you into a new mode. Keystrokes are used to control what happens in the modes, and I find that some of these keystrokes are often not well defined. Many of these modes use the space bar to mean 'do the next thing', and it's taken me some time to work that out.

It can sometimes take time and experimentation before you make the program work as it's supposed to. In general, the documentation doesn't often tell you the 'thinking' that went on when a feature was designed, and for some complex modes you are never sure if you are using them 'properly'.

### Further information

You can get the latest version of Emacs from your nearest GNU storage site. I'd recommend the O'Reilly book on Emacs: *Learning GNU Emacs* by D. Cameron, B. Rosenblatt, & E.S. Raymond (ISBN 1-56592-152-6). ■

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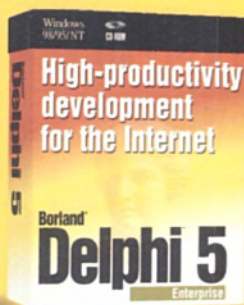




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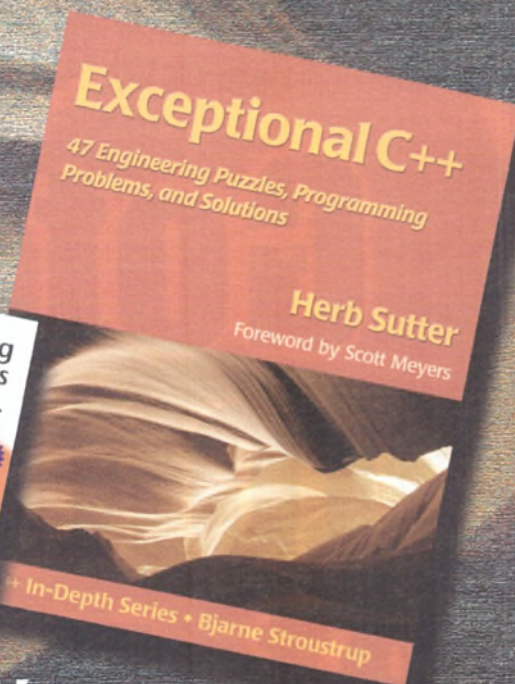
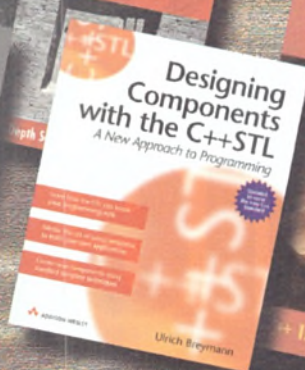
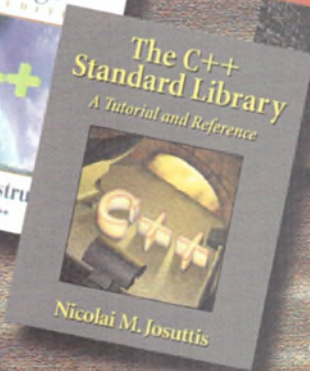
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# The C++ Programmers' Book of 1999



Francis Glassborow reviews the ideal bookshelf for a C++ programmer before revealing which C/C++ title has won the 'best of year' award.

Before giving my choice of *C/C++ Programmers' Book of 1999*, I think it is time that I once again did a more general survey. I have mentioned many of the following titles previously, but many of you may find it useful if I pull them all together.

First, you need a book that gives a general introduction and overview of C++. My choice here is *The C++ Programming Language, 3rd Edition* by Bjarne Stroustrup (ISBN 0-201-88954-4). There is only room for one book in this area, but if you work in domains where execution speed is a major priority you might choose *The C++ Primer, 3rd Edition* by Stan Lippman & Josée Lajoie (ISBN 0-201-82470-1). Lippman, as lead author of this book, has a programming style that is heavily influenced by his work in the film industry – an environment where every bit of speed is beneficial.

Whichever of these you choose you should almost certainly invest in the corresponding 'answer' book; *C++ Solutions* by David Vandevoorde (ISBN 0-201-30965-3) for Bjarne Stroustrup's book or *C++ Primer Answer Book* by Clovis Tondo & Bruce Leung (ISBN 0-201-30993-9) for the Lippman and Lajoie book.

Next, you will need a tutorial/reference for the Standard C++ Library. *The C++ Standard Library* by Nicolai Josuttis (ISBN 0-201-37926-0) is so far ahead of all the competition in this area that it should be an automatic choice.

You will certainly need something to help you with template technology. As this is a tough area for most programmers, I suggest you start with *STL for C++ Programmers* by Leen Ammeraal (ISBN 0-471-97181-2) and add *Generic Programming and the STL* by Matt Austern (ISBN 0-201-30956-4) for when you understand the basics and are ambitious to get full value from the STL. The former book is also useful when you are mentoring an inexperienced programmer and need to get them started with using the STL. Matt Austern's book should give you a good idea about how to develop templates for your own code.

You should have some form of style guide even if only a starter for your own. *Industrial Strength C++* by Mats Henricson & Erik Nyquist (ISBN 0-13-120965-5) must be the leading candidate for this slot. While Henricson and Nyquist focus on the traditional aspects of style, there is the matter of writing effective source code in C++. You would have to go far to find something better than *Large Scale C++ Software Design* by John Lakos (ISBN 0-201-63362-0). Unless you know that you will never work on large projects (in which case I wonder why you are using C++), your work will benefit from a thorough understanding of this book.

Tangential to this is an understanding of how to write C++ that will compile to a fast executable. With the development of high-speed Internet links, execution speed is becoming a major factor with server side software. Even if you are not so concerned with execution speed, your bookshelf will be more complete with the addition of the just published

*Efficient C++* by Dov Bulka & David Mayhew (ISBN 0-201-37950-3). By the way, Dov Bulka is one of the speakers at the Spring JaCC where he will be talking on both C++ and Java during separate talks.

No self-respecting C++ programmer could own a bookshelf that did not include copies of *Effective C++* and *More Effective C++* by Scott Meyers (ISBNs 0-201-92488-9 and 0-201-63371-X). These are books that should be restudied periodically until you are fully familiar with their contents and never accidentally ignore the wealth of advice they contain. Of course, sometimes you will know better and sometimes you will be right. By the way, if you are happy with electronic copy, I would strongly recommend that you invest in the CD version that combines both books with some extra material (ISBN 0-201-31015-5).

With the last two titles I have moved on to books that will help your C++ programming develop and mature into a skill that you can be proud of. The newest book in this area is *Exceptional C++* by Herb Sutter (ISBN 0-201-61562-2, for more details on this book see the review by Kevlin Henney in this issue, p. 56). Those of you who follow [comp.lang.c++.moderated](http://comp.lang.c++.moderated) will have come across Herb Sutter's *Guru of the Week* (GotW) items where he presents a problem for people of different levels to attack. After a suitable period of time (often including his hints and prompts) he provides his own solution (prepared before the problem is ever presented) together with a mention of the people that he considers have earned the title *Guru of the Week* by the quality and insight shown by their postings on the subject. This is no easy accolade, as exemplified by Scott Meyers' admission in the foreword to *Exceptional C++* that Sutter's problems have caught him out more than once. Though the book contains 47 items, I believe they are substantially expanded from the first 30 GotW problems. As we are, at the time of writing, up to GotW number 63 I think we can all watch out for the next volume. And while I remember, Herb Sutter is another speaker for the Spring JaCC.

Let me turn to a few books that every professional programmer should know (and re-read from time to time by way of refreshing their memories and getting their thinking back on course). Jon Bentley's *Programming Pearls* (ISBN 0-201-65788-0) and *More Programming Pearls* (ISBN 0-201-11889-0) are in the must read category. A 2nd edition of *Programming Pearls* was recently published in 1999, while *More Programming Pearls* is still a first edition but is worth reading even if a second edition may eventually come out. *The Mythical Man Month, 2nd Edition* by Frederick Brooks (ISBN 0-201-83595-9) is in the must-read-at-least-once category. Somewhere you should find room for *The Practice of Programming* by Brian Kernighan and Rob Pike (ISBN 0-201-61586-X).

There are quite a number of other books that I would happily see on any C++ programmers bookshelf, but there are just three more for which I would be disappointed if they did not have a place. The first is *The Design and Evolution of C++* by Bjarne Stroustrup (ISBN 0-201-





54330-3), which will give you considerable insight into how C++ was designed and what it was designed for (not just object-oriented programming). The next is *Ruminations on C++* by Andy Koenig & Barbara Moo, who the attendees of the Autumn JaCC may remember. Only the most exceptional of C++ programmers would learn nothing

from this book, and even these would appreciate the clarity with which it is written. The ISBN is 0-201-42339-1. Finally, I would like to see a copy of *Multi-Paradigm Design in C++* by James Coplien (who spoke at the Autumn JaCC and is coming again to speak at the Spring event). The ISBN for this book is 0-201-82467-1.

You can find other suggestions on ACCU's list of highly recommended books, which is to be found at <http://www.accu.org>. And, of course, you have your own electronic copy of the C++ Standard as well as access to *comp.std.c++* and *comp.lang.c++.moderated* to help you with the more intractable of problems.

### C++ Programmers' Book of 1999

For the award of *C++ Programmers' Book of 1999* there were several excellent candidates. *The Practice of Programming* was an early front runner, but the publication of *The C++ Standard Library* pushed it back to second place. Then I had the embarrassment of having a pdf version of *Exceptional C++* sitting on my hard-drive from mid-summer, knowing that this must be a candidate. An actual printed copy only landed on my desk less than a week inside my self-imposed cut-off date. In the meantime, the second edition of *Programming Pearls* had arrived for consideration. Great though that book is, I decided that it did not contain quite enough new material to be a candidate.

After much soul searching I decided to cop out and declare *Exceptional C++* (Herb Sutter) and *The C++ Standard Library* (Nicolai Josuttis) as joint *C++ Programmers' Book of 1999*.

Those of you who recognise ISBNs will realise why I believe Addison-Wesley have no competitor for the title *C++ Publisher of the 20th Century*.

### Last 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;
}
```

Look carefully and decide what output you expect. Then compile and execute the program. Does it produce what you expected? If you are lucky, the answer will be *no*, and that will make you think a little further. Unfortunately, the answer is quite likely to be *yes* and henceforth your mental model of how C works will be defective.

The key line is the invocation of `printf`. The compiler must produce code that will evaluate three arguments to send to `printf`. The first argument is simple; the compiler prepares and initialises a string literal whose address is passed as the first argument. It needs to evaluate `fn` twice in order to determine the second and third arguments. The first problem is that the rules allow it to evaluate arguments in any order. I

hope you can see that in this case the different orders will result in different results ('1 2' or '2 1'). However, that is not the end of the story.

The compiler can evaluate the arguments of the two invocations of `fn` in any order, and may evaluate both before dispatching either to `fn`. Herein lies a serious problem because there will be no sequence points between two such evaluations. Remember that side effects (actually writing the values back to store) of an evaluation are only required to be complete at the next sequence point. This means that the storage for `i` may be written twice between sequence points and that, as most of us know, gives undefined behaviour. The sequence points at entry and exit from a function do nothing to protect the evaluation of arguments being passed to the function. Their purpose is to ensure that all relevant side effects are complete before a function is invoked and that all internal side effects are complete before a function returns.

If you want to write robust code, you must be meticulous about avoiding multiple writes in any complete expression. If you can see more than one place where a variable (either directly or through an alias) can change during the evaluation of an expression, you are in trouble. Changes that are hidden within functions can still interact but they will not produce undefined behaviour. For example:

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

This has unspecified results but there is no undefined behaviour. The output must be either '1 2' or '2 1'.

C++ programmers are just as vulnerable to unwitting invocation of undefined behaviour. Unfortunately, they often believe that overloaded operators on their own types will be safe even when the same operator for built-in types would not be. For example, consider:

```
#include <iostream>
enum mytype {low=0, high=100};
mytype operator++(mytype & mt) {
    return static_cast<mytype>(mt==99)? mt=low : (mt++);
}
int main() {
    int i;
    mytype mt = low;
    std::cout << i++ << " " << i++ << '\n';
    std::cout << ++mt << " " << ++mt << std::endl;
}
```

Both the lines of output invoke undefined behaviour, or do they?

### This month's problem

Explain the way that the overload of `operator++` for `mytype` works in the example above, including the reason for the `static_cast<>`.

Now consider my final assertion (about undefined behaviour). True or false?

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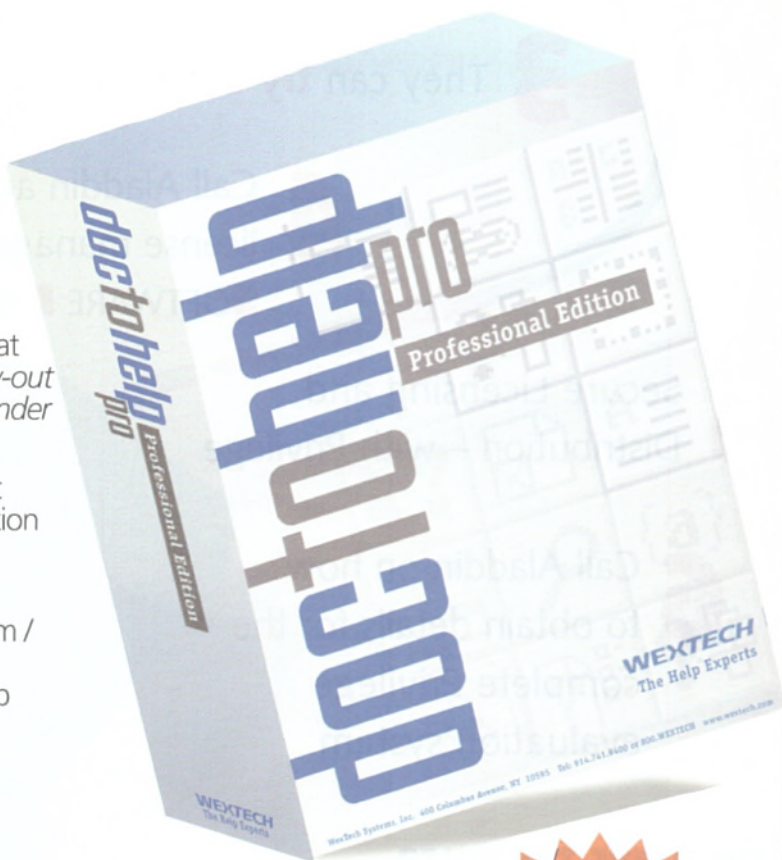
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# Use the (Team) Source

Mark Smith puts himself under the source code control of TeamSource, a tool found within Delphi 5 Enterprise. He compares



it for use with Visual SourceSafe.

Source code control. Every successful project has it. Many unsuccessful projects don't. As a contractor, I've had to get used to many different source code control (SCC) products over the past few years, including PVCS, MKS SourceIntegrity, and Visual SourceSafe. These products all work in the same basic manner: you select a bunch of source code files and add them to the SCC database. The source code files on your hard disk become read-only, unless you check the files out of the SCC database. While you have files checked-out, other people can read the unmodified versions in the SCC database, but nobody else can check the files out for modification. When you are happy with your changes, you check them back in, and the other developers can then check the files out to make their own modifications. This is a serial model of coding: one person's changes follow another's.

One of the many goodies released with Delphi 5 Enterprise is a product called TeamSource. This is a sort-of version control system (VCS). I say 'sort-of' because although it looks pretty much like any other VCS, it seems to be a unique product, a sort of hybrid between a document server and a traditional VCS. Probably the biggest single difference with TeamSource is that any programmer can modify any file at any time – a parallel model of development. When the two developers need to combine their code, TeamSource reconciles the differences between the changes, and informs the rest of the team that a new revision of the file is available, so that they can proceed.

The Delphi and C++Builder teams have been using TeamSource as a part of their development process for over a year so it works for them, but they have slightly different problems to the rest of us: the Delphi VCL files are pretty well fixed from release to release. This leads to coding horrors like the thirty thousand-line `windows.pas` file. Clearly, one person locking this out for more than an afternoon is going to cause severe scheduling problems for the rest of the team. Figure 1 shows the TeamSource application. The left pane shows the changes I need to make to my local project to bring it in line with changes made by other team members, while the right pane shows what I need to do to the project archive to bring it up to date with my changes.

One of the neat-o features of TeamSource is that it can use other SCC tools as a back end, rather than use its own in-built Zlib back-end. There is a full set of interface declarations that give you access to the TeamSource API, and the first company to come out with its own TeamSource link is Quality Software Components ([www.qsc.com](http://www.qsc.com)), which produces GP-Version. You can use its back-end engine as a replacement for the Borland one without using the full product. I've been working on a Visual SourceSafe-TeamSource link. I will post to EXE OnLine, as well as CodeCentral on the Borland developer community website (<http://community.borland.com>), just as soon as Borland fixes its CodeCentral server. Be aware that this is most definitely 'work-in-progress', though.

## Why bother?

What do you gain from using TeamSource? At first, I had real difficulty answering this question, so I ran Visual SourceSafe (VSS) and TeamSource together to try and work out what TeamSource had to offer, and what it lacked. As you can see from Figure 1, TeamSource has a modern Outlook-style interface, which is a big improvement on the functional but somewhat homely interface offered by VSS. Creating a project archive is pretty easy in both tools. Perhaps VSS wins this one because you can drag and drop a project file on the archive database root, while in TeamSource you need to point the product at the root directory. Handily, TeamSource then recurses through the directory tree collecting all the filename extensions and asking which ones you want to create in the project archive.

The biggest help that the UI offers seems to be that TeamSource shows you almost immediately which files you have that are out of date with regard to the copy in the SCC system. MKS SourceIntegrity does this, but takes an age when there are lots of revisions. SourceSafe also reminds you to add new files to the archive, a useful feature and one not offered by VSS. It also does the reverse. If one of your colleagues decides that a file is no longer required, they can delete it from the archive. TeamSource will then advise the other team members of this so that they can remove it from their local drive as well.

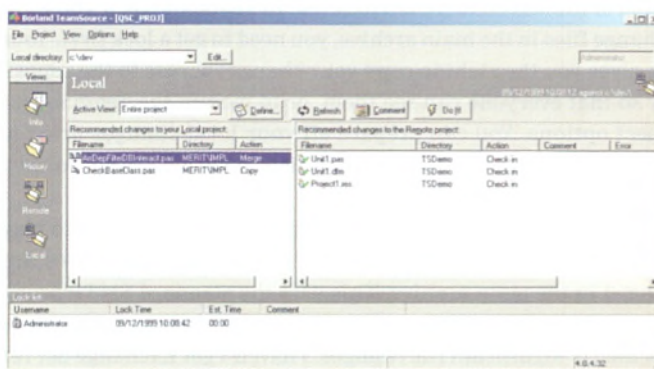


Figure 1 – TeamSource in action.

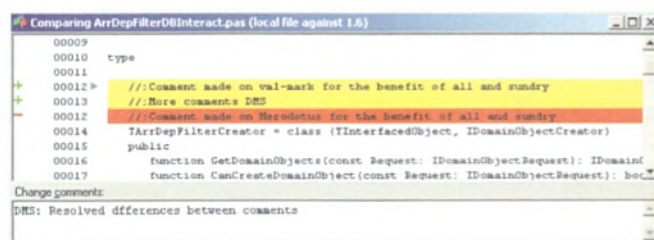


Figure 2 – Reconciling differences with TeamSource.





**On a lot of projects I've worked on, branching has been frowned upon or forbidden, chiefly because resolving branched files has proved difficult to get right.**

So far so good. In VSS, when you want to edit a file, you need to retrieve and lock it in the archive database. Clearly, if someone else has it locked, then you have to wait for them to finish with it, or create a branch. Now, normally branches are considered a bad thing, but the TeamSource's parallel mode of source code control offers no other mode of working. All you need is the confidence to reconcile the differences between changes, and TeamSource seems quite good at this. See Figure 2 for an example.

The only place where I have found TeamSource to be unable to do something sensible with the merging of text files is where you have two sets of changes to a single line. Basically, at that point you have to reject one of the changes to that line and keep the other. TeamSource relies on the back-end version controller engine to deal with merging, so if you are using an engine that can cope with that level of complexity (and has an API that actually exposes it), you should be able to sort it out.

Clearly, no software product can deal with merging differences between arbitrary binary files, so TeamSource doesn't offer merging for binaries. Delphi form files are saved as text in Delphi 5, so there should be no problems reconciling differences between DFM files either.

If you look very closely at Figure 1, you will notice that at the bottom of the screen there is a lock list. In TeamSource, if you want to change files in the main archive, you need to get a lock first. Your lock gives you the right to copy your changes across to the repository so that everyone can see them, or to modify the TeamSource project options. You can prepare all your local changes prior to acquiring a lock, and locks expire after a certain time, so they aren't such a big deal.

A major feature of TeamSource that I haven't had time to play with is its ability to email members of a team when files are changed in the main archive. This uses the standard SMTP protocol so that workers not permanently connected to the LAN can be informed of significant file changes. I haven't got Exchange Server

running on my home NT server (and they won't let me play with the one at work), so I have not been able to test this feature. I think this probably points the way forward for TeamSource as a more distributed SCC system. It looks like it should work well over a dial-up connection, but I have yet to prove it.

The final neat feature is the comment server. This is installed into the Delphi IDE and allows you to build your check-in comment as you are editing the files. You can also see the history of comments while editing the file.

#### Scenarios for using TeamSource

On my current project, a simulation system, the compile/link/debug cycle can take some tens of minutes to complete. Clearly, this leads to wasted time – there's only so much documentation you can write, after all. Since I have two PCs, I use a TeamSource archive in addition to the VSS one so that I can develop on both PCs, without worrying too much about making modifications to one file on two computers. All my changes are done on the laptop while my main PC is debugging.

#### Annoyances

The single biggest thing that is missing from TeamSource is full support for the idea of branching. A branch is a separate thread of development that is run in tandem with the main programming effort, usually for the purposes of fixes to released software. On a lot of projects I've worked on, branching has been frowned upon or forbidden, chiefly because resolving branched files has proved difficult to get right.

As a first release, TeamSource is not without its own share of bugs. I needed to reboot the NT server machine where my TeamSource project files were stored as part of the attempt to install Exchange Server. TeamSource objected violently to the server disappearing, as it appears to try to read the server directory every few seconds. Another problem, which may be related, was the infrequent appearance of the error message 'Asynchronous socket error 10061' at the end of checking-in a number of files. The application seemed to stop checking files in at this point so I had to close it and start it up again. The description for this error code in MSDN says that the server actively refused the connection, so it may be related to the fact that my server box was fairly busy at the time.

There are a couple of bugs reported on the newsgroups. One is that bookmarks (version labels) can reproduce themselves so that you can end up with several, or even hundreds, of identical bookmarks on a project. You can delete the excess bookmarks, so there is a workaround. The other problem is that sometimes files show up with the 'correct by hand' flag. This seems to be linked to the change to Daylight Saving Time at the end of October.

#### Borland's time

I'm not sure I want Borland to be spending their time developing stuff that's not at the core of their development products. On the other hand, it's good that it is actually using its own products to build real systems, not normally something that it seems to do as far as the outside world is concerned. And of course if it brings in money, then that's no bad thing either. ■

*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](mailto:msmitha@cix.co.uk).*

## Product updates

### MemProof

Atanas Stoyanov has enhanced his excellent free profiling tool, MemProof, that I wrote about in February 1999. It now supports Delphi 5, C++Builder 4, and the third beta of Windows 2000. You can download the new version from <http://www.totalqa.com/download/memproofdnd.html>. Stoyanov has also started a new venture, AutomatedQA, with a new product, QTime, a fully-featured memory testing tool for Delphi and C++ applications, including those written in Visual C++.



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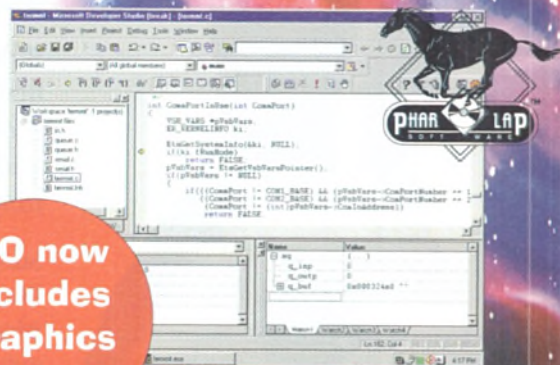
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# Exploring the performance of serialisation



**Lou Grinzo finds a surprising performance benefit delivered by serialisation when dealing with complex objects.**

**P**erformance is one of those distinctly fractal-like topics in programming – just when you think you’ve reached the bottom, you find out there are entire other levels of complexity to explore. If anything, Java amplifies this situation thanks to its basic architecture of interpreted bytecodes, which hinders its performance, as well as the fact that it provides a relatively rich selection of built-in facilities that provide you with more than one way to do some basic operations.

## **Saving bits, saving time**

Programmers, being the ornery and overworked lot that we are, have a habit of following established patterns in their work and not taking the time to explore alternative routes to the same destination. At times, this is because of a simple lack of time, as when porting a largish C/C++ program to Java on a tight schedule, and at other times it’s due to plain old stubbornness. One area where this syndrome crops up is serialisation versus ‘manual’ manipulation of persistent data, which prompted me to examine the performance implications of serialisation.

As with all performance studies, this one was an exercise in controlling variables as tightly as possible, and simply reporting others (like the platform used) in detail. I decided to look at how the response time needed to save numerous objects of the same class to a disk file varied as a function of the method used (serialisation or ‘manual’ code), the number of objects stored, and the complexity of each object. If you’re the sort who just has to see the results up front, check Table 1 for the details.

To avoid combinatorial explosion, I used just two levels of object complexity in my testing. ‘Simple’ objects had a single `int` as their serialised data, while ‘complex’ objects stored two `ints`, three `doubles`, and four `Strings`. I made a sincere effort to write the code in what I thought was a reasonable fashion and didn’t favour either the manual or serialised versions. (Although I’m sure I’ll get at least one email showing me how to shave nanoseconds off the response times by rewriting 20 lines of code. Performance geeks – including yours truly – are like that.)

I also had to run each test multiple times and average the results. The system time under Windows doesn’t provide very fine resolution, which means that short and identical runs will vary slightly in their reported response times. It also means that some very short operations will report a response time of zero milliseconds, as seen in the table in the simple/manual column.

## **Introducing serperf**

The program I wrote for this study is a command line program called ‘serperf’, and is available from EXE OnLine. To get the online help, such as it is, simply run serperf with no options and it will explain its syntax. You must tell serperf whether you want to read or write

data, the number of objects, the complexity of object to use, the method (manual or serialisation), and the name of the disk file. I’ve concentrated in this column only on writing objects to a disk file, but serperf will also read them from disk files it has created. Measuring the speed to read large numbers of objects can be problematic, thanks to the tendency of modern operating systems to cache disk files quite aggressively. This requires you to flush the cache completely between measurements, possibly by rebooting the system. Windows would make rebooting this many times almost unbearably painful.

I tried to keep serperf’s command line syntax as close to English as possible without introducing unneeded words. For example, to make the program write 1,000 complex objects to `test.fil` via serialisation, you would use the command:

```
java serperf write 1000 complex serialize test.fil
```

which can be read as: ‘Write 1,000 complex objects with the `serialize` method to `test.fil`’. serperf will follow your orders and report its response time in milliseconds. All command line values are required and must appear in the order shown. The one optional parameter, which comes after the ones shown above, is used only with a read command. If that parameter is ‘show’, then serperf will display the data on the screen after reading it. I added this during development for debugging and experimental uses, and decided it was just useful enough to leave it in place in case others want to add support for their own classes.

If you run serperf on various platforms, you might get quite different absolute times than I reported. The vagaries of systems, including CPU speed, disk speed, amount of RAM, and disk caching are all likely to affect your timings to one degree or another. The ratios of pairs of timings likely won’t vary much, unless you’re crossing a characteristic boundary – meaning a level at which some factor suddenly comes into play. For example, you might find that for a given complexity of object and storage technique that saving 5,000 objects takes about five times longer than does saving 1,000 objects on platform A, but that on platform B it takes nine times longer. This difference in ratios is likely due to some performance enhancing feature, such as disk caching, helping the 1,000 object case on platform B, but not being able to help the 5,000 object test as much. Similarly, since all objects are stored in main memory during processing, it is possible to use a large enough number of objects in a serperf run to force your system to page or swap data to the hard drive. This could increase response time dramatically.

My test system for all these measurements was as follows: a 300 MHz Pentium II with 64 MB of RAM and an EIDE hard drive, which was running Windows 98 SE and Sun’s JDK 1.2. No other programs were running besides serperf, and none of the tests here triggered system paging.





## The envelope, please

As you can see from the results in Table 1, serialisation delivers some impressive benefits when storing large numbers of complex objects, but very little gain with less than about 5,000 simple objects. The conclusion here is obvious but counterintuitive.

If your program will always work with a relatively small number of objects or simple objects, you will likely be better off using manual storage instead of Java's built-in facilities, but the margin of difference will be so slim as to be irrelevant in all but the most performance sensitive applications. As with all performance results that have 'interesting' implications, this one should be investigated in more detail, mimicking conditions from the intended application as closely as possible before you make any design or implementation decisions.

I was surprised by how much of a performance benefit serialisation delivered when dealing with complex objects. The response times for manual versus serialised writes are nearly equal for 100 complex objects, but beyond that serialisation quickly pulls into the lead. Serialisation is better than the manual approach by a ratio of approximately 9:1 at 1,000 objects, and improves even more to a ratio of over 18:1 for 5,000 objects.

Even more surprising is how flat a graph of the serialisation performance would be. While the complex/manual case results in response times that rise with the number of objects, the serialisation curves increase at a much lower rate. Going from 1,000 to 5,000 objects, the response time for the complex/manual case rises by more than a factor of 3.5, but for the complex/serialisation case it increases by just a factor of 2.25.

The bottom line is that from a performance standpoint serialisation is either a negligible cost or a benefit. The fact that it's typically easier to implement and maintain makes it all the more compelling.

## Experimenting with serperf

I encourage you to run serperf on different platforms, change the source code, and generally treat it as a first step in exploring this performance issue. It's relatively simple to add more objects that have particular characteristics that mimic those of some real-world project. You must add a class that extends my `spOBJ` class, add a new legal value to the command line parameter for your new object type (see `parms.getObj` and the `obj_` constants defined in the beginning of `parms.java`), and add the code in `serperf.java` (in the `setupArray` and `doRead` methods) to support the new type.

Even though I refer to one of my test classes as 'complex', I can already hear the objections that it clearly isn't. And I'd be hard-pressed to argue the point; my 'complex' class `complexObj` uses

only a few intrinsic types and no other objects or aggregate types, such as arrays or Vectors. I'm sure any active Java programmer could find far more complex class definitions than this in real-world projects. I decided to use this artificial class because anything much more complex would likely be sensitive, in performance terms, to the exact nature of the class, which would have made the 'complex' results even less representative. And frankly, this approach gives other people an incentive to add support to the program for their own class definitions and run their own particular tests.

If you read the `serperf.java` source code, you'll notice that the `doWrite` method contains a comment that indicates there are two ways to perform serialised stores. The one that's active in the program as delivered, and that was used for all my measurements, serialises the entire array of objects via a single call to the `ObjectOutputStream`'s `writeObject` method. By commenting out the line that performs the `writeObject` call and uncommenting the `for` loop that immediately follows it, you can instead serialise the array with one call to `writeObject` for each object in the array. (You would have to make a corresponding change to the `doRead` method also, of course, to make it read objects in the array individually.) This approach might be more representative of your preferred usage of these facilities or your program's requirements. I experimented briefly with this 'manual serialisation' method, and found that it didn't make a significant difference, even for large numbers of objects. Given that all the real work is being done in the `writeObject` method and the code it calls, and it's just the explicit loop overhead that's added to the program, this result isn't surprising.

If you experiment with reading objects, please make sure you read your test files using the same method used to create them. Reading serialised data manually will produce garbled data, and trying to de-serialise manually saved data will trigger an `IOException` and abrupt program termination. And note that because of the way that Java's serialisation works, if you change the definition of the serialised classes (`simpleOBJ` and `complexOBJ` in my sample), then the serialised test files you've created with serperf will no longer be readable, since the class signature will have changed and Java will consider them to be different classes. Trying to read such files will cause the program to terminate with an `InvalidClassException`.

## More numbers to come

This is just the first of several columns that will examine various performance issues in Java. If you have a particular area that's always intrigued you in terms of performance (as serialisation has intrigued me), or if you know of some particularly interesting Java performance trick or technique, drop me an email.

And, of course, if you decide to run serperf on a platform different from mine, please let me know the results. If we get enough input, I'm sure I can convince the keepers of EXE OnLine to let us turn our collective performance studies into an ongoing project.

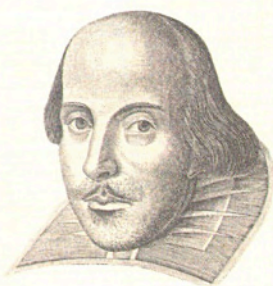
*Lou Grinzo has been working with and writing about desktop computers for more years than he'll publicly admit. He's currently focusing on cross-platform technologies, including Java, Linux, and XML. His website is <http://www.gizmoDrome.com> and you can email him at [lou@gizmoDrome.com](mailto:lou@gizmoDrome.com).*

The code for this article is available on EXE OnLine and via ftp at [ftp://ftp.exe.co.uk/pub/exestuff/200001\\_java.EXEONLINE](ftp://ftp.exe.co.uk/pub/exestuff/200001_java.EXEONLINE)

Number of objects	1	10	50	100	1000	5000
Simple objects, manual storage	0	0	10	10	122	418
Simple objects, serialisation	254	276	308	318	328	364
Complex objects, manual storage	20	174	200	372	3,514	17,928
Complex objects, serialisation	286	308	330	352	440	990

Table 1 - Response time (in milliseconds) averaged over five runs





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# Visual Installer

Jon Perkins explores the Visual Studio 6.0 Plus Pack.



Last month I mentioned that the next version of Visual Studio was some way off yet. However, this doesn't mean that Microsoft isn't providing any new tools for Visual Basic developers. Far from it. The *Visual Studio 6.0 Plus Pack* CD was made available to MSDN subscribers in the October 1999 quarterly update (Office Test Platform and Development Tools Disk 15: *Windows 2000 Developer Readiness Kit*). This toolkit goes some way towards updating the Visual Studio product with some of the newer technologies. The two most significant technologies are the Microsoft Data Engine (which I covered in the November 1999 issue) and the new Visual Studio Installer 1.0 product, which provides a means of creating installation programs that work with the relatively new Windows Installer technology.

Before we get into the Visual Installer product, which is the key topic of this month's column, I'd just like to review some of the other items available on the CD. Microsoft is pushing Windows 2000 very hard, as is indicated by the fact that it has already announced the impending retirement of the NT4 version of the MCSE exams! For developers who haven't had much of a chance to read up on the new features within Windows 2000 this CD provides some good starter material. There are several presentations lifted from last year's TechEd 99 conference that discuss features such as MSDE, COM+, and the Windows 2000 Application Specification. There are also some selected chapters from a Microsoft course entitled *Building Solutions for Microsoft Windows 2000 with Visual Basic*, as well as the Visual C++ equivalent. Finally, there are several whitepapers that discuss Active Directory and the Windows Scripting Host.

## Windows Installer

The Windows Installer was the subject of a feature article by Ian Murphy (*Putting Windows in their place*, EXE, July 1999), although if you don't have a copy of that particular issue it can be found on EXE OnLine. For this reason, I will not attempt to provide too much coverage of this underlying layer, but there are a few aspects that I will discuss in order to add to the information that Ian Murphy originally provided. First, the Windows Installer 1.0 was made available for the first time with Microsoft Office 2000, but a newer version 1.1 ships as an integral part of Windows 2000. The second point is that the whole Windows Installer technology is itself a redistributable component that can be added to Windows 9x or Windows NT 4. The redistributables, both version 1.0 and version 1.1, for Windows 9x and Windows NT 4, are available as part of the platform SDK that ships with MSDN.

One feature likely to be popular with members of installation teams is that the Windows Installer is transactional. This means that a full regression path is maintained throughout the installation so that in the event of a failure the state of the system can be restored. It is only at the point after the installation is confirmed as having completed successfully that the rollback data is wiped. A further feature, of interest to both installers and developers alike, is that Microsoft is now providing direct support for different levels of application patching, ranging from full file replacements down to modifying binaries at the byte level. True to its greater focus on providing for the enterprise environment, the Windows Installer can support environments from a local CD-based installation through to network installation servers.

The way in which the Windows Installer runs differs among the two general categories of platform. Under Windows 9x it is available as a callable COM routine, whereas under Windows NT 4 and Windows 2000 it runs as a true service. By the way, if it is being installed onto Windows NT 4 there is a requirement that the enhanced shell that is provided by Internet Explorer 4.01 SP1 or higher must already have been installed.

One of the features most visible to the end-user is of course the auto-repair facility and it is because of this that the slightly revised Windows shell is required. You will be aware that the applications that are shown under the Programs menu from the Start button are normally straightforward shortcuts. For example, if you find the Notepad menu item (under Accessories), right click it, and select Properties you will see that the target location is set to `%SystemRoot%\system32\notepad.exe`. However, if you have Office 2000 installed then a right-click over one of the application icons will reveal that no such shortcut information apparently exists. In fact, what is happening here is that the target reference is actually a GUID, therefore it isn't actually displayed because there's not much that a user will want to do with it. When the user clicks the shortcut, this GUID is passed to the Windows Installer with a request for the component path. The Windows Installer will then check that the file and its dependencies actually exist; if not, then it is the Windows Installer itself that invokes the repair utility. Once this has been successfully completed the required component path is returned back to the Windows shell and the application is launched.

## Visual Studio Installer

Windows developers who chiefly use Visual Basic as their development tool will be only too aware that they never really get the opportunity to use the full Visual Studio environment. That's changed because the Visual Studio installer project environment is now hosted within Visual Studio. The New Project dialog allows for three such project types (see Figure 1), one of which is specifically geared towards Visual Basic.

The Wizard that is displayed by the Visual Studio Installer (VSI) project is notably more concise than the Package and Deployment Wizard (PDW). Whereas the PDW asks you the questions up front and then generates the project for you, the VSI purely asks which Visual Basic project file (vbp) to work with and then sets up a new VSI project file (with the extension `wip` for Windows Installer Project) using default values. You then have the opportunity to alter the various settings interactively, which makes the whole process much better than before. The Project Explorer window groups the various configuration data into four Target Machine categories and a separate Files listing. The Target Machine categories are:

1. **Filesystem:** where the various files get installed to. The files shown here relate only to non-redistributable components. The standard Microsoft items such as the Visual Basic runtime and the common controls are bundled up separately into items called Merge Modules (with the extension `msm`) and do not get displayed. These days Microsoft makes more of a thing about specific common installation locations such as Application Folder, User's Desktop, User's Start





**The purpose of this build option is to include the Windows Installer component/service along**

**with your own installation, so if it doesn't already exist on the target machine it will be installed first.**

Menu, and Windows System Folder, all of which are displayed by default. Other less frequently chosen locations such as the Common Files Folder can be added from a selection displayed by right clicking the folder pane and selecting Add Special Folder.

2. **User Interface:** this allows you to specify which dialogs will be displayed. A standard list of choices is initially presented but you can add dialogs by right clicking the User Interface pane and selecting Add Dialog. Users of InstallShield might find this description familiar, but the difference here is that you can't see a preview of the dialog at development time. There is scope for adding your own graphic to each dialog via the `BannerBitmap` property. The bitmap here must be a long narrow item that fits along the top of the dialog, but curiously I couldn't find a reference anywhere within the documentation as to what size is necessary for an exact fit: my own deduced values were 497 pixels wide by 68 pixels high.

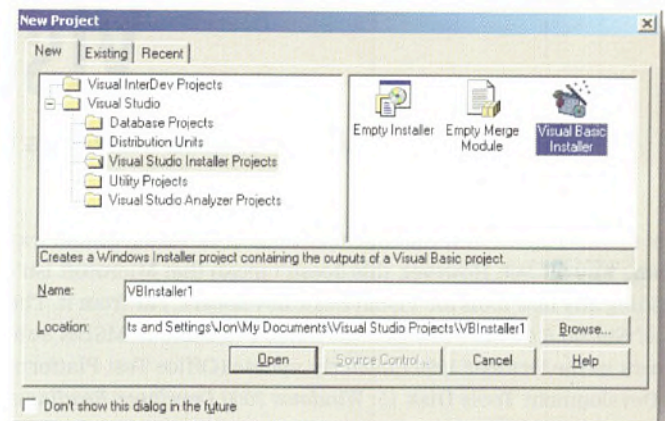
3. **Registry:** almost identical in appearance to RegEdit, this allows you to specify new Registry entries. As with other items it is possible to specify whether this information should be deleted in the event of an uninstall.

4. **Associations:** these allow you to associate different types of Windows objects with your application. Apart from the typical document extensions, this provides association support for MIME types, COM objects, and type libraries.

The Files node of the Project Explorer displays the core application executable plus all dependent files, whether they be common controls and runtime files or your own additions, such as help files. Selecting each file causes the Properties window to display default settings that in most cases you can alter should you wish to. For example, a `Vital` property determines that if a file can't be installed for some reason then the whole installation is kaput and should be rolled back. There are also settings to denote whether a file should be read-only, whether it is a shared or system file, and whether (and how) it should be registered. You can also specify that a file be regarded as permanent – that the file will still exist if the product itself is subsequently uninstalled.

### Conditions

Another feature that is new from previous versions of Microsoft setup tools is that simple expression macros can be processed at runtime in order to determine whether to take a course of action. This can be applied at both the global level and at the individual file level. A condition consists of a simple statement that evaluates to true or false and that can be made against any one of many predefined property values. For example, there are a couple of properties called `Version9X` and `VersionNT`, which return the major and minor version numbers of the current version of Windows. On



**Figure 1 – New installer type projects within Visual Studio.**

any given machine only one of these will actually return a value, so if the target machine is Windows NT 4 then the `Version9X` property will return an empty string. This could be very useful if you want to install target platform-specific files. For example, if you create two versions of a component that are closely aligned to the underlying services provided by the operating system, eg networking, then you can bundle both files into the install project. But when the condition expressions are evaluated only one will equate to true and so only one instance of the file will be installed. An example of a simple condition is:

```
VersionNT>=400
```

### Properties dialog

The Properties dialog under the Project menu provides a greater than expected set of possibilities for customisation. A Launch Condition tab allows you to specify one or more conditions that will be evaluated when the installation program starts up. For each launch condition, you can also specify an error string to be displayed in the event that the condition fails.

Note that the Build tab contains one feature that you may want to use until Windows 2000 (or Office 2000) becomes more widespread. A Build Type list-box offers by default an Installer-type build, but examination of the alternate entries reveals the important option called **Installer With Visual Windows Installer Loader**. The purpose of this build option is to include the Windows Installer component/service along with your own installation, so if it doesn't already exist on the target machine it will be installed first.

### Alternate tools

There's no doubt that the Visual Installer is a significant improvement over the Package and Deployment Wizard. It's no surprise then that companies that specialise in installation tools, such as Wise and InstallShield, lost no time in establishing themselves as alternate suppliers of installation products based around the Windows Installer. As Visual Installer doesn't offer much in the way of scripting, there is still a place for alternate tools of this nature, but I'd also guess that there will probably be a few less developers who feel the need to go out and pay for a replacement for something that is free to registered users. ■

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



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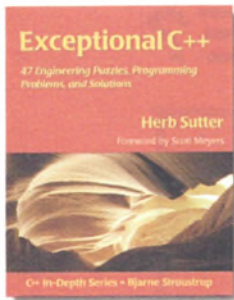
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## Herb Sutter's *Exceptional C++* Reviewed by Kevlin Henney.



Walking into a bookshop these days (an increasingly rare event for the Internet enabled), and wandering over to the computing section, one might be forgiven for thinking (a) that the Web was the only concern of all software professionals, and (b) all development skills could be thoroughly mastered from a standing start in 21 days (or less). By their length, many of these books leave *War and Peace* standing

in the short novella league, but very few forests standing at all. Quality is typically an optional extra, often not provided.

The proportion of developers that read books or magazines about development is disturbingly small – putting one in mind of Bertrand Russell's comment, 'Many people would sooner die than think. In fact they do.' – and the proportion, in turn, of good books cheerfully follows (perhaps even exceeds) Sturgeon's Law: 'Sure, 90% of all *X* is crap. That's because 90% of everything is crap.' Where *X* may be science fiction, software, computer books, etc.

Therefore, a sense of relief, a comfortable chair, and many cups of coffee greeted a batch of highly readable, insightful, and short books about software development as they landed on my doormat. For this month, I look at the first one...



**The book's size, and the size of each item, further help to allow each item to be read and digested in a coffee break, long compile, or a couple of tube stops.**

Built on the stability of the ISO C++ standard, Addison-Wesley's new *C++ In-Depth* series, with Bjarne Stroustrup as series editor, seeks to drill down into particular topics of interest to the C++ programmer. Each book in the series is intended to be short, ie in the 200 to 300 page range, and focused. One of the first in the series is Herb Sutter's *Exceptional C++*. He is well known in the C++ standard community, to readers of *C++ Report*, and to those who have come across his *Guru of the Week* website and postings on `comp.lang.c++.moderated`. The book is based on the *Guru of the Week* challenges, but adds a significant amount of extra detail and solution.

For those who like puzzles, there are forty-seven challenges, each of which is graded in terms of difficulty. For those who don't, the structure of the book is such that each section can be read as a problem/solution-driven approach to exposing some of the subtleties of C++, presenting robust and repeatable solutions. Many of the boxed guidelines provided are genuinely useful. For instance, 'Prefer passing objects by `const&` instead of passing by value' and 'For consistency, always implement postincrement in terms of preincrement, otherwise your users will get surprising (and often unpleasant) results'. Some, however, do come across as a bit content free and perhaps even harmful, eg 'Design with reuse in mind' is neither useful nor practical advice; in the past and present – and undoubtedly future – such advice has been responsible for gold plated, complex code that fails to meet its original purpose. Developers would do better to design with use in mind.

The items in the book are broken into readily identifiable topics. *Generic Programming and the C++ Standard Library* covers

iterators, strings, containers, and temporary objects. *Exception Safety Issues and Techniques* are the dominant theme of the book, and the topic from which it gets its title. *Class Design and Inheritance* focuses on the use and abuse of inheritance. *Compiler Firewalls and the Pimple Idiom* deals with dependency management issues and an idiom originally known as the Cheshire Cat idiom. The titles of *Memory Management* and *Name Lookup, Namespaces, and the Interface Principle* are self explanatory. *Traps, Pitfalls, and Anti-Idioms* offers a catch-all section for certain poor practices. And *Miscellaneous Topics* is a catch-all for everything else, including the oft orphaned topic of `const` correctness, which I always feel deserves its own section.

The comfortable style of writing and simple, structured layout make this an easy book to read in spite of the weight of its subject matter. The book's size, and the size of each item, further help to allow each item to be read and digested in a coffee break, long compile, or a couple of tube stops.

These problems – and their solutions – are not esoteric: they are all based on common use of the standard language and library that

you can find in many systems being developed today. If you are new to C++, or are unfamiliar with the standard library and other features that differentiate third from second generation C++, you may find you have to refer to other material (online or treeware) to get a better feel for the issues presented.

The gist of the book can be summarised by one of the headings in the book: 'Write what you know, and know what you write'. You may not necessarily agree with all of the conclusions and recommendations, but you will certainly have to understand your own thinking in detail to do so. Either way, reading the book will significantly increase your knowledge of C++ and how to work with it, to the point implied by the title. ■

### Book details

<b>Title:</b>	<i>Exceptional C++: 47 Engineering Puzzles, Programming Problems, and Solutions</i>
<b>Author:</b>	Herb Sutter
<b>Cover:</b>	Paperback
<b>Publisher:</b>	Addison-Wesley
<b>ISBN:</b>	0-201-61562 2
<b>Price:</b>	£18.99
<b>Pages:</b>	224

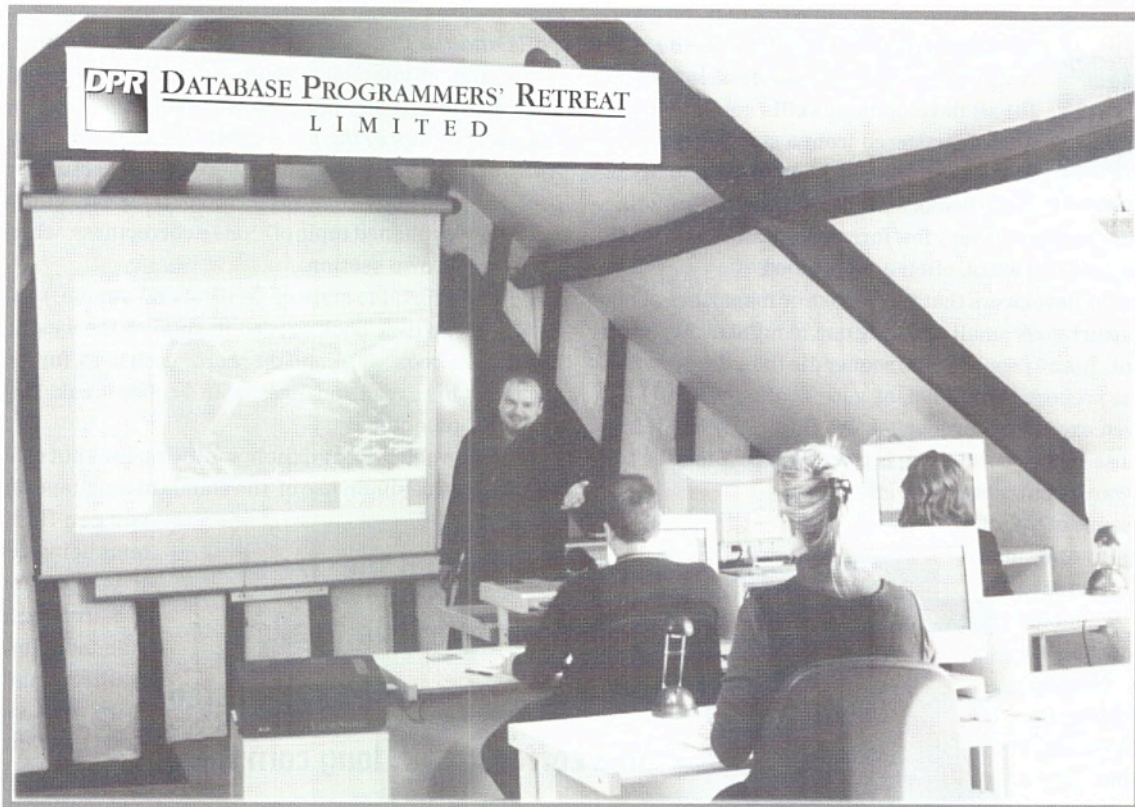
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Herb Sutter's *Guru of the Week* website, containing current and past *Guru of the Week* challenges:  
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**JaCC 99**

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, Kevlin 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.

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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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Kevlin Henney

## The EXE Questionnaire

*In the first of a new series we turn the spotlight on a well known figure within the world of software development. This month we feature Kevlin Henney, member of the BSI C++ standard panel, patterns enthusiast, conference speaker, and all-round good egg. Kevlin is also Principal Technologist at QA Training.*

**What was the first computer you worked on?**

The first computer I used was a UK101, but the first I used professionally was a Data General MV.

**What was the first computer language you worked in?**

The first computer language I learnt was Basic on said UK101, and the first I used commercially was Fortran 77. By the way, you're not recording this first bit, right?

**What was the last program you wrote?**

Fairly unexciting, but nonetheless useful and necessary: a test harness. This is for framework and library classes (which I guess don't qualify as programs, per se) that will be finding their way into some courses, articles, talks, pattern write ups, libraries, etc.

**What was the most difficult project you worked on?**

While there are certainly technologies used on projects that are challenging (and indeed challenged), the real source of difficulty is often development culture – many companies have a political climate that works against good development. The Software Engineering Institute's Capability Maturity Model has been unofficially extended to reflect this – check out the Capability Im-Maturity Model (CIMM) at <http://www.stsc.hill.af.mil/CrossTalk/1996/nov/xt96d11h.asp>.

**Are the best software developers born or made?**

Yes.

**Which one aspect of the software industry would you change, if you could?**

Creeping featurism.

**What advice would you give to someone starting in software development today?**

'Are you really sure about this?'

**What is your proudest accomplishment, within IT?**

Hmm, I guess it would be either of these:

- The development of QA's 5 day *Advanced C++ Development Techniques* course, with Andy Olsen. This was a radical reworking of the previous 4 day version and focused on standard C++, patterns, and practices associated with language features rather than language features for their own sake.
- Once threatening the manager of an integration team with a macro: `#define private public`, to be precise. The software produced by the project I was on was supposed to be allowed to call a particular function in their centralised framework. It was declared `private` at the time, but without it our software could not be completed to contract and the manager seemed to be unperturbed and unhurried by this. I admit it was unsporting and definitely below the belt, but the jaw-dropped expression alone – 'you can't do that... can you?' – was worth it. This episode confirmed for me both the power of the C preprocessor and why it is generally an abomination to be avoided where possible.

**Commercial, shareware, freeware, Open Source?**

They all have their place; it is a matter of balance and context as to which strategy is the best. My personal feeling is that the dial is currently too far over into *commercial* for many products.

**How do you react to the flames of language wars?**

By donning NBC gear followed by – depending on the nature of the debate, debaters, and debatees – extreme indifference (go off and make a cup of coffee), extreme moderation ('hey, we should all get

along, they're only languages after all'), or extreme views ('if language shapes the way that we think, surely languages derived from Basic are a way of avoiding thinking').

**What is your favourite book?**

The non-programming books that have most influenced the way I think about software development would probably be

- *The Design of Everyday Things* by Donald A Norman, with principles and practices that can be carried over to the internal design of software and not just the more predictable view of its user interfaces.
- *minimum* by John Pawson: less really can be more.
- *The Timeless Way of Building* by Christopher Alexander is the work that originally laid out the motivation, definitions, and manifesto for patterns. Although a great book in its own right, there is a lot more to patterns than is contained in the Gang of Four's *Design Patterns*.
- *How Buildings Learn: What Happens After They're Built* by Stewart Brand; because buildings change, and so does everything else. To quote Jim Coplien, 'in software the only constant is change'; to understand the nature of change in structures seems to be something directly relevant to software development.
- *The Elements of Style* by Strunk and White is a classic book for written composition, whether prose or code.
- *To Engineer is Human: The Role of Failure in Successful Design* by Henry Petroski, because it would be nice to think of software development as related to engineering, as engineering being related to humans, and of failure related to something positive.

**What is your favourite film?**

Oil on water catching sunlight. It's about interfaces.

**What is your favourite website?**

If it's the site I visit most often, that would probably be [www.google.com](http://www.google.com), without a doubt the best search engine out there at the moment. In terms of sites that I tend to find myself recommending to others, it would be one of: the CIMM site I mentioned before; the Interface Hall of Shame at [www.iarchitect.com/mshame.htm](http://www.iarchitect.com/mshame.htm), which critiques poor user interface design, with Lotus Notes and the Windows interface receiving some less than honourable mentions; and the Programmer's Stone at [www.ftch.net/~honeyg/progstone/progstone.html](http://www.ftch.net/~honeyg/progstone/progstone.html), the most accurate profile of the successful programmer mindset I have come across.

Another one I find rewarding and tend to hang out on is the *Wiki*, for which a useful entry point is at [c2.com/cgi/wiki?WelcomeVisitors](http://c2.com/cgi/wiki?WelcomeVisitors). It's quite difficult to define exactly – a dynamic and interactive website with some of the spirit and culture of a good newsgroup or list gets close, but it has more of a bazaar feel to it. The focus of topics tends to include OO, patterns, and XP.

**What is your latest gizmo?**

Something rather functional: a touch screen-driven alarm clock. What makes it interesting is that it's so poorly designed. Sure it works, but I'm talking about usability: I am presuming that it was designed by someone who is single, sleeps heavily, and has no other timepieces (e.g. watch, palmtop, PC, etc). My wife, however, is altogether less keen on it.

Next month: Kent Beck



# 13 ways to loathe VB

Verity Stob has recently been press-ganged into a Visual Basic project. For the benefit of other programmers who may be brought down in this way, she has prepared an executive summary of her experience.

1. *Procedure and function call.* This area of Basic has come on in leaps and bounds. Whereas in the bad old days you had to use GOSUB, these days you have *subs* ('subs' is the preferred baby-speak for what grown-ups call procedures or void functions) and functions. You write:

```
Subname Param1, Param2
```

to call sub Subname and:

```
Result = FuncName(Param1, Param2)
```

to call function FuncName. Notice the useful difference in syntax, with and without parentheses, which serves more purposes than I can describe. It is of course a syntax error to write:

```
Subname(Param1, Param2)
```

but the good news is you *can* write:

```
FuncName(Param1, Param2)
```

to call a function and ignore its return. However, if Param1 or Param2 are reference parameters – and they will be unless you have specifically demanded value parameters – they will be treated *in this specific case* as value parameters, and any assignment to them discarded on exit from FuncName.

Obviously the syntax:

```
Call FuncName(Param1, Param2)
```

fixes this, and causes Param1 and Param2 to be treated as reference parameters.

Right.

2. *Variable declaration.* This is achieved using the intuitive keyword Dim. To declare an integer I write:

```
Dim I As Integer
```

To declare a whole load of integers write:

```
Dim I, J, K, L As Integer
```

Actually (haha got you!) this doesn't work. This declares I, J, and K as variants and only L as an Integer. This almost never matters, except quite often.

3. *Calling functions and accessing arrays.* In most languages you can distinguish between a call to function F with parameter 3 and a reference to array F index 3 because one is written F(3) and the other F[3]. In Visual Basic they are both written F(3). Yes.

4. *Another thing about arrays.* The index of the first element is 0, unless it is set to 1 by a directive.

5. *But there are also collections,* modern object-oriented versions of arrays. And the first element of these is usually 1, unless it happens to be 0. Sometimes it is 0 and sometimes it is 1, depending on where you found it. Do you feel lucky, punk? Well, do ya?

6. *Did I mention 'object-oriented'* back there? Hahahahahahahahaha.

7. *Initialisation.* This area of Basic has come on in leaps and bounds. Whereas in the bad old days you had to use a completely barbaric mechanism based on the keywords DATA and READ, this has now been swept

away. The fragment below illustrates the modern way to initialise an array in code.

```
Dim A(20) As Double
```

```
A(0) = 4.5 ' May work, may not - who can tell?
```

```
A(1) = 4.71
```

```
A(2) = 4.82
```

```
A(3) = 4.92
```

```
...
```

You get the idea.

8. *Arrays of constants.* No such thing. Anyway, what would you do with 'em if you had 'em?

9. *The type Integer declares a 16-bit integer.* That's right, sixteen bits. Yes I *am* using the latest version. Unbelievable, isn't it? Let's have a big warm EXE welcome back to code that dies suddenly around the 33 KB mark.

10. *Assignment.* This area of BASIC has come on in leaps and bounds. Whereas in the bad old days you used the = operator for assignment, preceding it with LET if you were a fusspot of the first order, these days you use the = operator for assignment, preceding it with Let if you are a fusspot of the first order. Or Set if it's an object. Which is compulsory not optional.

11. *Logic.* This particular language is supposed to be easy and intuitive, so here's a test for you. Suppose that Check1 is a checkbox on a form, and you execute the code:

```
Dim b As Boolean, c As Boolean
```

```
b = Check1.Value
```

```
c = Not Check1.Value
```

Then b as expected will contain True if the checkbox is checked and False if the checkbox is unchecked. What do you think c will contain? (Clue: always True. No, really.)

12. *The four magic constants of the apocalypse:* Nothing, Null, Empty, and Error.

12.5 *The stupid editor,* which by default will put up a whining dialog if you try to leave a line which it recognises as syntactically incorrect. Like when you leave an incomplete line temporarily to go and copy a long identifier into the clipboard, for example.

12.7 *The stupid compiler,* which by default does a 'compile' so superficial that you can get runtime errors caused by an If missing its End If.

12.8 *Procedures, sorry 'Subs', can be declared Public, Private, or Static.* Two points to anybody who correctly guesses what Static does. Three points to anybody who can suggest a sane use for it.

13. *Bill is making even more money out of this.* And I am powerless to stop him. In fact, I am helping him. ■

(Next week: Java. Verity Stob is currently appearing as a troll in every single tiresome religious discussion about languages on Usenet.)



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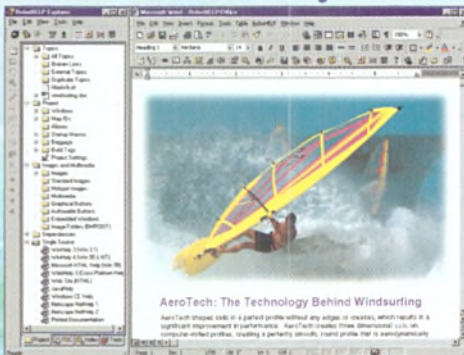
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