

EXE

NOVEMBER 1997

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Data
binding
faster
than
Thrust SSC

Squeezing
Delphi data

Version
control:
better than a
whiteboard?

C coders pay
lip service to
const

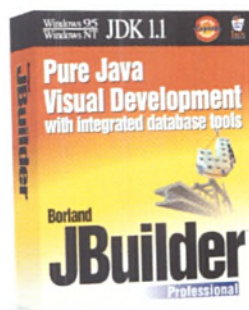
Stalking
Bill Gates

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spam, spam...



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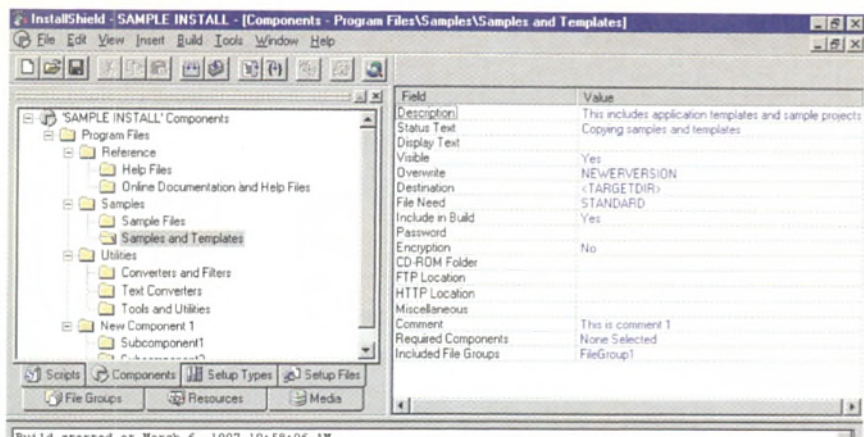
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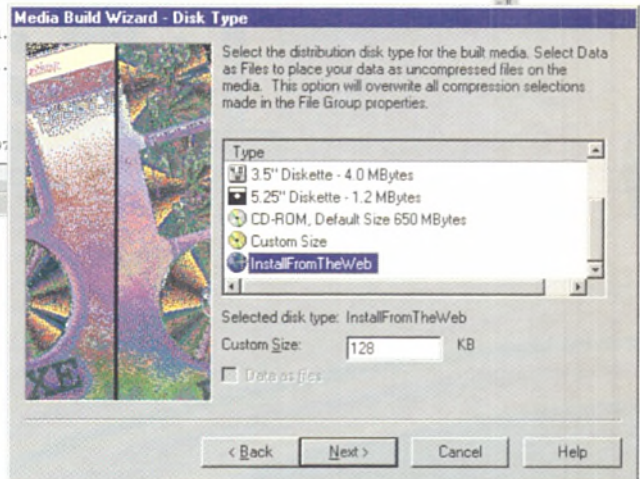
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FORWARD



Build started at March 6, 1997 10:58:06 AM.
Calculating size of cabinet files...
Copying InstallShield engine files to Disk 1...
Building system cabinet file 'sys1.cab'...
Copying uncompressed setup files to Disk 1...
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Sometimes you're not happy with the final painting or want some slight variation, the easiest is to go back to the sketches. That is if you still know where they are.

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EXE: The Software Developers' Magazine is independent and not affiliated to any vendor of hardware, software or services. It is published by: Centaur Communications Ltd, St Giles House, 50 Poland Street, London W1V 4AX. EXE Advertising/Editorial/Production Telephone: 0171 287 5000 Fax: 0171 437 1350 Advertising email markp@dotexe.demon.co.uk Subscriptions Tel: 0171 292 3706 Fax: 0171 439 0110 email: execirc@centaur.co.uk. EXE is available by subscription at £35 per annum (12 issues) in the UK: see subs card within this issue. The magazine is published around the 1st of the month. To subscribe or if you have a subscription query, please call 0171 439 4222 or write to The Subscriptions Manager, EXE, (address above). We can invoice your company if an official company order is provided. Back issues are available at £3.50 each. 'A Subscription implies that this journal will be sent to the subscriber until one of the three expires' (AG Macdonell.) Editorial. Address all editorial enquiries and comments to The Editor, EXE, (address above) or email to editorial@dotexe.demon.co.uk. We welcome letters, opinions, suggestions and articles from readers. These may be edited. Information contained in EXE is believed to be correct. If errors are found, we will endeavour to publish a clarification in the next issue. Copyright Material published in EXE is copyright © Centaur Communications Ltd. Articles (or parts of articles) may not be copied, distributed or republished without written permission from the publishers. All trademarks are acknowledged as the property of their respective owners. Repro & Typesetting: Atelier Dataset Ltd Printer: St Ives (Roche) Ltd. Front Cover Illustration: Jonny Mendelsson ISSN: 0268-6872

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Out of touch



Bill Gates was here! He was in the UK for a day last month. Have you met

him? After all, it's you Windows developers who helped Microsoft be so successful. Somehow, I don't think meeting British developers fitted into his agenda. His whole morning was booked for a meeting with Tony Blair as you no doubt read in the dailies or watched on the telly. And in the afternoon, he went to Cambridge to lecture a room full of undergraduates (http://www.microsoft.com/BillGates/billgates_1/speeches/cambridge.htm). Journos, including EXE's editorial staff, were lucky enough to be invited to a Q&A session with the great man himself.

The whole exercise was

disappointing. A big media circus! The first few rows were reserved for the national press and foreign correspondents, then there was a row of TV

cameras. Bill Gates managed not to give any precise answers. Of all the PC journos I talked to after the Q&A, not one found the event newsworthy.

After all, it's you Windows developers who helped Microsoft be so successful

cameras and behind it all the PC journalists. In other words, we couldn't see much. Of course, the sound system didn't work well – high technology! After a short five-minutes introduction by Bill Gates on how we all live in a wired world, it was Q&A time, a whole forty-five minutes of it. Most questions were from the Nationals. Well, they couldn't really see us behind the

How has Microsoft managed to evolve all these years? Some ten years ago, Bill Gates used to come to Europe often, once or twice a year. He had the time to meet with small groups of techy journos and with developers. Everyone really had the opportunity to ask him questions and he replied directly to them.

Microsoft 'owns' at least 80% of the desktop according to

most market studies. Microsoft decisions have a very strong and direct impact on the work of most developers these days, but at the same time Bill Gates is more and more out of touch.

It used to be easy to have a techy to techy talk with Microsoft's developers, even with Bill Gates himself. Now all relationships with Microsoft are governed by the strong marketing and PR team. It's hard to get through to techies and most of them practise marketing-speak. This even shows up in things like the Knowledge Base. Look at recent items on security issues, you won't find any clear explanation of what went wrong.

No wonder this attitude creates resentment in the developers' community.

David Mery

Stalking Bill Gates



If you read *Need to Know*, the UK's self-proclaimed most sarcastic weekly technology news e-zine (<http://www.ntk.net>), you might have been wondering what the following (*NTK* 10/10/97) is all about:

'So it was with great reluctance and irritation that we award ten pounds and a bunch of CDs to NTK reader David Mery for winning last week's *Stalking Bill Gates* challenge. David, who works at NTK's favourite hardcore top-shelf development mag, EXE [*thanks for this, erm, rather unusual description* – Ed], not only met the man himself on his visit to Cambridge (requirement #1), but also

incomprehensibly harangued him in front of the world's press about releasing the source to the original Gates-and-Allen coded 4 KB Basic (as Gates promised to do almost a decade ago) – winning him an extra bonus fiver.'

Here's the full story. Nearly ten years ago, a French mathematician and freelance journalist, Andre Warusfel, asked Bill Gates for the source code of the Basic he co-wrote with Paul Allen in 4 KB for the Altair. Bill Gates promised to send him the code as soon as he was back in Redmond. Andre never received the source code. I then took over this quest and every time I met Bill Gates, probably five or six times in the past ten years, I asked him for the very same code. Bill Gates

regularly said he had forgotten and would do it as soon as he was back in his office.

Since I never received the code I took the opportunity of meeting him in Cambridge last month (see above) to remind him of his promise. He asked me to provide him with the name of the two persons to whom he made this promise. It has now been two weeks and I've not even had an acknowledgement of my email to Microsoft's PR agency.

This Basic 4K, as it is nicknamed, is a historic artefact. It's of no commercial use today so there isn't any business need to keep it confidential. It is this very program which started the micro-computing commercial software industry. The Gates

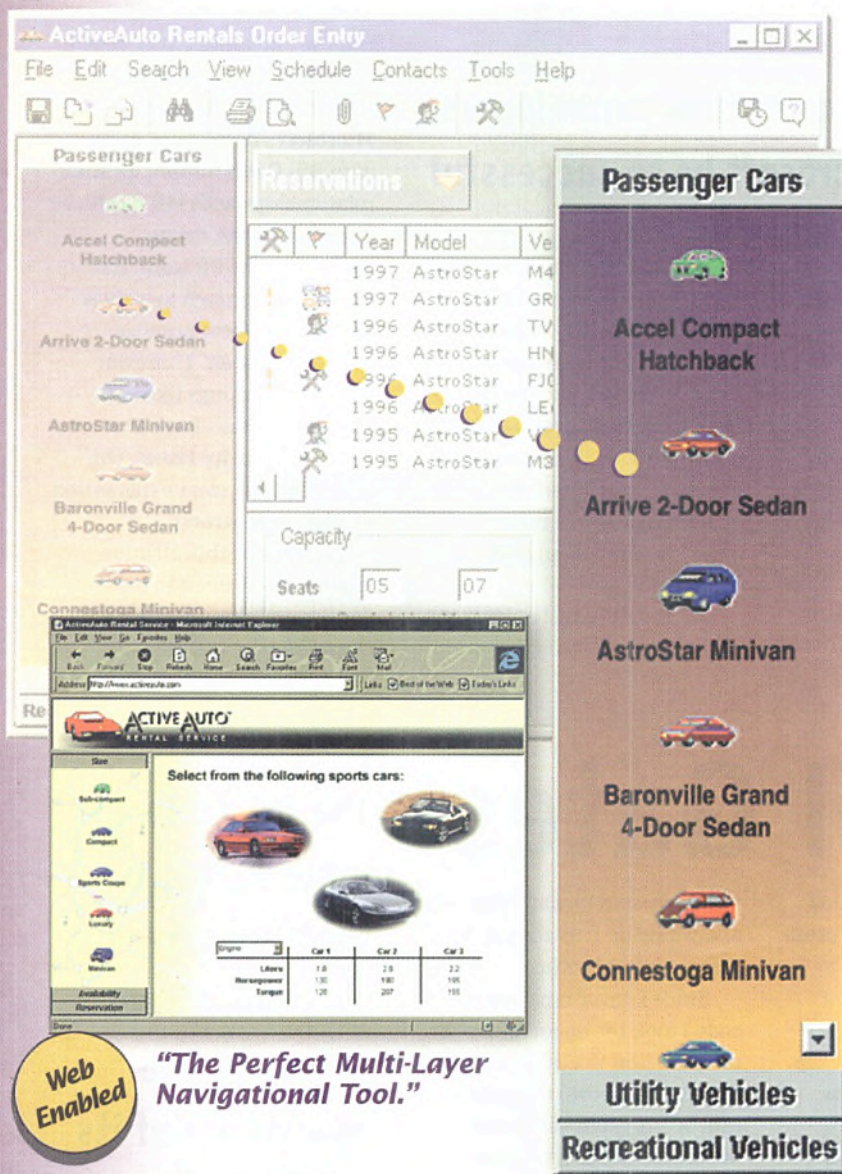
The PC software industry has a short history and we should have access to the milestones of its evolution

and Allen Basic was licensed for the Altair by MITS in 1975 and was the genesis of Microsoft. The PC software industry has a short history and we should have access to the milestones of its evolution.

I'll keep you posted on any new development.

David Mery

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Sun and Microsoft wage war over Java

Sun responded to last month's launch of Microsoft's Internet Explorer 4.0 browser suite by filing a suit for alleged breach of contract, claiming that IE4, and version 2.0 of Microsoft's Java SDK, are not fully JDK 1.1-compliant as required by the Java licence. The suit seeks to prevent Microsoft from badging products which are not JDK 1.1-compliant (as certified by Sun) with the Java Compatible logo, but stops short of actually withdrawing Microsoft's license to build Java products.

The suit hinges on the allegation that Microsoft has added methods and classes into the existing Java libraries which, if included by a developer, would render the resulting code incompatible with any JVM but Microsoft's, and that Microsoft has not included support for Sun's JNI (Java Native Interface) or RMI (Remote Method Invocation), both of which are standard parts of JDK 1.1.

Apparently, were RMI/JNI included in the Microsoft VM, it would be possible to build applets which could remotely launch and operate Windows applications on other VM-equipped machines on the network – a potential security



and licensing nightmare. Microsoft claims that its contract gives it the right to be the reference implementation of Java on Windows, a claim that Sun denies. According to Sun, only it has the right to set the reference specification for any platform.

The latest act in this litigious opera came when Microsoft and Sun released their Java licence

contracts into the public domain on their respective Web sites – Microsoft had said it would do so anyway and Sun appears to have followed suit.

There may be further disagreements between the two companies with the release of Windows CE 2.0, which includes a JVM compatible with that in IE 4.0, and which may be subject to the same problems.

This case may well decide the future of Java as a desktop development technology; should Sun win, Microsoft will be forced to concede that the core Java standard must remain resolutely cross-platform – an element it has been heavily downplaying since the beginning – whereas a win for Microsoft would effectively splinter Java across platforms, with the dominant Windows sector going one way and everyone else another. Expect this one to run and run...

www.microsoft.com

www.sun.com

Allaire's acclaimed **ColdFusion** Web application development system has been ported to **Solaris**. Previously only available on Windows 95/NT, the ColdFusion **Application Server** includes a development environment and **server extensions**, and is NSAPI and Apache compatible. www.allaire.com

WindRiver's **Tornado** embedded application development environment has been released for the **I20** platform. This version runs on the company's **IxWorks** RTOS for I20 – which is in fact the only **commercial OS** available for this controller family. www.windriver.com

Internet telephony is a hot topic which will get even hotter if **Voxware** gets its way. Its **VIPSuite** IP telephony SDK is built around a **scalable** codec which, it claims, can achieve much **improved** voice quality over **low-bandwidth** (28.8kbps) connections. www.voxware.com

The latest version of **DataView's** eponymous **data visualisation** development tool includes WebDataViews, a **browser** plug-in which allows DataViews applications to be viewed over a **Web** connection. DataViews 9.8 is available for Windows 95/NT now, Unix 'shortly'. www.dataviews.com

The **WebDataViews** technology has been separated from the **DataViews** environment into as a **standalone** product, AXViews. Supplied as an **ActiveX** control, AXViews can be included in HTML documents, or any ActiveX-aware application. www.dataviews.com

Ilog ships JViews

Ilog has started to ship its 2D graphics library for Java. JViews is 100% pure Java and supports JDK 1.1. It has been completely rewritten and supports most of the graphical objects (lines, rectangles...), managers (pan, zoom, interaction/behaviour...), and the multiple views feature of C++Views. JViews lets you easily create Java applications which integrate behaviours such as nodes, links, pushbuttons or even graphs. Missing in the Java version is some of the basic functionality already provided by AWT, such as widgets, buttons and bars. Tests conducted by Ilog show that JViews is, on average, four times slower than C++Views depending on the speed of your JVM. Pricing starts at \$6500 per individual developer licence.

www.ilog.com

01344 661600

SDK 2.0 for Java

If you're willing to risk the wrath of Sun, version 2.0 of Microsoft's SDK for Java is available on the Web for download today. The SDK includes the IE4.0 version of the Java Virtual Machine, J/Direct, and the much-vaunted AFC (Application Foundation Classes). This at least is one step ahead of Sun, whose JFC (Java Foundation Classes) will not be ready until the next JDK revision.

Many of the added features in this version of the SDK are controversial, not least in light of the current legal dispute between Microsoft and Sun. In particular, J/Direct has been seen by many as a way of locking Java firmly onto Windows. Java applications built with SDKJ 2.0 can be permitted to break out of the normal Java sandbox and access privileged system resources. This is hardly a new idea – Microsoft was touting it months ago – and indeed many observers have commented that the sandbox is so restrictive that it prevents the development of useful Java applications, but it doesn't go down well in the 100% Pure Java community. Microsoft also claims that this version of the JVM is up to 500% faster than the competition, a claim apparently borne out in recent independent tests.

Although there is as yet little or no Java code out there written using AFC – at least in the public domain – there is every incentive to start using it. The AFC libraries shipped with Internet Explorer 4.0 and are already installed in large numbers of PCs worldwide. AFC will also ship in the Macintosh version of IE4, and possibly even the Windows 3.x version.

www.microsoft.com/msdn

Microsoft previews Windows NT 5.0

Adding auto-resizing intelligence to controls is no longer a problem thanks to **KL Group's Olectra Resizer**, which automates the resizing process for **VB** forms. Supplied controls include **Grid Containers** and a **Geometry Manager**.
www.klg.com

The latest point release of **MKS SourceIntegrity**, 2.1, adds version control functions into the **defect tracking** system, creating what MKS calls a fully integrated solution. The **client** product is fully **32-bit** in the Windows 95/NT version for extra stability.
www.mks.com

Continuus has ported its Windows NT/Unix change management system to work with **Sybase's PowerBuilder** development tool. The PowerBuilder version fully implements the '**task-based**' version control philosophy of the earlier versions and is aimed at large scale development teams.
www.continuus.com

Borland-based developers who are tired of the supplied **BDE** should check out **Apollo 4.0** from **Luxent**, a smaller and faster alternative customised for **Delphi 3** and **C++ Builder**. It weighs in at only **200 KB** and includes a fast text search capability.
www.greymatter.co.uk

Java cryptography comes courtesy of **J/Crypto** from **Baltimore Technologies**. It is an **RSA** public-key encryption class library supporting **DES**, **MD5** and **SHA-1** algorithms. J/Crypto can be integrated into the JDK 1.1 **Java Cryptography Architecture** as a JCA extension, as well as JDK 1.0.2.
www.greymatter.co.uk

At the IE4 launch event last month, Microsoft revealed more details about the forthcoming Windows NT 5.0, currently entering wide beta. The beta will be distributed to MSDN subscribers as well as to 'selected corporates'. Many of the improvements in the operating system have been in the field of integrating as many services as possible into the base OS; existing services such as IIS will become much more tightly integrated with the OS, and among the new services Microsoft is touting the Active Directory – its LDAP compatible directory service – as one of the main benefits for application developers.

The user interface for NT 5.0 will be the Active Desktop interface of Internet Explorer 4.0 – as will that of Windows 98 – but better

performance is promised than on NT 4.0 because of direct integration into the core OS. In addition, the joint Win98/WinNT driver architecture – the Windows Driver Model – will finally make its debut.

Two extra developer technologies were rolled out, which will begin to be delivered now but will form part of the final NT 5.0 release as well; COM+ and DNA. DNA, which stands for Dynamic interNet Application architecture, takes the disparate OS services currently available under NT 4.0 and scheduled to be available under NT 5.0 – IIS, Dynamic HTML, client and server-side scripting, directory services, transaction services, message queues etc – and packages them up in a single set of COM interfaces. COM+ is, as it

sounds, an extension to COM. Details of precisely what extensions there will be are sketchy, but will include in-built ODBC database binding at the object level and a kind of run-time polymorphism called Interceptors where COM objects will be able to dynamically change their functions according to the host platform.

Developers should not expect to find all these features in NT 5.0 Beta 1, which will be 'feature incomplete'. Nor should they look forward to an early release of the OS: it looks as if at least three beta releases will be needed before NT 5.0 is ready to ship. At this point, Microsoft would not commit itself to any date more precise than 'the second half of 1998'.

www.microsoft.com

Playing Caché with your objects, relationally

InterSystems is well known for its involvement with **OpenM** and **Mumps**. This is now history with its **Caché** post-relational **DBMS**. Caché is based on a transactional multidimensional data model. It can be accessed in three ways: **Direct Access** for maximum performance, **SQL** for interoperability through **ODBC**, and **Objects from Java**, **ActiveX** or **C++**. Though **InterSystems** is targeting new customers for Caché, users of the beta were mainly **Mumps** customers migrating to Caché. Not

making any change to their applications, according to **InterSystems**, they gained a 30 to 40% speed improvement. This is due mainly to better support of multiple processors and in situations where most of the I/O bandwidth is in use.

According to a research by **Tate Bramald Consultancy**, 50% of **RDMS** users think their current database will not meet 50% of the requirement they will have in five years. Apart from the obvious wishes such as better reporting and scalability,

87.3% of the surveyed users want a simple database combining relational with multidimensional features.

Caché exists in four configurations: standalone, **Workgroup** (up to twenty-five users), **Division** (up to 500 users) and **Enterprise** with prices ranging from £100 to £750 per concurrent user. Caché supports **Microsoft** and **Netscape** Web servers and is available on **Windows 95** and **NT**, **OpenVMS**, **AIX**, **HP/UX** and **Digital Unix**.

www.intersys.com

A full blown Corba-based application platform

NetDynamics 4.0 is the latest product from **NetDynamics**. This Corba-based environment is dubbed an 'enterprise network application platform'. It is made up of an application server at the core, and a Java object framework (400 classes, 4000 methods, **JDK 1.1** compliant), a **Studio** (development tools), a **Command Centre** (distributed management), and **Platform Adapter Components** for third-party adapters. **NetDy-**

namics supports **Java** on the server and has done so since version 2.0. The application server offers Corba services such as load balancing, security, sessions, transactions... The **Studio** can generate **HTML** or **Java** or **JavaBeans** or **ActiveX** controls, but development can be done with popular PC-based tools (from **Microsoft**, **Borland**, **Symantec** etc). Most clients are supported, be it an **HTML** browser, a **Win-**

dows machine, a 3270 terminal or a **PDA**. This is what **NetDynamics** calls the 'optimal weight' client. With the **Platform Adapter Components**, **NetDynamics 4.0** can be integrated with most types of legacy data.

Pricing starts from \$895 per developer, the application server at \$200 per concurrent user for a production system.

www.netdynamics.com

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IE4 launch triggers war on two fronts

A new version of **Purify**, now under the **Rational** banner, supports error-checking and memory leak detection on **Windows CE 2.0**. Purify 5.0.1 only works within the WinCE emulator on a **PC** rather than on a CE device itself. Beta version available from www.rational.com

PharLap's TNT embedded development toolkit has been upgraded to integrate with Microsoft's **Developer Studio 97** environment. Embedded developers can use DevStudio to build **embedded** applications with the TNT back-end. www.pharlap.com

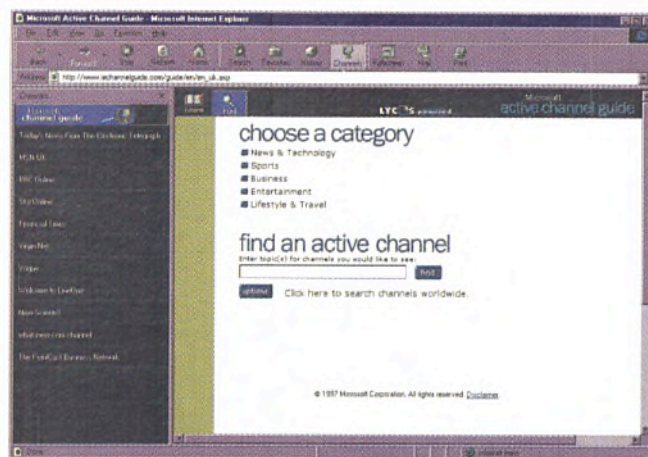
Look! for **Tornado** is a GUI object-oriented **debugging** extension for **WindRiver's Tornado** embedded development toolset. Based on Objective Software's Look! for C++, the product claims to vastly **simplify** the traditionally tortuous embedded debugging process. www.ost.com

The latest **milestone** in the 'official' **Unix** world comes with the release of **SCO's System V Release 5** kernel. SVR4 was used as the basis of both SCO UnixWare and Sun **Solaris 2.6** and updated versions of both should be ready soon. www.sco.com

The **JavaCard 2.0** API, previously available for download from Sun's Web site as a **beta**, has been released in a **final** version. Sun sees the spread of Java-based **smartcards** as a crucial demonstrator of the language's scalability. Download the final code at www.java.sun.com

The launch last month, more than a year after it was first announced, of Microsoft's Internet Explorer 4.0 browser has put the software giant at loggerheads with two of its greatest rivals. We report elsewhere in this issue about Sun's suit against Microsoft over JDK 1.1 compliance, but almost as significant is the total failure of Microsoft and Netscape to come to any form of agreement about either Dynamic HTML or channels. Users of IE 4.0 and Netscape's Communicator face the prospect of not being able to view sites or channels designed for the other.

Should this matter to software developers? Almost certainly. With an increasing demand, particularly on corporate application developers, to make applications work across the Web, it is imperative that standards emerge about what services should be available on a Web client. Many developers are also being asked to implement sophisticated Web sites requiring a good deal of custom programming, much of which would be made easier by a reliable DHTML



standard. Sites which do not wish to alienate one or other camp are faced with the unenviable choice of either creating two separate sites and/or channels, or implementing none of the extensions and looking behind the times.

Neither company appears inclined to shift positions, despite claims from Microsoft that CDF would be tweaked to make it possible for Netcaster channels to be repackaged as Active Channels. It looks as though it may come down to a straight fight between the two

technologies. In the meantime, developers are left to dither.

On the plus side, IE4 appears to have been generally well-received by users, with record downloads swamping a number of distribution sites for the browser. Complaints about the impact on system performance have been registered, however, as have some problems with the uninstall program which many users have found unreliable or at worst nonfunctional.

www.microsoft.com

www.netscape.com

New brokers from Visigenic

ORB specialist Visigenic has launched new versions of its VisiBroker range. VisiBroker 3.0 is available in C++ and Java flavours and is fully Corba 2.0 compliant. The major new feature in VisiBroker 3.0 for Java is the inclusion of Caffeine technology; this eliminates the need for developers to write in IDL by converting Java classes over to IIOP-compliant frameworks. The Object Database Activator persists objects through OO databases if available.

The Visigenic ORBs have already been licensed by companies such as Borland, Oracle and Netscape, and VisiBroker 3.0 will be available with products from these companies. It can also be licensed separately from Visigenic.

www.visigenic.com

Windows CE 2.0 SDKs

It's been a busy month for Microsoft. To coincide with the October 30 launch of Windows CE 2.0 the company has made available on the Web beta versions of development toolkits for Visual Basic and Visual C++ which allow applications to be written for WinCE 2.0 in each of those languages. A Visual J++ version is in development. Contrary to rumours which suggested that Microsoft's planned JVM for Windows CE was not yet in a fit state to ship, a version of the JVM supposedly feature-compatible with the Win32 reference implementation will be included in ROM with WinCE 2.0 machines.

Each toolkit includes a full SDK and software emulation of a standard WinCE 2.0 device, so developers need not actually have a device for testing. If an actual CE device is used for testing, the supplied remote debugger allows for full debugging on the PC across a serial link.

The Visual Basic 5.0 runtime for Windows CE forms part of the standard WinCE 2.0 distribution to OEMs and so should be available on WinCE devices in ROM.

Both kits are on the Microsoft Windows CE site. The Visual J++ toolkit is not yet available in beta, but advance orders are being taken on the site. For those of you without multi-megabit lines, be aware that the betas are on the order of 80 MB each.

www.microsoft.com/windowsce



IBM's VisualAge for Java extends existing server apps to the Web without rewriting from scratch.

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Bike
Sail
Chris
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Life is too short to spend rewriting code. VisualAge for Java** is the first enterprise-aware, incremental-compile development environment on the planet. It extends the 'write once/run anywhere' promise of Java to include 'Don't rewrite what's already there.' Instead, you visually program extensions to existing server data, transactions or apps – and VisualAge for Java generates the connectivity code to your Java clients. Seeing is believing. Visit www.software.ibm.com/ad/vaj7j, and see why the fastest way to the Web is also the fastest way to the beach. Call Vanessa Johnson today on 01705 498151 for more information on where you can purchase your copy.



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ENQUIRY NO. N6

Interpreting the data

I'm not one to brag, you understand, but I consider myself to be in pretty good shape. I exercise regularly, I drink to excess only on special occasions (birthdays, Christmas, Friday nights), and I only eat fried food in company. I also take regular medical checkups, and give blood in order to get the benefit of the tests they perform on the donations. So, I'm sure you can understand that, when I discovered I was poorly, I was a bit miffed, and when it turned out that what was wrong with me was caused by a problem which I had carried for several years, I felt somewhat let down.

The point of this piece is not to grumble about getting sick, it's to find out what went wrong – in medical parlance, it's the post-mortem. In retrospect, all the evidence was there, but nobody noticed. Example; when I went onto the bone marrow donation register, and they performed expensive tissue typing, one of the tests they should have done would have identified specifically what I had, but I now know that the test would have produced numbers so extreme they probably would have discounted the result. The condition also produces clear and characteristic physical changes, but nobody noticed those either because – well – I've always looked like that.

In the course of grumbling, I've discovered that many people have had similar experiences. Here is a person who when ill, asked for the test which would identify a condition which was a major part of the family history, but who was eventually dismissed as a hypochondriac. (It turned out to be the hereditary condition she suspected). Here is a whole battery of pregnant women who

know something is amiss with their babies, yet the tests show nothing, and in the long run, the mothers are right.

When I look at medicine, I see, above all else, expense. Here, for example, is what you or I would describe as a plastic bag, worth pennies. But to a doctor, it's a medical use filing facility, or Muff for short, and worth £5.62, plus the manager's time finding the cheapest supplier. But the biggest consumer of money is technology. Over the last thirty years, diagnostic equipment has mushroomed in complexity and expense. A radiologist now has to cope with ultrasound, PET and CAT scanners, and a whole pantry full of tracers and opacifiers. Gone are the days when a radiologist was actually an osteopath.

With the increasing cost and complexity of machinery, the operators become more specialised, better educated, and since machinery is left idle for as little time as possible, more utilised. Since they know more about the machinery, the operators know less about people. I reckon a typical vet probably knows more about human disease than a typical doctor (because vets tend to be generalists) and neither knows anything much about human health (which is what we're actually buying, after all).

Increasing technology has created a welter of new data, and the increasing specialisation has created a need for specialised interpreters of that data, specialist diagnosticians. Yet, there don't seem to be any.

Interpretation – what makes data mean something, and what turns abstract experiment into testable theory and useful model – is just not done, by anyone. Speed kills, we're told, so traffic

Babies do it, children do it, so why is it so hard for adults to make sense of the world around them? Jules tries to see the wood beyond the trees.

planners try to reduce the speed of traffic in populated areas. How come half the traffic calming measures increase accident rates? Because they work by making roads harder to understand, and less tolerant of driver error. A businessman asks 'Where are we, and how did we get here?', and is answered with ten pages of close-written figures. Some people can understand such tables, but I can't (I need pictures), and I suspect that, since he's asking the question, neither can the businessman. But I can't think of one accounting program which can produce pictures of key performance indicators interactively, and on demand.

Interpretation works two ways. As well as finding out what the data is telling us, it can also tell us what we need to know next. A television which is showing a poor picture may have something wrong with it, or it may have a poor antenna, or there may be something wrong with the video recorder. What's the first test to perform? It's not the cheapest (thumping the set is unlikely to yield useful information), nor is it the one which gives most information (sending the set back to the manufacturer for a thorough checkup will certainly identify any problems inside the set, but it's expensive and time-consuming, and may not improve the situation).

The irony is, even though little interpretation is done these

days, we know more about it now than we ever did. Expert systems built on *how* and *why* questions are effective when used by intelligent humans. Powerful statistical techniques such as factor analysis are available. Both of these are suitable for easy, general-purpose, computer implementation.

It is technology, and in particular the awesome information-handling capacity of computers, which has caused this information overload. Merely sifting through the incredible quantity of data which the modern world generates seems to be occupying most of our lives. While several people are working on filters which can throw data away, nobody seems to be thinking about interpretation in the wider context. Perhaps a general-purpose expert interpreter will be the next killer app.

In the absence of any interpretation technology, the raw quantity of data continues to expand. That extra data has to be paid for (in human resources and in advancing technology), yet it's pointless – unless a table of numbers can be made to mean something, there's no reason to buy it. What's most worrying is that, as my experience and the accident statistics show, too much data obscures the truths which they are supposed to illuminate. ■

01707 662698; jules@cix.co.uk; much better, thank you.



Borland (please) help

Dear Sir,

After reading Will Watt's editorial about Delphi help in September's EXE I felt I should share my experience of Borland's newest baby JBuilder.

Dave Jewell rated it very highly in his review (in the same issue) – fair enough – it's a very good development environment and the true two-way tools technology is *very* impressive, as is JBuilder's visual handling of AWT layouts. *But* the documentation is awful: it's scant – two thin manuals (user guide and programmers guide – not even the component library reference which is referred to in the documentation), one of which makes Borland's QA look like a bunch of monkeys. The sections of the programmer's guide which explain how to use the database components repeatedly refer to sample applications (such as `params.jpr`) which don't exist on the CD or as part of the installation – this is quite serious as there are very few code samples to back up what's stated in the text. Furthermore references are made to methods (such as `changeParameters`) which just don't exist (unless the class browser is telling porkies) – incidentally

`changeParameters()` is mentioned in the on-line docs, sadly not in the windows help files so no context sensitive help. Is Borland blindly following Microsoft's lead (with VC5's help) or does it really believe we'd be better off without help files and context sensitive help?

At least the user's guide was a source of amusement – check out the diagram of `BorderLayout` on page 7-12 – I guess Scotts Valley must exist in its own little spatial dimension (cue some Bill Gates/Microsoft jokes about redefining NSEW).

All in all the poor documentation supplied with



JBuilder mar an otherwise brilliant product which I feel should have been released over the web as beta version 0.9, not 1.0, as it's not fit for release as a finished product, particularly if you're using it to develop database apps. I got my copy from Borland who offer a 60-day return policy – unless the above maladies are rectified in an update/patch I can see myself sending the product back for a refund. Oh well, maybe JB 2.0 (or whatever) will be much better in the documentation dept...

John O'Connell

John.Oconnell@btinternet.com

I have a great deal of sympathy with your comments. My review of JBuilder was a review of beta code, and therefore an unfinished product. In general, when reviewing beta software, there is an implicit 'gentleman's agreement' that one does not draw attention to bugs and deficiencies that may well not be present in the final release. One can't always be as forthright as one would like, and you have to take on trust the vendor's promises that certain aspects of a particular product will be cleaned up in the 'shrink-wrap'.

The help system built into JBuilder is a case in point. Yes, it's all very clever that the help system is written in Java, but what's the result? As you rightly point, context-sensitive help goes out the window and we all have to suffer a help system that's far less accessible, slower,

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and more memory hungry than the native Windows equivalent. Since JBuilder itself will only run under Windows, I see little advantage to be gained from this approach. I'm all for writing portable code, but not at the expense of usability. Come back Delphi help – all is forgiven!

When reviewing the beta version of JBuilder, the end-user documentation didn't exist. The paucity of documentation only goes to compound the deficiencies with the help system.

My biggest disappointment was with the memory requirements and overall reliability of the IDE. The beta code did not like running on a 32 MB machine and was very buggy. The release code still doesn't like running in 32 MB (Borland recommends 48 MB) and again, I suspect that this is largely due to the mixed native-code/Java approach that's been taken in the implementation of JBuilder. More serious is the overall reliability of the IDE which still GPFs on my machine far more than I'd like to see in released code.

On the positive side, I would certainly agree with you that JBuilder is an excellent product, but I'd be strongly tempted to wait for JBuilder 1.1 before attempting to use it in anger. – Dave Jewell.

Borland UK, to which this letter was forwarded, promised a reply but none

has reached us so far. Lots of information, including a FAQ, is available at www.borland.com/devsupport/jbuilder/ – Ed.

The Java Lobby

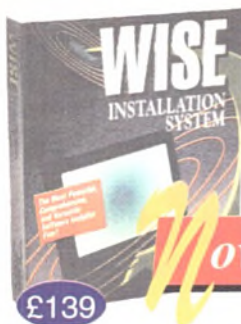
Dear Sir,

Your readers may be interested to know about the Java Lobby (at www.javalobby.org), which is a group of over 6000 members who believe that the voice of Java developers and users has been almost totally ignored in media coverage of Java. There is a great deal more dimension to the Java story than 'Sun vs Microsoft', and we believe that ultimately it is the support of developers that will define the success or failure of Java.

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Please visit our website and read our group's recent 'Open Letter to Bill Gates' in which we request that Microsoft fully implement Java in Windows and Internet Explorer. Thank you. Simon Springall
simon_springall@MENTORG.COM

If you agree with the principles of the Java Lobby and want to show your support, you can join it, free, on its Web site. – Ed.



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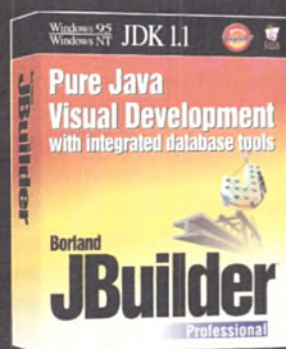
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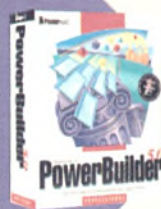
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Putting a stop to spam

From every corner of the Internet, spam is dropping in our email boxes. Peter Collinson decided to put an end to it, and describes how to tweak sendmail to limit the damage.

This summer I decided that I have had enough. I've been living with a constant dribble of spam for some time, but the dribble has become a torrent and up with it I will not put. I am supposing that you have occasionally raised your head from the terminal in the last two or three years, and understand that by spam I mean unsolicited commercial email, unwanted bulk email that pollutes your mailbox.

I guess that *hillside.co.uk* has been live in the DNS for ten years and my email address is old enough to be part of the legacy database that many of the compilers of email directories used to seed their service. Anyway, my email address seems to have found its way unerringly into the clutches of the spam merchants and things have progressed steadily from there.

When spam mail started, you were often given clues to the originator of the message and could send a polite message back asking to be removed from the list. I never engaged in retaliatory spam, but some folks did. I expect that the activity was cathartic. I don't suppose that sending a polite message ever did any good, but it also made you feel better.

If there was no working electronic address in the spam, then there was perhaps a fax number. You could fax back a message informing the originators of the errors of their ways. On a couple of occasions, this led to apologetic calls from the company involved saying that they would never do it again. I didn't believe them.

One company did call me to apologise although I had sent them around 30 faxed pages. They had sent me a four-line message and an address list. The address list was immense, the total file from the email message was around 50 megabytes. It was 72 A4 pages when sitting in my fax queue. They turned the fax machine off after 30 pages. This was a relief, as my point had been made and it was costing me money to keep on sending the pages.

I became deeply annoyed with another company, which was actually mailbombing me. I finally sent them a message, something along the lines of 'Please stop sending me unsolicited email I make a point

of never buying anything from companies that use these means'. Quite polite. But I faxed it one word per page in a large font. I never got past page 5. The mailbombing stopped, so the fax had an effect.

I slowly became bored with my life as a fax terrorist. Spam became so frequent that I stopped looking at it. There was a period when people ended their messages with an exhortation to send a reply so they would 'remove you from the list'. I was never really taken in by those claims and just got into the habit of looking at the first line and deleting the mail. *[This was probably as well since some spammers use any replies they get to validate email addresses as being live! - Ed.]*

The final straw this summer was the bit of email that attempted to sell me replacement windows. Our house was built just after the war and is graced with its original galvanised windows complete with brass handles. We get two unsolicited phone calls per week trying to sell us windows, and now there was someone from the USA trying to do the same.

The origin of the problem

People sending spam mail have a problem. They need to hide their identities. Otherwise, as we've seen, a proportion of their targets will send a message back asking for removal, and some people will mailbomb them back. Of course, setting the machine name is trivially easy on a PC system, you just type it into the box and the mail program believes it. At the moment, a proportion of spam mail originates from addresses that don't exist like *hello@32011.com*.

The spammers' next problem is covering their tracks. You may not realise that every time a piece of mail passes through a machine that machine adds a header to the start of the message. These headers are often suppressed by mail reading programs, but are exactly the information that is needed to trace the path of the message. Here's some mail that came in to me as I was writing this article. Since I've complained politely to the sites used by this mail, I've obliterated the real names and addresses in italics:



Illustration: Jonny Mendelsson

Received: from somewebsite.ca ([legal IP address])
by craggy.hillside.co.uk (8.8.7/8.8.6) with ESMTP
id DAA07411 for <pc@hillside.co.uk>;
Sun, 14 Sep 1997 03:58:10 +0100 (BST)
Received: from hotmail.com (Cust124.isp.in.the.us.net
[legal IP address]) by somewebsite.ca (8.8.5/8.7.3)
with SMTP id SAA29477;
Sat, 13 Sep 1997 18:55:54 -0400 (EDT)

Received: from hotmail.com (hotmail.com
[000.000.000.000]) by hotmail.com (0.0.0./0.0.0.)
with SMTP id AAA000000 for
<verysexygirls4u@hotmail.com>;
Tue, 20 May 1997 15:57:22 -0500 (EST)
From: verysexygirls4u@hotmail.com
Date: Sat, 13 Sep 1997 18:55:54 -0400 (EDT)
To: verysexygirls4u@hotmail.com

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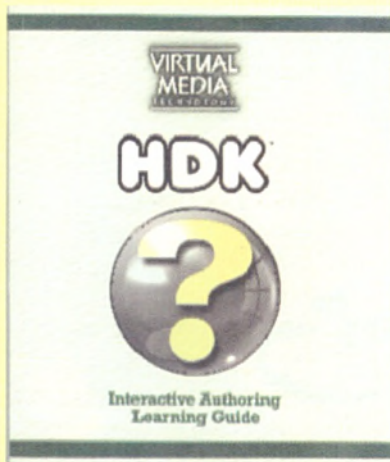


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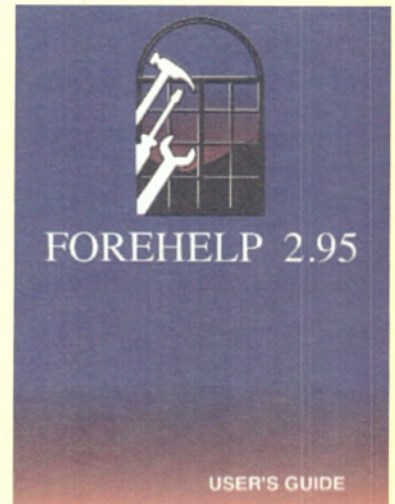
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Fax: 01203 411 727
E-mail: sales@oxfordcc.co.uk

If you saw this message in your mailbox, (and you may well have done), without seeing this header, you would perhaps think that some user at *hotmail.com* is sending you spam mail. If you don't know, *hotmail.com* provides free email accounts so your conclusion might have some basis in reality. You may send angry mail to their problem email address *abuse@hotmail.com*. But you would do so in error, unless you looked carefully at the message header. There are three *Received* lines added in reverse order, so let's start with the bottom one. This looks bogus to me, I'll guess it was in the message when it was sent out.

The next line up is the one of interest. It's added by some unsuspecting relay site in Canada saying that the mail came from *hotmail.com*, which is what the sending machine claimed to be. It also prints the reverse lookup of the actual IP address that was sending the mail. This was a dial-up customer of *isp.in.the.us.net*. The PC doing the sending had connected to the US site on the phone, and had then made a direct connection to the mail system in Canada. The Canadian system is prepared to relay and send it on. The first *Received* line is added by my machine.

Now I cannot trace the originator of this message, but *isp.in.the.us.net* can and may take steps to stop it happening again. I suspect that *hotmail.com* would be interested that someone is forging their identity and also the Canadian site may be interested that someone is using its resources. All of these people will need to see the mail header to prove to themselves what has happened.

SMTP

The root of the problem is the SMTP mail protocol between the client and the server. The client sends command lines and the server responds with command codes (I talked about the construction of Internet Protocols in my article *Designing a network protocol* (EXE, September 1996). Two commands in SMTP are of interest, the first one:

```
MAIL From:<sender@address>
```

gives the originator of the message and is set in the example above to *verysexygirls4u@hotmail.com*. The receiving machine has no idea whether this information is correct. Actually, when SMTP was first implemented, it generally ran in an environment where the sending agent was trusted to be saying the correct things. Mail systems were run with super-user privilege and would always send the 'correct' information. In fact, many security problems on the Internet stem from the original underlying assumption that the communication was being done from a level in operating system that could be trusted. The basis for this assumption disappeared when the PC came along. Actually, I guess I would contend (in hindsight) that the thinking was flawed in the first place.

The second SMTP command of interest is:

```
RCPT To:<rcpt@address>
```

specifying the address that the mail is to be sent to. There can be many instances of this command, so our forger above probably made one connection to the unsuspecting relay to send the message to many different people.

All the spammer now needs to do is to collect email addresses creating a list of recipients. Well, quite a high proportion of spam

mail is from people selling email address collection software. Among other places, the software scans Usenet news mailings for email addresses; it also scans the Web, presumably for *mailto* commands. All this is not terribly sophisticated, sellers of spam mail software talk about 'targeted lists', but I don't think that this is a reality judging by the amount of US specific spam I receive on my .uk mail address.

Solutions are actually hard, the aim of the spam mailer is to send a message that is indistinguishable from any regular person-to-person mail and in fact, creating such mail is easy.

Some spam mail emanates from companies that are selling the ability to send bulk unsolicited mail. These companies have their own machines and range of IP addresses. Some people are simply blocking access from these IP addresses to their site at the IP level by putting filters into the routers. Of course, they have to keep monitoring the various registration bodies to check whether the spammers have new addresses.

If you run a mail system, then you should almost certainly refuse to relay mail for third parties. Most Unix based mail systems will relay mail by default. This is not a bug, but derives from the history of networked email. When I started the UUCP network in the UK, everyone in the world relied on everyone else to relay mail. This was the way it all worked. Mail from the UK destined for remote parts was copied and passed from machine to machine until it ended up in someone's mailbox. One of the features of the early mail system at UKC was the ability to translate from a domain name to a route through the world UUCP network. The ability to relay has persisted into the days of SMTP by default. It's not needed now because each machine connects directly to the recipient's machine using the DNS to supply an address.

Relaying is being exploited by the spammers and many sites are now turning it off, and only relaying mail for known internal addresses. Actually, there was an article in the Guardian recently bemoaning this loss because if relay is not open to all, then you cannot inject mail into the Internet at some unspecified point, your mail will be rejected.

There is a lot of work going on with the folks that develop mail systems to provide hooks that can check aspects of the mail transmission. If you run a Unix system, then you are quite likely to be running *sendmail*. The most recent releases of *sendmail* have developed some hooks that you can use to check for characteristics of spam mail and refuse to accept it. These hooks, for example, allow you to control mail relaying, only permitting it for machines on your site.

If you are running a system that has a vanilla version of *sendmail* 'as distributed by the manufacturer', then you should probably replace it by a more recent version anyway. *Sendmail* has been the target of many hackers and has been updated several times to patch security holes.

Installing sendmail

Installing the new version of *sendmail* is actually quite easy. The release of *Sendmail* comes with a great many Makefiles aimed at allowing you to create a drop-in binary that will replace the existing *sendmail*. It can use the current control file (usually */etc/sendmail.cf*) and also the existing alias files.

So, these days on my Solaris and BSD/OS systems, I type *make-sendmail* and the script works out what operating system and machine I am using, picks the correct Makefile and generates a



binary that will run on the appropriate system. The binaries are made in their own directories, so the same source can be NFS mounted and used to make the executable for different systems.

Although you can use the extant `sendmail.cf` file that sits on your machine, my advice is to buy into the generation mechanism that Eric Allman has created for the new versions of `sendmail`. This allows you to generate the complex `sendmail.cf` file from a control file containing very few lines. The control file is run through the standard Unix macroprocessor, `m4` to generate the needed `sendmail.cf` file.

To create a simple setup, there are only four lines that are needed to generate the `sendmail.cf` file. You will find these files in `cf/cf` on the `sendmail` distribution, look also at `cf/README`. Here's the standard contents for a Solaris machine, in `cf/cf/generic-solaris2.mc`, you'll see:

```
OSTYPE(solaris2)dnl
DOMAIN(generic)dnl
MAILER(local)dnl
MAILER(smtp)dnl
```

Actually, there's a bunch of comments above these four lines, so the file is a little longer. The lines are all calls to `m4` macro definitions, and the `dnl` at the end of the lines is an `m4` nicety (Delete to New Line) that ensures that the newline characters are not passed into the output file.

The first line specifies the operating system type and pulls in several definitions that control the placing of several ancillary files. The second line pulls in some general settings, the idea here is that should you wish to have several machines then you can create your own localised domain definition. The generic one is fine for me. The last two lines define the types of mail interface that can be used: `local` does the local mail delivery and `smtp` handles outbound SMTP mail.

You create the `cf` file by using `make`. The default `Makefile` is for the Berkeley 4.4BSD version of `make` and will not work with the standard `make` command on Solaris, so you need to use the alternative file, type:

```
make -f Makefile.dist generic-solaris2.cf
```

The `Makefile.dist` command file knows how to make a `cf` file from an `mc` file. Once you have the `cf` file, you can install it in the correct place and off you go.

The basic file will probably not be good enough for your system and you may want to make several additions. Mostly these can be done by adding new standard statements. Here are two examples. First, the `hillside.mc` file for my main mailhost machine reads:

```
OSTYPE(solaris2)dnl
DOMAIN(generic)dnl

MASQUERADE_AS('hillside.co.uk')dnl
EXPOSED_USER('postmaster hostmaster webmaster')dnl

MAILER(local)dnl
MAILER(smtp)dnl
```

The `MASQUERADE_AS` feature adds statements into the `sendmail.cf` file that stamps all outgoing mail as coming from

`hillside.co.uk` and not the fully qualified machine name of the system that is my mail hub. The `EXPOSED_USER` feature ignores the name rewriting rules for these users, so if automatic systems complain then you can tell which machine on your network sent those complaints. Incidentally, to receive mail as your main domain name, you need to add that name to the `sendmail.cw` file.

On my slave machines, I want to pass all mail to my mailhub for relaying so their `.mc` files also have the line:

```
define('SMART_HOST',
craggy.hillside.co.uk)dnl
```

added before the `MASQUERADE_AS` line. This feature passes all outbound mail to my mail hub for further processing. There are a great many standard features that you can add into the `.mc` files. You can add 'raw sendmail language'. You'll find that this is how the various anti-spam features for the Sendmail 8 release are being distributed at the moment. Eric Allman intends to release some standard anti-spam features with release 8.9 of `sendmail`.

Sendmail anti-spam measures

Allman has an experimental set of anti-spam measures on his Web site. There's also an extensive set of measures for the new `sendmail` written by Claus Assmann from the University of Kiel in Germany. The URLs are listed below.

Currently, I've only used a couple of Allman's hacks. First, I've prevented mail relaying via my site except for internal machines. This works by looking up the IP address of the machine that is calling to send mail and translating that to a name. If the name does not appear in a file that contains a list of allowable names, then relaying is denied.

Second, I am insisting that the mail address in the SMTP `MAIL FROM:` command contains a valid address. This is done by looking up the site in the DNS and declining to deal with the mail if the name is not registered. Since there may be a temporary failure for this lookup, a temporary failure message is sent meaning that the sender will retry. The logs show that this measure has inhibited several bits of spam mail from being delivered to my machine.

If the address appears to exist in the DNS, then it is sought in a table of known originating spam sites and rejected if the site is known. The intention is to build up a list of spam sites and ignore them. I suspect that this action is of little use, since the names of spam sites seem to change rapidly and freelance forgers tend to use an original bogus source address for a single piece of mail. Claus Assmann's hacks are very extensive in this area, they allow you to stop mail from sites and also from known users.

I've talked about `sendmail` changes largely because that's the mail delivery system that I use, but there are several pointers to anti-spam measures for other mail systems on Scott Hazen Mueller's site. Several people have generated systems that scan each bit of mail that you receive. The scripts use regular expressions to look for known keywords that exist in Spam mail so that the mail can be discarded or moved to some junk mailbox. Someone has implemented this type of system for `sendmail` itself.

Is there a permanent fix?

Well, in the long run, there appears to be no real automatic solution that can be applied on the machine receiving the mail. I think that we all have to campaign to ensure that free relaying is stopped on the



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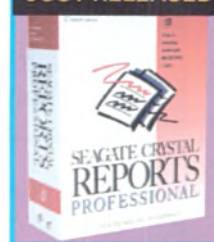
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Internet. I've started to inform innocent relayers of spam mail that their machines are being used for this activity. Many ISPs are engaged in implementing relay inhibition measures.

However, I suspect that all the current anti-spam solutions are simply temporary fixes. In the end, spam mail will become indistinguishable from mail that you actually want to see. I spent some time discussing this with Allman this summer and whenever I came up with a 'characteristic' of spam mail, he could counter with a scenario where that feature would happen in the normal course of events.

For me, the frustration is caused by my inability to stop the deluge and there seems to be some light at the end of this tunnel. Some of the original perpetrators of spam mail have realised that they need to clean up their act and provide people with a way of removing their email addresses from the central lists. Spam mail from these companies now advertises the web site in the mail header of their mail. The front page of the Web site says: 'IEMMC was formed in May of 1997 as a trade association dedicated to promoting the responsible and ethical use of direct email as a marketing tool on the Internet'.

The Web site contains a form that allows you to register your email address for what is termed the 'Global Mail Filter' and you are told that you should never receive unsolicited mail from a participating member again. The registration process is a two stage one, you supply your email address and are then sent mail with a magic number. You then have to go to another page to supply the email address and the magic number to ensure that your address is

removed. The Web site is slow and can time out, returning empty documents. If you persist, you do eventually get through the sequence of operations. I've entered three addresses from my site and had to spend a lot of time re-transmitting pages. However, since I supplied my email address, it does seem to have worked, I have not seen junk email from these folks since.



Where to go, what to get

If you want the definitive book on sendmail, then you need *sendmail* (ISBN 1-56592-222-0), by Brian Costales with Eric Allman. It's in its second edition, published by O'Reilly & Associates. This book is perhaps not for mortals, but is certainly required reading for system administrators. However, you don't need this book to create .mc files, the sendmail distribution has several README files that should not be ignored.

Allman's own sendmail site is <http://www.sendmail.org> and contains pointers to all the other sites I've mentioned (and the source distribution of sendmail itself). Claus Assmann's site is <http://www.informatik.uni-kiel.de/%7Eca/email/english.html>. Scott Hazen Mueller's site is <http://spam.abuse.net>. The Web site for IEMMC is <http://www.iemmc.org>.

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

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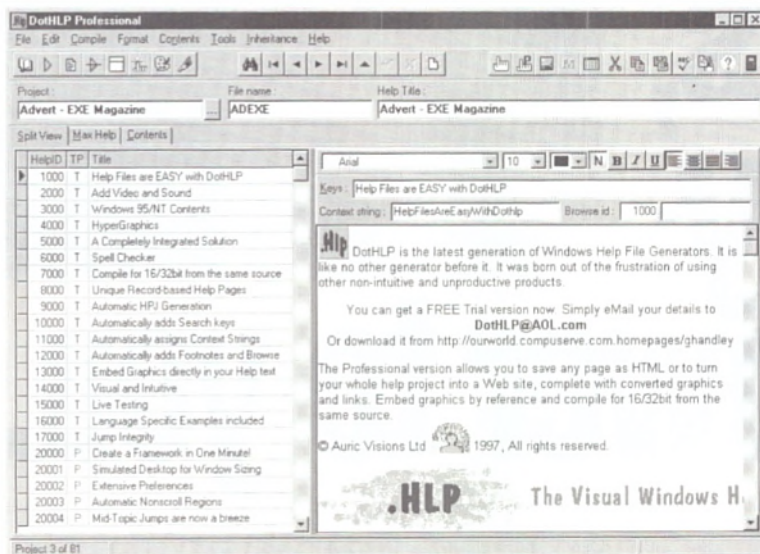
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A lovely bunch of identifiers

Dynamic binding lets one use methods and properties of objects, without having to know in advance whether or not they have them, a very useful feature. With static binding, one will generally retrieve members of an object through a fixed offset. For example, if one creates an object in C++ and reads from one of its public members, one will do so by reading from a fixed offset from the start of the object data. It is known at (static) compile time that the object supports this member and that it is located at a specific offset. However we cannot read from a fixed offset if it is not known whether the object has a member; instead, we must bind to the member dynamically.

In order to bind to something dynamically, we need an identifier with which to represent the thing that we want. This identifier must be different to the identifiers for all the other things we might ask for. The object we are requesting something from needs to use this identifier to find what we want and give it to us.

Dynamic binding is usually done by individual members or by interfaces. When binding is done by individual members, the client requests members one at a time. When binding is done by interfaces, the client requests a pointer to a structure (the interface) with pointers to other members at known offsets. Binding by member is the most common approach in Visual Basic. Binding by interface is the most common approach in Java.

Getting an interface

One popular standard for dynamically binding to interfaces is Microsoft's COM. COM identifiers interface using a Universally Unique Identifier or UUID. To get a pointer to an interface, one calls the `QueryInterface` method of the `IUnknown` interface of the object one is interested in. This will generally be implemented by compar-

Robert Ennals continues his series on dynamic optimisation, by looking at ways to reduce the overhead of dynamic binding.

ing the requested interface ID against the IDs of those interfaces it supports in turn. An example of a common implementation of `QueryInterface` is given in Listing 1.

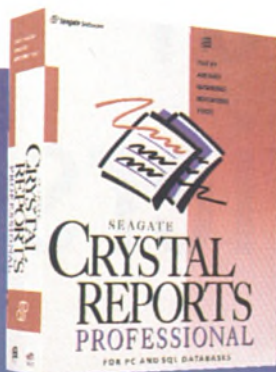
Although this function will not have to compare the whole of a UUID in order to verify that it is not the correct one, it will still have to check part of each wrong UUID and the whole of the correct UUID. A problem is that there will need to be a branch attached to each of these possible UUIDs. If several different UUIDs are commonly requested then on many processors this will lead to mispredicted jumps. While the overhead of such a `QueryInterface` call is not great, if an interface is requested very frequently and something very simple is done with it then this overhead may be significant.

If identifiers were small and bunched together then interfaces could be retrieved by offset in a table instead. Objects would place NULL in the table when the interface is not supported and a valid pointer when the interface is supported. Doing this would reduce the overhead of finding an interface to a single level of indirection.

Long bunched identifiers cannot be used as offsets in a table as they could point to anywhere in the range of the data type. If UUIDs were used as the offsets into a table of pointers, the table would have

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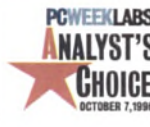
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```

HRESULT QueryInterface(REFIID riid, LPVOID FAR* ppvObj)
{
    if((riid == IID_THING_A)
    {
        *ppvObj = m_ithinga;
    }
    elseif(riid == IID_THING_B)
    {
        *ppvObj = m_ithingb;
    }
    // other interfaces omitted
    else
    {
        // we don't have it
        *ppvObj = NULL;
        return (HRESULT)E_NOINTERFACE;
    }

    // was one of our interfaces

    AddRef();
    return S_OK;
};

```

Note that if the COM object is implemented using C++'s multiple inheritance (as is often the case) then m_thingX will be a pointer to the object itself, precast to the required base class.

Listing 1 – A common way of implementing the COM QueryInterface method (C++ code).

to be the size of an entire 128-bit address space which would take up a 26-digit number of terabytes. Listings 2.1 and 2.2 show the difference between long sparsely distributed identifiers and short bunched identifiers.

Generally, one will only be working with a very small set of identifiers. For example, when dealing with interfaces on ActiveX controls, there are only a few interfaces that controls on any machine will support and that are queried for.

Also, querying for a small subset of common interfaces is likely to take up most of the time. Even if it was thought that there were too many interfaces for it to be sensible to put them all in a table, putting the most commonly requested ones in a table could cause a major speed up.

So in order to get the maximum speed, we need a way to map large, sparsely distributed unique identifiers recognised external to the machine, into small bunched offsets recognised only in the machine in which they are created. And for each object to provide a table containing appropriate interface pointers at these offsets.

Dynamic optimisation lets us do this. A dynamic optimiser can set the system up such that by default all interfaces are obtained via the QueryInterface method, but specially selected interfaces that seem to be requested frequently are given low id numbers. The optimiser will then proceed to replace selected QueryInterface calls for that interface with retrieval by offset from a table attached to each object. This table can be the same table used by the objects themselves to find interfaces to return from QueryInterface.

A balance needs to be struck between putting too few interface pointers in the table (and not getting a benefit) and putting too many interface pointers in the table (and wasting memory). Decisions as to what to put in the table can be made based on the results of dynamic profiling. It is possible to have some interface pointers in tables for



some objects, but not for others. One way to do this is to guarantee that an object has certain interfaces in a table if it supports certain other interfaces. As interfaces tend to go together in groups, the method works quite well.

A method might accept objects via one interface and then know from the fact that this interface is supported that another interface it wants will be supported as well. It might also retrieve one interface via QueryInterface and conclude from the fact that that interface is supported that certain other interfaces it needs will be at known offsets in the table. Listing 3 gives an example of this. Note that the requirement to have a pointer to the interface in the table does not require the object to implement the interface as the pointer may be NULL.

Unfortunately this system breaks down if an object supports two interfaces that require it to have different other interfaces at the same table offset. The dynamic optimiser must catch the definition of objects which break its current rules and reorganise the identifier bunching accordingly. See Listing 4 for an example of a progression the table offset allocation might go through. Note that string based identifiers can be replaced in the same way as UUIDs can.

When offsets need to be reallocated the overhead will be quite high. All code known to be optimised to use offsets for reallocated interfaces must be regenerated to use a different offset or a function call. Luckily, new classes are rarely introduced to the system while it is running so this overhead should not be significant.

Another way to speed up working with multiple interfaces is to

merge interfaces that always go together into one interface. For example, if all classes in the system that support interface X also support interface Y then the optimiser may merge them into one interface so that code which needs to use both interfaces need only query for one of them. This optimisation can be used less frequently than the table offset method, but yields a greater speed up when it is implemented.

Shrinking interfaces

Having a fast way to retrieve interfaces is very useful. It is generally agreed that interfaces should be as small as possible, focusing on one specific task. Inter-

```

DEFINE_GUID(IID_IPropertyNotifySink,
    0x9BFBBC02, 0xEFF1, 0x101A, 0x84, 0xED, 0x00, 0xAA,
    0x00, 0x34, 0x1D, 0x07);
DEFINE_GUID(IID_ISimpleFrameSite,
    0x742B0E01, 0x14E6, 0x101B, 0x91, 0x4E, 0x00, 0xAA,
    0x00, 0x30, 0x0C, 0xAB);
DEFINE_GUID(IID_IPersistStreamInit,
    0x7FD52380, 0x4E07, 0x101B, 0xAE, 0x2D, 0x08, 0x00,
    0x2B, 0x2E, 0xC7, 0x13);
DEFINE_GUID(IID_IPersistPropertyBag,
    0x37D84F60, 0x42CB, 0x11CE, 0x81, 0x35, 0x00, 0xAA,
    0x00, 0x4B, 0xB8, 0x51);

```

Listing 2.1 – Unbunched UUID identifiers (taken from the OLE header file oleclid.h). These cannot be used as offsets in a table.

```

1 : IPropertyNotifySink
2 : ISimpleFrameSite
3 : IPersistStreamInit
4 : IPersistPropertyBag

```

Listing 2.2 – Bunched identifiers which can be used as offsets in a table.


```

void thingy(ISuperCool thingy)
{
    /*
     we know from it's type that thingy supports
     ISuperCool. The dynamic optimiser gurantees it must
     then have IAlsoCool at offset 1 in it's table
     */

    IAlsoCool acool = thingy;
    // interface retrieved by offset

    /*
     INotSoCool is not guaranteed to be in the table when
     ISuperCool or IAlsoCool are implemented, so we must
     retrieve it by looking
     at the supported interfaces
     */

    INotSoCool nscool = thingy;
    // implemented by inspecting the object
};

```

Listing 3 – Making assumptions about what interfaces are available in a table.

faces containing only one method are seen as being good style. Any interface containing more than ten methods is seen as being seriously bloated.

Unfortunately, this isn't the way many interfaces are designed. Take for example many of the standard COM interfaces. Microsoft admits that they are too big and too general. Many standard OLE interfaces have methods which can be optionally implemented. For these methods, the implementer is allowed to return an error code to signify that the method is not implemented.

One of the reasons for these interfaces being too big is worries about the overhead of requesting many small interfaces. If this overhead could be dynamically optimised away then it would encourage people to write smaller interfaces. Designers can be freed from concerns over performance and concentrate only on producing a clean solution.

This kind of runtime binding to items is not limited to objects. It can be useful for many other things as well, particularly binding to members items of objects in dynamically typed languages. Dynamically typed languages such as Visual Basic frequently spend more time finding things that actually using them.

Tracking a moving target

One tricky area with dynamic optimisation is code changing size. Often, when code is altered through dynamic optimisation it will change size. If there is more code directly after the memory location of the changed function, and the changed function has increased in size, then the following function will have to be moved in order to make room. This then has a knock on effect on code that jumps to this code as pointers to it will have to be updated to reflect the new position.

In order to keep the overhead of moving code around to a minimum, it can be helpful to have gaps in the address space for code to expand into. The size of these gaps should vary according to the optimiser's guesses about how the size of the code that will expand into these gaps will vary.

If the code is optimised to make it too big for the available gap, the optimiser can either choose to keep the beginning of the changed code in the same place and move the following code up a bit, or it can move the changed code to a completely new location and leave the previous location as a hole for other code to expand into.

Leave the optimisation to us

Although dynamic optimisers use self-modifying code themselves, they find it very hard to optimise programs which use self-modifying code. This is because when a program modifies itself unpredictably it is very hard to keep track of what code depends on what. Also if a program wants to modify itself, it needs to know exactly how it looks in memory, thus any code which can be self-modified cannot be changed by the dynamic optimiser.

As a result, unless your self-modifying code is as cunning as the best dynamic optimiser and you have versions for every available CPU variation, you will actually slow your software down by using self-modifying code. You may even cause your code to not work.

In order for code to be easily dynamically optimised, it needs to be as high-level as possible so that the optimiser can easily track dependencies and see what is going on. Although self-modifying code has huge benefits, it is best left to the optimiser and kept out of your own programs.

Implementing it

Dynamic optimisation is currently quite rare. Timid optimisations (where code does not need to be constantly changed in order to work) are more common than fierce optimisations (where code does need to be changed) as it is easier to implement. However even timid optimisation is rare.

Simple forms of dynamic optimisation have been used in implementations of Smalltalk and Lisp compilers, and GNU C. More advanced dynamic optimisation has been used in several experimental compilers.

Dynamic optimisation works best when used together with dynamic compilation. If the program is provided to the user in static binary form then there is little hope of dynamically optimising it as machine code tends to be too low-level.

Compiler vendors tend to be wary of using dynamic compilation in static compilers as dynamically optimised code often breaks or goes very slowly on processors it has not been designed for. I remember a few

years ago when the MC68060 was released and it was discovered that a well-respected compiler that used a statically compiled dynamic optimisation produced code that failed on the new CPU. A patcher program had to be developed that checked programs for this trick and undid the optimisation when they were loaded.

With dynamic compilation, the program is provided in an intermediate form which is then compiled to target the user's hardware. Targeting the correct hardware directly allows code to be generated that is known to work with the user's processor.

Although at the time of writing I know of no dynamic optimisers for it, Java would be a very good language to dynamically optimise. The performance gain would be significant. Java bytecode is high-level enough for it to be possible to trace dependencies. It cannot contain self-modifying code which would break the optimiser. Its lack of pointers, and its specific instructions for method invocation allow us to easily trace what is calling what and what is changing what. Its lack of an address space allows us to move things around and maintain links to



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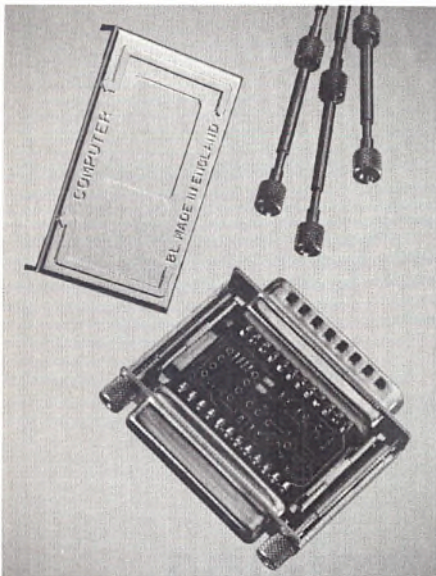
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```
class A implements X, Y
class B implements X, Z
class C implements X, Y, Z
> Y and Z go with X, put Y and Z at offsets 1, and 2 when X is implemented.
class D implements P, R
class E implements P, Q
class F implements P, Q, R
> Q and R go with X, put Q and R at offsets 1 and 2 when P is implemented.
class G implements P, X, Q, Y
> offset clash between Q and Y. Implementation of P and X implies that
  both are at offset 1. Reorganise offset map to rectify problem.
```

Listing 4 – Progression in allocating offset ids. The '>' symbol indicates a conclusion the optimiser makes as a result of defined classes and usage of them.

things without disturbing the program. All methods are virtual, and so dynamic inlining can be used to great effect. All objects are allocated from the heap and one can gain speed increases by optimising some objects into their parents. Its intense use of interfaces allows it to benefit significantly from dynamic interface table generation.

Add to this the fact that dynamic compilation allows the optimiser to be far more processor specific that a static compiler can be and it is likely that a dynamic optimiser for Java would be able to produce code significantly faster than compiled C. Throw that at the next person who tells you Java is a slow interpreted language that will never be suitable for anything beyond a web page!

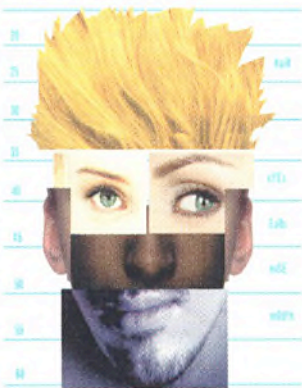
Java already has a form of dynamic optimisation in the interpreter (see the 'quick' bytecode variants) and I would be surprised if dynamic optimisers for Java compilation do not appear soon.

Logical abstraction != physical abstraction

The main benefit of dynamic optimisation is that it can optimise away layers of abstraction. One can write programs that take advantage of the extensibility and maintainability of a logical abstraction without suffering the performance overhead of a corresponding physical abstraction. For example, one can gain the logical advantages of a virtual method call without the physical disadvantages of generating code for one when it is not needed. Or one can gain the logical advantages of runtime

binding while still having the speed of fixed offset indirection.

All the optimisations described in this series are used to remove the overhead of having a layer of abstraction while still allowing that abstraction to function logically. Theoretically it should be possible, using dynamic optimisation, to make any high-level program run just as fast as the equivalent program written with less abstraction. It is common



knowledge that the simplest operating systems with the fewest levels of abstraction are the fastest. Dynamic optimisation will allow us to produce operating systems with all the layers of abstraction we could want, while still being just as fast as the operating systems that let you 'hit the hardware'.

It seems ironic that self-modifying code, a technique long criticised as being very bad style and best avoided

may provoke programmers into writing clean, easily maintainable code with many layers of abstraction.

Note however that none of the methods described in this series can solve the problem of a poor algorithm. These optimisations cannot reduce the complexity of an algorithm. They can only reduce the constant factor of operational overhead. ■

Robert Ennals is researching dynamic optimisation. He can be reached by email via the forwarding address ennals@iname.com which should follow him around when his real email address changes. He can also be reached by post at 19 Belgrave Road, Hampton, Middx, TW12 2AZ.

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NOVEMBER NEWS

DevPartner Studio SmartDebugging tools from NuMega, made for MS Visual Studio developers to include NuMega best-sellers: BoundsChecker Visual C++ Edition; CodeReview, SmartCheck and FailSafe for Visual Basic; Softlock for Windows NT and 95. All these would cost around £200 separately - the DevPartner Studio costs £735. There is also an array of SmartDebugging tools for Visual J++ in the pipeline. You'll receive these automatically and for free if you purchase SmartSubscription. Check out NuMega's SmartDebugging White Paper at www.numega.com.

QBS Software News, Volume 7 Issue 2. Out this month. The 100 page full-colour software developers' catalogue. Contact us for your free copy.

SoftDev/WebDev 1997. 12-13 November, Olympia 2, London. We'll be there - stand 250 - with our partners for the show WallData (demonstrating Arpeggio live!) and Visual Components (demonstrating dbComplete). Tickets? Please call 0181 240 5042.

Crystal Reports v 6. Latest version of the industry-leading report writer. New web components provide advanced web reporting capabilities. Smart Preview #1: Smart Navigation™ allows drill down and search in runtime reports. Smart Preview #2: Event & Callback support allows interactive user response. Automation Server has over 500 properties, methods, events. Active data driver: integration within VB, reporting off runtime data. Many more superb new and existing features.

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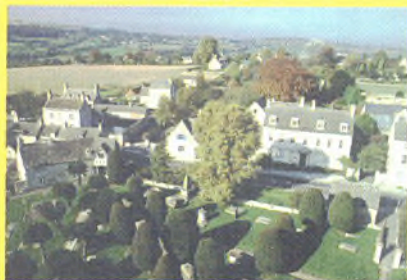
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Sometimes you're not happy with the final painting or want some slight variation, the easiest is to go back to the sketches. That is if you still know where they are. Philip Harris checks out Versions 2.0, a low-cost version control system, and finds it's a whole lot better than a white-board for keeping track of changes you or other developers in your team make.

Work in progress

A version control system can be one of the most valuable components in a developer's toolkit. Saving time and money the first time the need arise to go back to a previous version of the software and letting him manage team projects far more effectively.

If you've not come across version control before the concept is simple. The software maintains a database containing the various parts of your project; specifications, designs, source files etc. Whenever a programmer or other user wants to modify a file they check it out of the version control database, make the changes, and check it back in. The new version is added to the database but older versions are not deleted. This lets you go back to a previous version of a file if you find that the changes you made are not required. In most cases, when a file is checked in the program compares the new version with the one currently in its database and stores only the changes.

When a file is checked in, users are allowed to add a description of the changes they've made. This lets other people working on the project quickly see what has changed and makes it easier to see what version to revert to at a later date. Most version control programs let you view the differences between two versions of a file line by line. So if you know that the file save facility was broken by the last change Bob made you can quickly check to see what he changed and fix it.

If you're a lone developer, a version control system can be useful if you need to go back to an older version of the software but if you're working in a team with other developers, testers and documentation authors, version control becomes essential. A version control system

will usually prevent more than one user from editing a file at the same time, so making sure that you don't get any clashes when you come to check changed files back in. Without a version control system you'd need to be pretty handy with a white-board to keep a multi-developer project running smoothly.

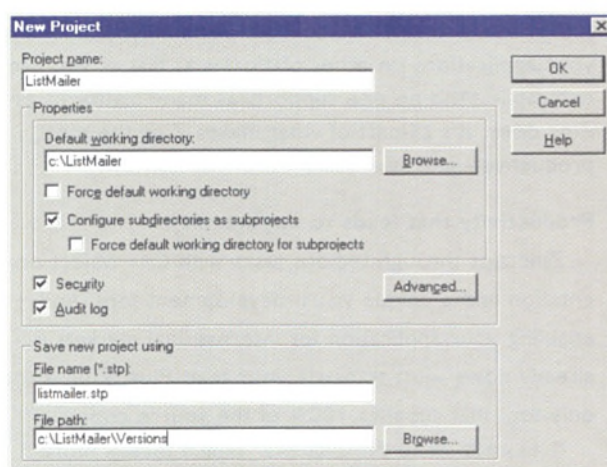


Figure 1 – Each Versions project has its own set of configuration options.

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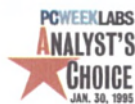
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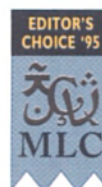


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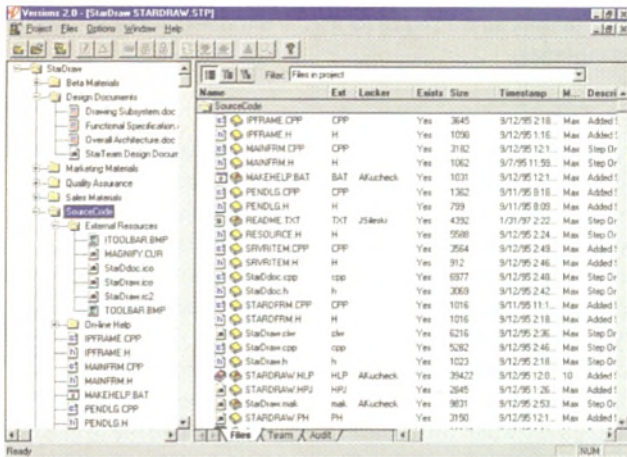


Figure 2 – Versions uses the familiar 'Explorer' style interface.

Back to basics

Versions, from US-based StarBase, is aimed firmly at the bottom end of the version control market. At £75 it's well below the price of the likes of SourceSafe and PVCS and cheap enough for a lone developer to justify. Despite the low price, Versions still aims to provide all the version control features a small development team will need.

The program is supplied on CD-ROM and a full installation, including a sample and files for integration with Visual C++ and Visual Basic development environments, takes around 15 MB. Like most of today's Windows developer tools Versions is only available for Windows 95 and NT. Installation is quick and easy although I initially had a problem with the program claiming that the Jet database files were in use. This gave me a chance to try out StarBase technical support and the problem was solved overnight (it turned out to be a clash with some virus scanning software). As well as the CD-ROM, the package includes a user guide which gives detailed step-by-step information on the various aspects of the program and a second booklet which



explains how to use Versions from within Developer Studio and Visual Basic. The documentation is reasonable and StarBase has included the manual in PDF form as well as the actual printed version and a help file. The help file contains much the same information but is not particularly well indexed. It's easier to flick through the manual to find the information you need.

If you've used version control software in the past, the first thing you'll notice about Versions is that it doesn't use a large central database to store the data files for all your projects. Instead each project is given its own file and associated data directory. Projects can contain sub-projects though so you can keep related information nicely organised. For example, the sample project includes sub-projects for Design Documents, Sales Materials, Source Code, User Manual etc. The advantage of this technique is that it goes some way to avoiding the Achilles heel of version control programs, namely that the version information for all the projects is held in a single database. One trashed file can take out whole chunks of your project. With Versions' project-file approach, damage is more likely to be limited to a single project.

There are two steps to creating a project. First, you fill in a dialog with information about the project, including the project name, where the project file will be stored and the default working directory (See Figure 1). This default working directory is where files will be put when a user checks them out although they can override this setting if they wish. The second stage is to create the first user for your project. Users are defined on a per project basis so if you have several projects you'll need to make sure you give them consistent names to avoid confusion. The first user you create in a project is deemed the admin-

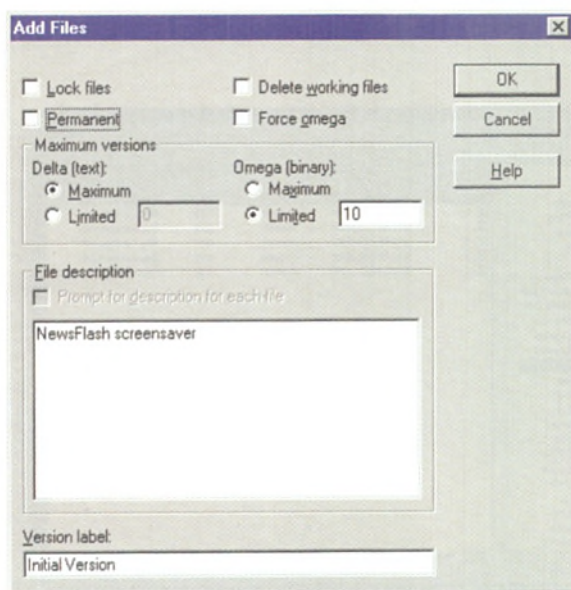


Figure 3 – Each file in a project also has its own settings.



istrator and is, by default, the only user allowed to perform some of the more serious project maintenance, such as deleting files. You can give other users administrator status at a later stage.

Once you've added your administrator user, the project window opens. This window uses an Explorer style split screen approach (See Figure 2). A tree in the left hand side lists the sub-projects and files which are in the current project while the right hand side contains details relating to the current selection. If you have selected a sub-project, it lists all the files within that sub-project, optionally including the contents of any further sub-projects as well. This list includes details such as the type of file, who currently has it locked out and its size. You can choose to list all files which are in the selected directory but which have not been added to the project. You can then select and add them to your project.

When you add a file to a project you can set various options including a description of the file and the maximum number of versions the program should maintain (See Figure 3). Versions will store a maximum of 32767 versions of a file but to save space in your database you can ask Versions to keep a smaller number. Once the limit is reached the oldest versions of the files are deleted. The exception is revisions marked as permanent which are never deleted. A particular revision of a file can be marked as permanent at any time.

The first release of Versions was unusual in that it always stored a complete copy of every version of every file in its database. StarBase christened this approach Omega storage as opposed to Delta which only stores the changes between versions of the file. Versions 2.0 uses Delta storage for text files and Omega for binary data although you can force the program to use Omega for all types of files should you wish. Omega storage is slightly faster although the

increase in disk space required by the database probably negates any advantages.

Minor milestone millstone

Once you've added a file to the project it can be checked in and out by developers and other users of the system. Checking out a file copies the latest version into the working directory on a users machine, checking in adds the modified file back into the database. Before you can modify a file you need to lock it, to prevent anyone else from changing it while you're working on it. This is where Versions differs from the norm a little.

Traditionally files that are checked out but not locked are made read only on your local system. This prevents you from accidentally modifying a file when you come to check the modified file in and finding it is locked by someone else. However, by default Versions does not write protect files when you check them out which somewhat defeats the object of the version control system. Luckily, there is an option to allow you to make files read only as you check them out. This option should really be on by default though.

As files are checked in and out of the Versions system, the program builds up a revision history for each file. By selecting a file in the left hand pane you display a list of the revisions made to that file (See Figure 4). By selecting individual revisions, any version of the file can be checked out, marked as permanent or compared with another.

As well as displaying information about the files within a project, the multitasking right-hand pane can display details of the team working on the current project. Selecting the Team tab at the bottom of the pane displays the list of users who have access to the current project. From here you can create new users and control what actions each user can perform. You can for example prevent individual users from locking files (ideal for keeping those pesky marketing kids at bay).

The right hand pane also contains a third tab, Audit, which hides one of Versions' more unusual features. Every action a user makes within Versions can be recorded as an entry in the audit log. This means that whenever anyone checks in, locks, removes or modifies a file it is recorded in the log. In fact, thirty types of event can be recorded (See Table 1). You can also view reports and graphs that analyse the contents of the database, the number of users etc.

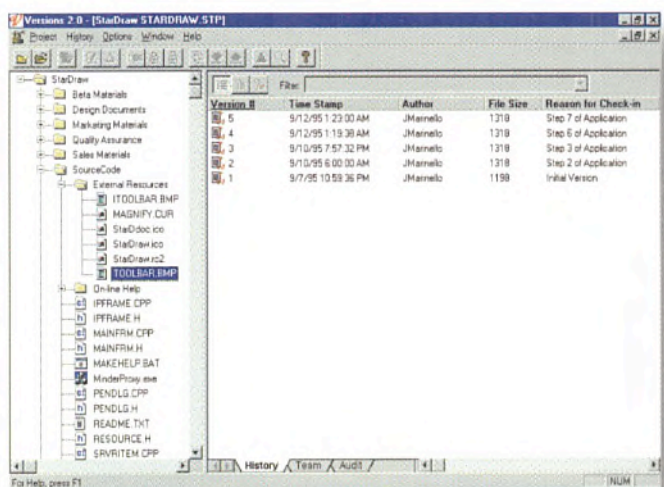


Figure 4 – Selecting a file within the project displays a list of associated revisions.



Milestones are used to mark significant events in a project's development. A milestone label is attached to all the files in the project and enables you to go back to a particular version of the project very easily. Versions support two types of milestones, a *normal* milestone and a *build* milestone. Both types can be applied in two ways, by marking the current version of all the files or by marking the files as they were at a specific date. The problem with milestones though is that they can only be applied to an entire project. There is no way to apply a milestone to a sub-project. This approach does make sense, but it means you can't use a single project file for all your projects.

Advanced features

Despite its low price Versions includes some advanced features that you'd only expect to find in a more expensive system.

There may be times where you want to produce two individual projects from one, for example you may want to produce a 'professional' version of your program based on the current 'standard' edition. To facilitate this, Versions lets you split a project or sub-project into two sub-projects which can then be worked on individually. And, if you want to, you can merge the changes to the project at a later date. The merge facility can also be used in situations where two people have modified the same file, if you've forgotten to turn on file locking for example.

There may be situations when a file is locked by someone who isn't around to unlock it, perhaps they went on holiday but forgot to check in their files. Under these circumstances, it is necessary to 'break' the lock and free that file for someone else to use. Of course, any changes the missing user made will need to be merged with the database later.

Email support is good, allowing the use of any MAPI compatible mail system to send messages, files and audit entries to other users. The system sends messages automatically when certain events occur. In particular if someone breaks a lock someone else has on a file.

Visual Diff, the program used to compare files within Versions, can be used as a standalone application outside the Versions envi-

ronment. As you would expect lines inserted, deleted and changed are all listed and the simple interface means the program is very easy to use (See Figure 5).

StarBase has included a utility to import PVCS data files into a Versions database although it is limited to the 32-bit version of PVCS 5.2.1. Whether many people will be trading in their PVCS system for Versions I wouldn't like to say but it's a nice addition to the package and shows StarBase has high hopes for the system.

The weakest point of any version control system is its database. Versions uses Microsoft's Jet database engine to store the actual revision information. This at least means you aren't relying entirely on untested technology. Unlike SourceSafe, Versions includes a selection of database management options, including facilities for checking for and repairing errors. Of course, everyone maintains up to date backups of their version control data files but it's nice to know there's something to fall back on.

Integration

Integration is the name of the game for developers these days. Gone are the days of a multitude of independent apps, now we need every application to be tightly coupled to the development system of our choosing. So, when I installed Versions I included the files required to integrate it with Microsoft Developer Studio.

• File added	• Sub-project added
• File checked in	• Sub-project branched
• Working file deleted	• Sub-project deleted
• File locked	• Sub-project modified
• File modified	• Sub-project moved
• File moved	• User added
• File purged	• User deleted
• File removed from project	• User modified
• File unlocked	• User group added
• Build milestone added	• User group deleted
• Label created	• User group modified
• Label deleted	• Security template added
• Milestone added	• Security template deleted
• Project created	• Version modified
• Project modified	• Version deleted

Table 1 - Versions maintains a comprehensive audit of actions performed on the project database. Each of the above events is recorded making it very easy to trace what has been happening to the project.

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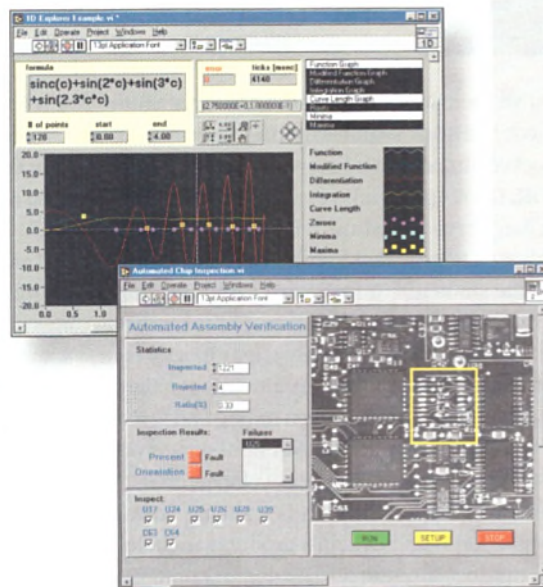
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If you've used SourceSafe with Developer Studio you'll know that version control slips seamlessly into the environment. Files can be added, locked, unlocked and even compared without leaving the safety of the IDE. Developer Studio even warns you if you try and edit a file that you don't have locked and will lock it for you if you wish. The FTC will be pleased to hear that Versions integrates just as well as SourceSafe. All the same menu items are available and assuming you are write protecting unlocked files you get the same warnings when you edit files you don't own. The only slight hiccup comes when opening a project. Versions doesn't automatically open the appropriate project file, instead it displays a file open dialog and forces you to find it.

As well as Developer Studio, Versions comes with files to integrate it with Visual Basic and Oracle Developer/2000. Other systems need to be integrated by hand which is a shame, it would be nice to have seen integration with Borland's products included.

All is not lost though, a fully documented command line interface allows you to integrate the system with your favourite devel-

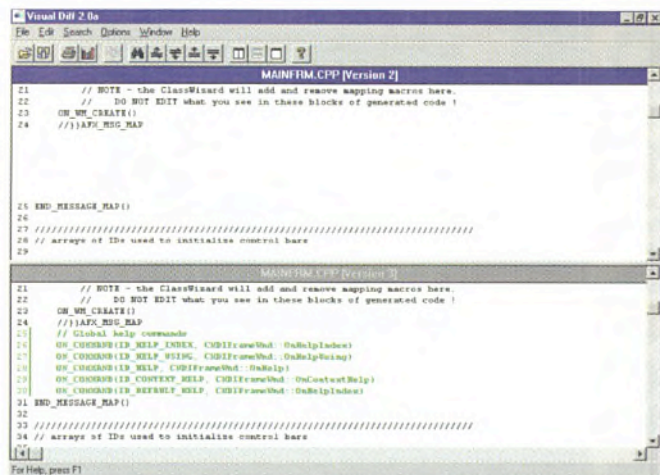


Figure 5 - Visual Diff's simple interface lets you quickly compare different versions of a file. You can run it standalone as well.

opment environment using delightful commands such as 'stdcmd lck /p "c:\stardraw.stp" /s "SourceCode" /is /un "Nal-lis" /pw "Password" /u *.*', which incidentally unlocks all the files in the SourceCode project and its sub-projects. No doubt many people will stick to task switching between their development environment and Versions.

A couple of commands within Versions enable you to Build or Test the current project. Like milestones, these commands can only be run

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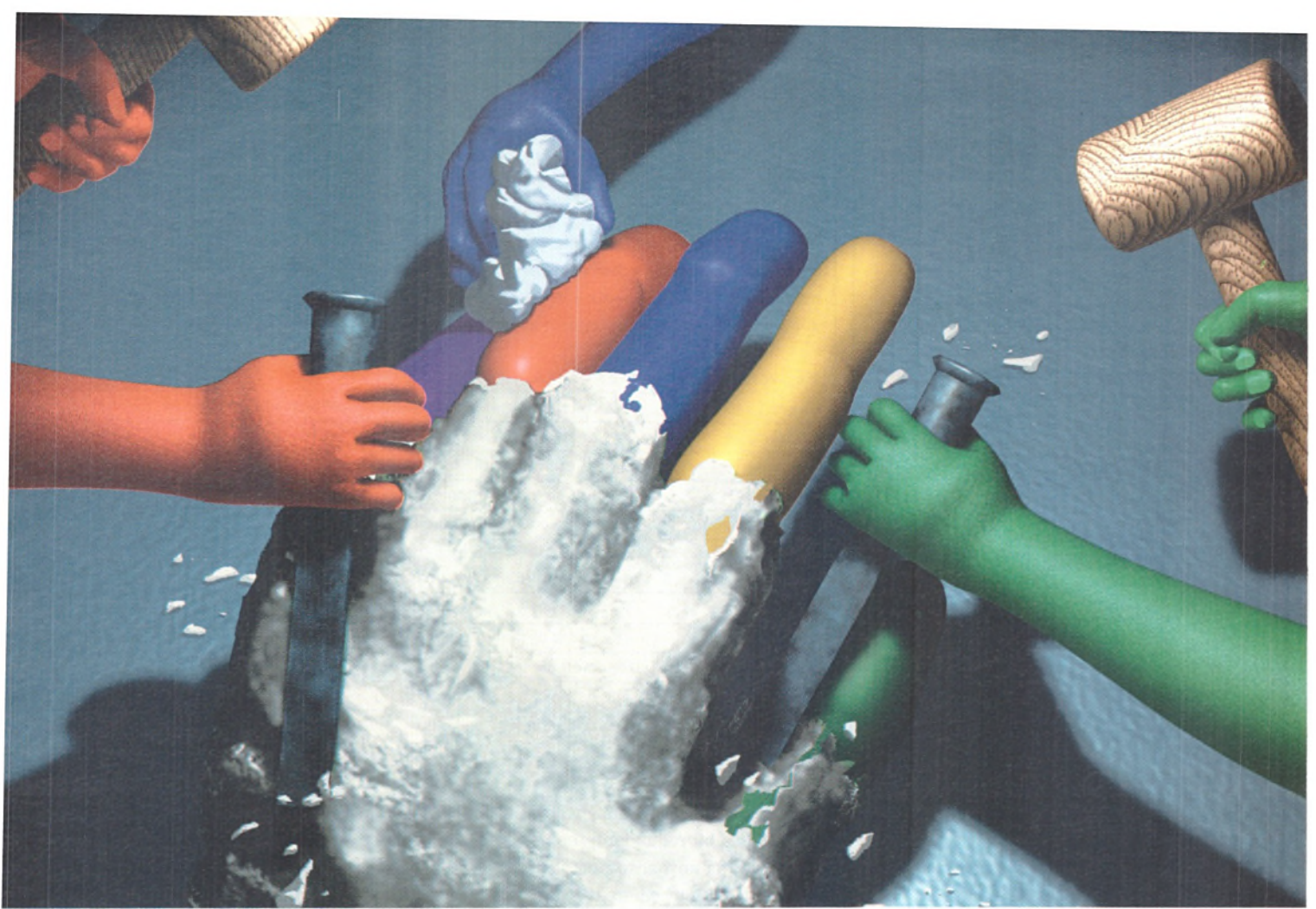
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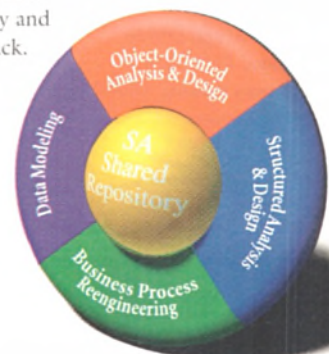


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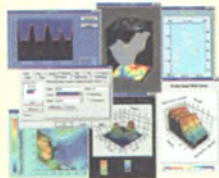
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REVIEWS WORK IN PROGRESS

Keyword key

Like some more expensive version control systems Versions lets you add keywords to your source file, these keywords are then expanded by the program when the file is checked out. The most common use for this is to create a detailed header for each file. Unfortunately, the program doesn't allow you to insert the description associated with a file. The keywords that are supported are:

Keyword	Meaning
\$Archive\$	The full file name used to store the version information for this file.
\$Author\$	The name of the user who checked the file in.
\$Date\$	Date and time stamp for the version.
\$Header\$	A header incorporating \$Archive\$, \$Revision\$, \$Date\$ and \$Author\$.
\$Locker\$	The name of the user who has the file locked.
\$Log\$	A full list of the changes to the file including the version number, the date, the author and the reason the file was checked in.
\$NoKeywords\$	Turns off keyword expansion for the rest of the file.
\$Project\$	The name of the project.
\$Revision\$	Revision number.
\$Subproject\$	The name of the sub project.
\$Workfile\$	The name of the work file.

for the whole project. Although the build option is probably a bit redundant, the test option is an easy way for anyone to run the project without having to know where it's stored, making the administrator's job a little easier.

Versions and Star Team

As well as Versions, StarBase produces a series of products called StarTeam. Using a similar interface to Versions the programs add defect tracking, threaded conversations and a project repository to the version control of Versions. Add the StarTeam Virtual TeamServer and you can access the system via a dial-up or Internet connection. From the moment you open the Versions box, it's clear that StarBase is hoping that as your development needs grow you'll upgrade to StarTeam. The Versions CD-ROM includes 60 day evaluation versions of all the other StarTeam products along with some very comprehensive tutorial videos explaining how to use the programs.

Overall, Versions is an excellent product. This latest version plugs the holes that were in the first release and there are some nice touches, for example the program automatically creates the working directory for a file when you check it out. Inevitably there are one or two quirks, but they will be less annoying if you've not used a different system in the past. In particular, having individual files for each project and having to manually open the version control project from within Developer Studio gets annoying if you change projects frequently.

Despite being aimed at the low end of the market and smaller groups of developers, the

program compares very well against its more expensive brothers. Of course SourceSafe is being given away with 'Enterprise' versions of just about every Microsoft product these days and it's debatable whether Versions offers enough new features to entice you to defect. However, the upgrade path to StarTeam makes Versions a very tempting alternative if you're planning on expanding your development team in the future. I'd like to see StarBase continue to develop Versions though, they are covering the low end of the market so well I'd hate to see them leave it behind to concentrate on the more expensive StarTeam.

Like debugging tools such as Bounds-Checker, a good version control program can save hours of work and pay for itself the first time you use it in anger. Of course you don't have to be a developer to benefit from a program like Versions. Web site designers, authors, in fact anyone who produces documents that change over time could benefit. Given that Versions is so cheap there really is no excuse for having to live without version control. Lone developers get the security of being able to go back to any version of a project while teams get control over the development process. All in all it's far better than a white-board. ■

Philip Harris is Director of Microtrope Ltd, a software company developing Windows products. He can be contacted on 01295 252002 or by email at piharris@microtrope.com. Versions 2.0 costs £75 and is available from Contemporary software (01344 873434).

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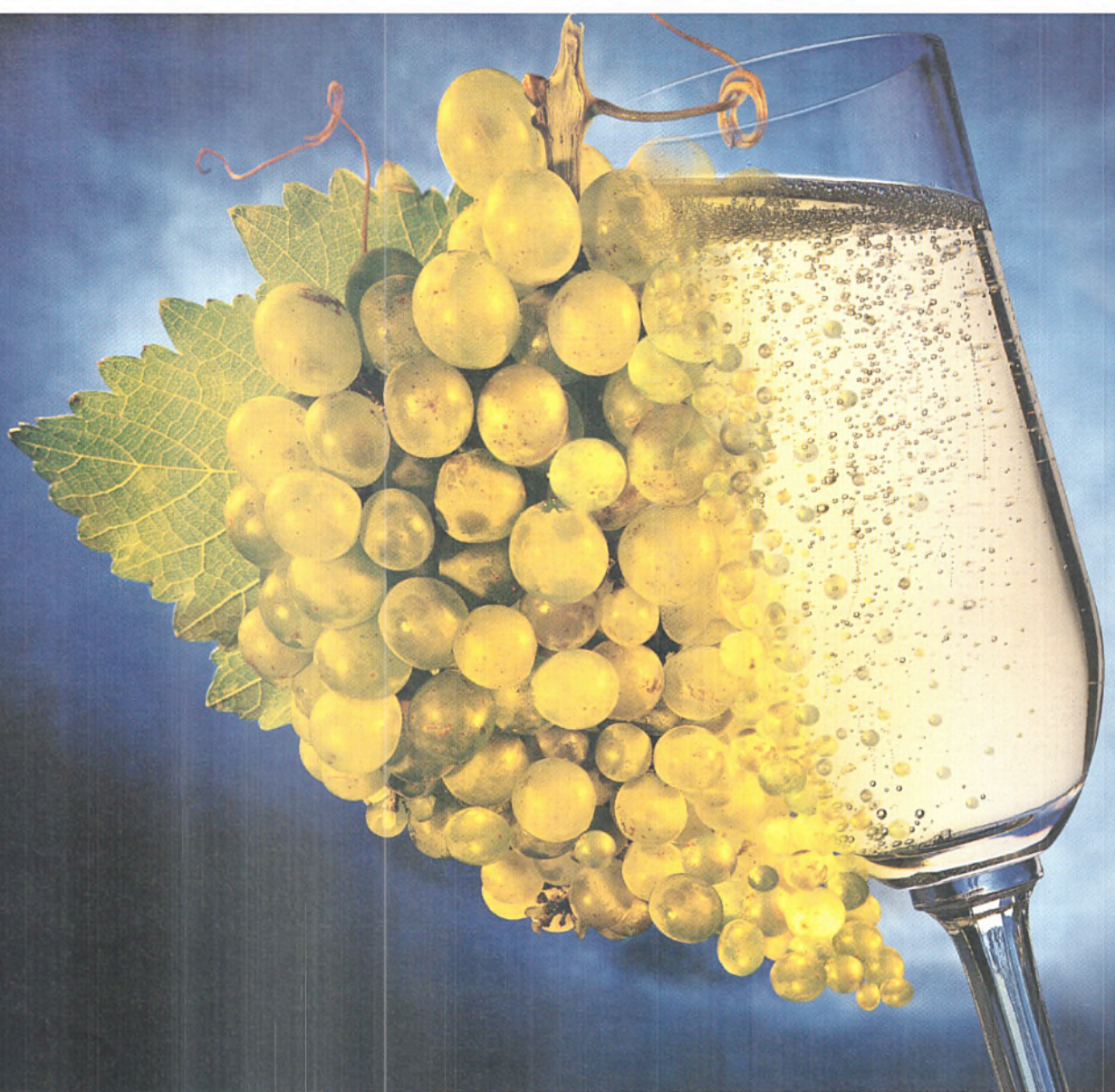
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 ENQUIRY NO. N33

Adding a little ZIP to your applications!

Having to add extra DLLs to your applications in order to compress the files they generate is paradoxical. Dave Jewell reviews TurboPower Abbrevia 1.0 which ships as a VCL.

For the last two or three years, it's been possible to buy third party DLLs that provide ZIP capabilities to application programs. Using these products, a C/C++, Pascal or even Visual Basic application can create ZIP files, extract individual entries from ZIP archives and so forth. The disadvantage with this approach, of course, is the need for a separate DLL. I'm certainly not opposed to DLLs on principle, but it's nice if you can package the ZIP functionality as part of the application itself. This is particularly relevant where (for example) you want to create a self-extracting EXE file for distribution over the Internet or as shareware.

Many moons ago, TurboPower released a set of ZIP libraries as part of their Async Professional communications library. These ZIP routines were provided as part of the DOS version of the library and, as far as I know, they never made it into a Windows version of the product. However, over the years, TurboPower has released a series of patches which enable you to modify the source code to work under Windows. A far more serious drawback with these routines is their

age: because they were written so long ago, there is no support for the 'Inflate/Deflate' compression method which is provided by PKZIP 2.04g. If you make much use of ZIP archives, you'll know that Inflate/Deflate has virtually replaced the other compression methods because of its efficiency and superior performance characteristics. Obviously, using a library which doesn't support the most popular compression method is a no-no.

Introducing Abbrevia

Happily, all these problems are now behind us. At least, they are if you happen to program using Delphi or C++ Builder! Abbrevia is a hot off the press library from TurboPower which provides new, state of the art ZIP routines packaged as a set of VCL components. You can link these controls right into your executable, and naturally, the Inflate/Deflate method is fully supported. Like all TurboPower products, you get *full source code* to the entire library, so you can dive in and tweak things to your heart's content.

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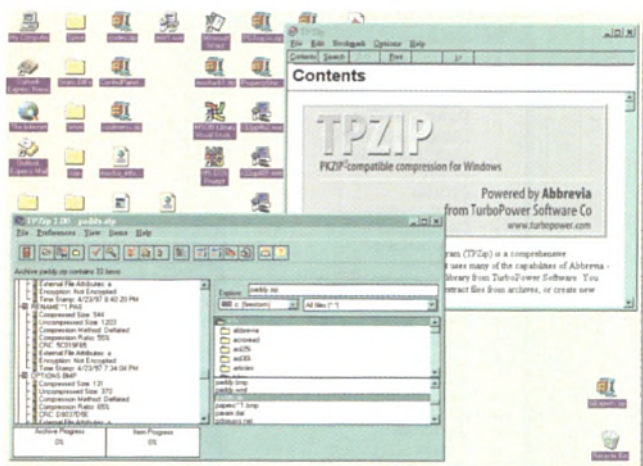


Figure 1—TPZip is the name of a comprehensive Zip/Unzip program which is included to demonstrate the capabilities of Abbrevia. As you'll be able to infer from the screen shot, Abbrevia provides two progress 'hooks', one for each item being extracted or compressed, and one for the overall archive progress.

Considering it's only a first release, Abbrevia is very full-featured and includes advanced ZIP features such as the ability to encrypt one or more entries in a ZIP file with a user-supplied password. Users of the ever-popular WinZip shareware program (from Nico Mak Computing) will know that disk spanning has only just been fully integrated into the latest version of the product, version 6.3 – previously it was only available as an add-on. However, Abbrevia offers full disk spanning capabilities from the word go. C++ Builder and all three versions of Delphi are supported, although there are some limitations on what can be done in 16-bit applications – this is discussed later.

So what do you get for your money? Like Sheridan and others, TurboPower is going over to the use of a single CD which contains *all* its current product range. When you buy Abbrevia, you get the CD along with the unlock code for installing your chosen product. This is a nice approach because you can browse the CD for information on other TurboPower products and even install trial versions for evaluation purposes. You also get a slim (124 page) but well-written manual. In addition to the source code, Abbrevia includes on-line documentation for both Delphi and C++ Builder. The manual describes how to install the product and documentation for each of the four possible IDEs that you might be working with. In this review, I'll concentrate on looking at things from a Delphi programmer's perspective.

Along with the CD, you get a floppy disk labelled 'TurboPower String Resource Manager v 1.01'. This needs to be installed onto your hard disk and forms part of the package. As you may be aware, TurboPower provides an extensive number of add-on libraries for Delphi/Pascal programmers and it found that an increasing number of programmers were experiencing problems with string resource ID clashes between those in the TurboPower library, and their own defined strings. To get round this problem, TurboPower developed its own resource string manager which goes a long way towards eliminating these problems, at the expense of a little more work for the developer. The String Resource Manager supports Unicode and DBCS strings and is provided as part of your chosen library.

After you've installed the various components into Delphi, you should see a new Abbrevia page on the Component Palette containing five new components. These are:

TabZipBrowser
TabUnZipper
TabZipper
TabZipKit
TabZipOutline



A large assortment of sample Delphi and C++ Builder projects are loaded onto your hard disk, and you can immediately start trying these out. To give you a feel for working with Abbrevia, take a look at the code below – which is taken from one of the TurboPower samples.

```
procedure TForm1.FormCreate (Sender: TObject);
begin
    ZnfName := ChangeFileExt (Application.ExeName, '.zip');
    TxtName := ExtractFileName (ChangeFileExt (
        Application.ExeName, '.txt'));
    with AbZipKit1 do
    begin
        BaseDirectory := ExtractFilePath (
            Application.ExeName);
        ChDir (BaseDirectory);
        FileName := ZnfName;
        if Count > 0 then
        begin
            ExtractFiles (TxtName);
            Memo1.Lines.LoadFromFile (TxtName);
        end;
    end;
end;
```

This code comes from a small 'notepad' style application which uses a TMemo control as the 'writing' surface. The application is based around an instance of the non-visual TabZipKit control. Since this is the FormCreate method, it gets executed every time the application starts running. The code uses the name of the application (CompPad) as a base to form two other filenames, CompPad.txt and CompPad.zip. The BaseDirectory property of the TabZipKit control is established to 'point' the control at the proper location and the FileName property is then loaded with the name of the ZIP file.

This property assignment causes the TabZipKit control to immediately load the specified ZIP file, assuming that it exists. If it does, and it's a valid ZIP file, then the Count property holds the number of files contained within the archive. The ExtractFiles method is called to extract the CompPad.txt file to disk and the LoadFromFile method of the TMemo control is then used to load the text file into the memo control.

Here's the code that gets called when the application terminates. (Bear in mind that ZnfName and TxtName are global string variables initialised by the FormCreate method.)

```
procedure TForm1.FormDestroy (Sender: TObject);
begin
    Memo1.Lines.SaveToFile (TxtName);
    with AbZipKit1 do
    begin
        if Count = 0 then AddFiles (TxtName, 0)
        else FreshenFiles (TxtName);
        Save;
    end;
    DeleteFile (TxtName);
end;
```

This code is even simpler. It first saves the current memo contents out to the CompPad.txt file using the SaveToFile method. It



then checks to see if the ZIP file has been created by looking at the `Count` property of the `TabZipKit` control. If the ZIP file doesn't yet exist, then `AddFiles` is called to add the file to the archive – this has the effect of creating the ZIP file. If the archive is already there, then `FreshenFiles` is called to update the existing entry. Finally, `Save` is called to update the on-disk archive and the temporary text file is deleted.

The overall effect is, of course, to make the contents of the Memo control 'persistent' from the user's point of view, and to provide background compression of the memo data with consequent advantages in terms of saved disk space. The casual user probably won't even be aware that the data is being transparently compressed and decompressed.

A control tour...

As you can infer from the above, the `TabZipKit` control handles both file compression and extraction and allows you to browse the contents of an archive. Functionally, it combines the capabilities of the other three high-level Abbrevia components, which is presumably why it's referred to as a complete 'ZIP Kit'. As the name suggests, the `TabZip-per` and `TabUnzipper` components contain the functionality needed to compress and extract, respectively, to and from ZIP archives. By separating this functionality out into two distinct components, applications which (for example) only employ decompression can be made smaller through not having to carry around the compression code.

The `TabZipBrowser` component provides no compression or expansion facilities. Instead, it simply allows you to browse the contents of a ZIP file in a read-only manner. One of the printed TurboPower tutorials shows how to build a file-searching utility which even looks inside a ZIP archive for matching files, courtesy of the `TabZipBrowser` component.

This is a good opportunity to describe how the various components provide programmer-access to the individual files within an archive. The `TabZipBrowser` control exports a property called `Items` which is an indexed array of type `TabZipItem`. The number of items in the array corresponds to the previously mentioned `Count` property. The `TabZipItem` class contains everything needed

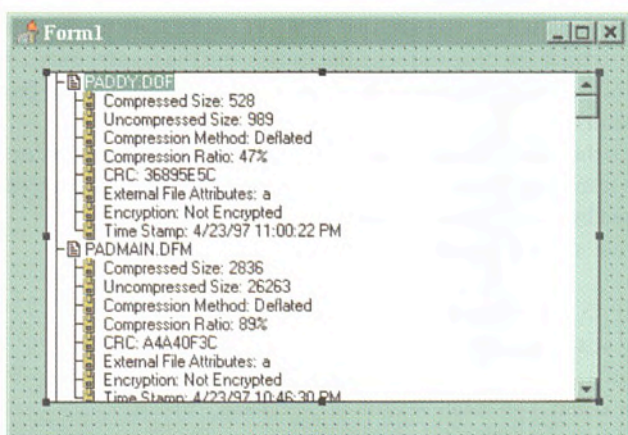


Figure 3—`TabZipOutline` is the only visual component in the Abbrevia library. It provides a hierarchical, 'outline-style' view of the contents of a ZIP archive. You can see the same type of control being used in the TPZip program in Figure 1.



Figure 2—This screen shot shows the various properties associated with the `TabZipItem` class which encapsulates a single entry within a ZIP file. If you're familiar with PKWare's seminal `APPNOTE.TXT` document, you'll see that that most of these properties map down directly onto fields within the internal ZIP data structures.

to describe a single entry in a ZIP file and contains a large number of descriptive properties – see Figure 2 for the full story.

`TabZipOutline` is the only visual component in the Abbrevia library. It's based on Delphi's `TOutline` component and provides a high-level view of the contents of a ZIP archive in addition to all the usual extraction and compression facilities – this even works at design time, once you've pointed the control's `FileName` property at a valid ZIP file (see Figure 3). For each entry in the archive, you can selectively enable and disable the fields that are displayed such as compression method, CRC, time stamp and so forth. At run-time, double clicking on a filename will collapse or expand the display of fields relating to that entry.

In addition to the above, Abbrevia contains a number of lower level classes and routines which round out the functionality of the library and provide a great deal of flexibility. Of particular interest are a couple of stream-related routines called `DeflateStream` and `InflateStream`. When you're working with streams, you can use these routines to provide low-level compression and decompression without using ZIP files. This stream-based functionality makes it easy (for example) to incorporate compressed data into your own proprietary file formats. If you've only got a single compressed object in your 'archive' this means that you can dispense with the ZIP file directory structure altogether. The code fragment below (also taken from TurboPower's sample materials) shows how you might modify the aforementioned `CompPad` project so as to use a proprietary '.ZST' file instead of a plain-vanilla ZIP file.

```
procedure TForm1.FormCreate (Sender: TObject);
begin
  ZnfName := ChangeFileExt (Application.ExeName, '.zst');
  TxtName := ExtractFileName (ChangeFileExt (
    Application.ExeName, '.pad'));
  ChDir (ExtractFilePath (Application.ExeName));
  if FileExists (ZnfName) then
```


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100-4287	Apple	Macintosh	2,500
100-7129	Apple	Washington Red	15,000
100-3930	Apple	Rome	1,500
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```

begin
  TxtStream := TMemoryStream.Create;
  try
    ZnfStream := TFileStream.Create (ZnfName,
      fmOpenRead or fmShareExclusive);
    try
      InflateStream (ZnfStream, TxtStream);
    finally
      ZnfStream.Free;
    end;
    TxtStream.Position := 0;
    Memo1.Lines.LoadFromStream (TxtStream);
  finally
    TxtStream.Free;
  end;
end;

procedure TForm1.FormDestroy (Sender: TObject);
begin
  TxtStream := TMemoryStream.Create;
  try
    Memo1.Lines.SaveToStream (TxtStream);
    TxtStream.Position := 0;
    if FileExists (ZnfName) then
      ZnfStream := TFileStream.Create (ZnfName,
        fmOpenWrite or fmShareExclusive)
    else

```

```

      ZnfStream := TFileStream.Create (ZnfName,
        fmCreate or fmShareExclusive);
    try
      DeflateStream (TxtStream, ZnfStream);
    finally
      ZnfStream.Free;
    end;
  finally
    TxtStream.Free;
  end;
end;

```

By using this type of approach, several benefits accrue. Firstly, the application itself can be smaller because you're not using the higher level ZIP handling controls inside your program – only the lowest level compression routines get into the executable. Secondly, the proprietary file will be smaller than the equivalent ZIP file (significantly smaller where only small amounts of data are concerned) because there are no disk space overheads associated with the central directory, directory tail and local header structures which must be present in every ZIP file. Most importantly, you've got complete control over the file format and this low-level approach makes it easy to encrypt the data in such a way that prying eyes can't easily reverse engineer the contents of your data file.

One word of warning: the TurboPower documentation tells you that InflateStream doesn't store any header or footer information as part of the stream – only the raw compressed data is stored. While this is certainly efficient, there's a potential problem due to a complete lack of CRC checking. As an experiment, I tried randomly mod-

/*more_coffee*/:

ifying bytes in a compressed data stream and then running `DeflateStream` to decompress the data. Because `DeflateStream` only 'sees' the compressed bit stream, it can't possibly know that the data has been corrupted – it will happily decompress a corrupted data stream, giving an 'inflated' result that differs by one or more bytes from the original. The bottom line is that if you plan to use the stream-based approach in a commercial application, I'd *strongly* advise modifying `InflateStream` to append a 32-bit checksum to the end of the compressed data. The `DeflateStream` code can then verify this checksum at the end of the decompression process.

Look Ma – no ZIP program!

While waxing lyrical about Abbrevia's flexibility, I'd be remiss if I didn't also mention the self-extraction facilities which have been provided by TurboPower. When deploying a shareware application over the Internet, it's very convenient being able to package your software as a single, self-extracting EXE file. Strange as it may seem, some end-users wouldn't know what to do with a ZIP file...

A self-extracting EXE file is essentially comprised of a 'stub' program onto which a ZIP file has been concatenated. The stub locates the concatenated ZIP file information and performs a file extraction in the normal way. Thus, there are two steps involved in the creation of a self-extracting archive: firstly, create your stub program and secondly, concatenate the wanted ZIP file to the end of it. TurboPower provides a couple of sample projects which correspond to these two steps.

Because you've got complete control over the stub code, you decide what happens during the extraction, where the files are

extracted to, whether the newly-extracted `SETUP.EXE` program is automatically started and so forth. TurboPower has put some thought into minimising the size of the stub code; before compiling a stub you need to set a special `$DEFINE` in one of the Abbrevia include files. This prevents most of the VCL library being linked in. With 16-bit Delphi, you can easily get the stub code down to around 86 KB and – if you're prepared to 'tinker', some further reductions could be made. Obviously, this is a bigger stub than you'd get from using something like PKWare's `ZIP2EXE` program, but not unacceptably so. If you really *must* have a stub that's significantly smaller, and you don't mind having less control over stub capabilities, then you can always use something like WinZip Self-Extractor from Nico Mak – this gives a stub overhead of around 16 KB.

The second step is to add the ZIP file to the stub. TurboPower has provided a routine to do this, `MakeSelfExtracting`, along with a sample project (it's not mentioned in the manual but it's called `MakeSFX`) to show how it's done. If you edit this project to point to the wanted stub and ZIP files, then run the program – hey presto – you get a self-extracting archive.

Limitations

Earlier, I mentioned that there are some limitations on using Abbrevia in a 16-bit Delphi 1.0 application. There are really only two limitations, and neither of them are of massive importance. Firstly, some of the Abbrevia components provide a boolean `DOSMode` property which forces all new entries added to a ZIP archive to have DOS



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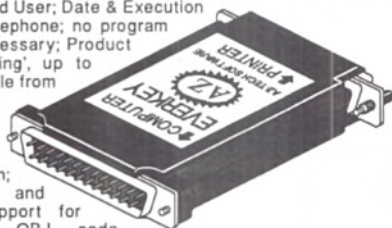
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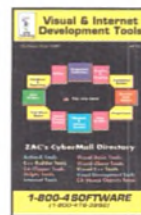
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compatible (8-3 format) filenames (ie C:\CoolMenus\order.txt gets mapped to C:\COOLME~1\ORDER.TXT). This mapping is done using 32-bit API calls and since these calls aren't available to 16-bit applications, the DOSMode property isn't available either. However, since long filename support is pretty thin on the ground for the 16-bit VCL library, this isn't likely to be much of a restriction.



Secondly, as you may know, the Microsoft IntelliMouse device generates a new Windows message, WM_MOUSEWHEEL, whenever the small wheel on top of the mouse is rotated. The IntelliMouse is supported by Abbrevia's user-interface components through a new event handler, OnMouseWheel. Once again, mouse wheel support is not available to 16-bit applications.

While on the subject of limitations, it's as well to point out that Abbrevia supports all the standard PKZIP compression methods (Storing, Shrinking, Reducing, Imploding, Deflating), but *for extraction only*. In other words, any ZIP archive which has been created with PKZIP 2.04g or other ZIP utility can be decompressed with Abbrevia. However, when compressing entries into a new or existing archive, only the Storing and Deflating methods are supported. Storing occurs when no worthwhile compression can be achieved (as when storing one ZIP file inside another) and, as previously mentioned, Deflating is the compression scheme which has effectively superseded the older strategies. Thus, you can see that there's no real limitation here, and there's the added benefit of reduced code size.

Thumbs up

From time to time, I've tried several ZIP-compatible libraries from other vendors, but they all had significant drawbacks such as the need for external DLLs or an inconvenient programming interface. When I heard that TurboPower planned to produce a ZIP library, I was very eager to try it out because its products are always of a high standard, easy to use and include full source code. Well, I wasn't disappointed. I hope that this review has shown you something of the compression library's flexibility and ease of use. Whether you're creating a custom installer program or whether you want to incorporate data file compression into your next killer app, I can heartily recommend Abbrevia.

Of course, there is one significant disadvantage – if you're not a Delphi/C++ Builder programmer, then you're out in the cold. I imagine that with some work it would be possible to use C++ Builder to package the Abbrevia code up into a DLL. Alternatively, if you're feeling adventurous, you could try making use of Delphi 3.0's 'One-Step' ActiveX technology to transmogrify the various Abbrevia components into a single OCX callable from Visual Basic, Visual C++ or whatever. In time honoured fashion, this is left as an exercise to the reader...

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

For more information or to get the latest free updates go to <http://www.turbopower.com>. Abbrevia 1.0 is available at £117 from Grey Matter (01364-654100, <http://www.greymatter.co.uk>).



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I know that I am precariously dodging the slings and arrows of the anti-Microsoft brethren among our followers so I thought I would issue a few basic points about J/Direct right up front so that no one can accuse me of being subtle or deceptive.

Just the J/Facts

J/Direct is a Microsoft specific technology that allows Java applications and applets to 'easily' incorporate legacy C/C++ code that is unaware of the Java Virtual Machine. Before using J/Direct you should be aware of the following basic facts and caveats. J/Direct is a Microsoft specific technology and, as such, is only supported by the Microsoft Virtual Machine. J/Direct changes your Java class file, adding attribute sections where appropriate to describe the J/Direct information. This is the Sun recommended technique for extending class files with VM specific information [*the outcome of Sun's suit against Microsoft should clarify this point - Ed*]. And J/Direct is the simplest and most efficient form of calling native functions on Windows-platforms. Although my results are preliminary, you should see good performance improvement with J/Direct over RNI/JNI technology.



Return to J/Direct

As a quick recap of last month's discussion, let's go over the major points of J/Direct. It is designed to simplify integration with legacy Windows systems, such as custom DLLs or the Win32 operating system APIs. Unlike JNI and RNI, J/Direct is specifically designed to link with legacy Windows code that is unaware of the Java Virtual machine, and its garbage collector. J/Direct does not require any glue or 'thunk' code to be written on the legacy code side (the Microsoft Virtual Machine automatically provides one, and only one, set of glue code). And J/Direct simplifies marshalling of complex Java and C/C++ data types.

J/Direct works by using special directives embedded in documentation comments. If you read last month's article you know that the syntax is a bit terse, but manageable. The following example shows a standard Windows C/C++ data structure described as a Java class, and includes the definition of a legacy API that expects the data type as its first parameter:

```
/** @dll.struct() */
class TRACKMOUSEEVENT
{
    public static final int HOVER_DEFAULT = -1 ;
    public static final int TME_HOVER = 1 ;
    public static final int TME_LEAVE = 2 ;

    protected int cbSize ;
    protected int dwFlags ;
    protected int hwndTrack ;
    protected int dwHoverTime ;

    TRACKMOUSEEVENT(int iHwndTrack,int iFlags,
    int iHoverTime)
    {
        cbSize = 16 ; // == sizeof(TRACKMOUSEEVENT)
```

J/Direct²

Following on from last month's introduction to Microsoft's J/Direct, Tom Guinther explains some of the more advanced and complex topics.

```
dwFlags = iFlags ;
dwHoverTime = iHoverTime ;
hwndTrack = iHwndTrack ;
}

/** @dll.import("USER32") */
public static native boolean TrackMouseEvent(
    TRACKMOUSEEVENT TrackEvent ) ;

public boolean TrackMouseEvent ( )
{
    return TrackMouseEvent ( this ) ;
}
};
```

Prior to the class declaration the documentation comment `/** @dll.struct() */` informs the VM that we want to treat the class `TRACKMOUSEEVENT` as a C/C++ style struct. Within the class the native Win32 method `TrackMouseEvent()` is preceded by a documentation comment, `/** @dll.import("USER32") */` that specifies that the function can be found in the USER32 system DLL.

Advanced J/Direct

Beyond the basics, J/Direct provides support for user-specified alignment of members within Java data structures that will be accessed by legacy code (ie classes preceded by an `@dll.struct` directive). This is often necessary because the typical C/C++ compiler affords the developer a lot of flexibility regarding how structure members will be aligned. In some cases, data structures may be aligned on 1 byte boundaries for compactness, while in others, data structures might be aligned on 32 or 64 bit boundaries (4 and 8 byte respectively) to promote better performance for a given CPU. In specialised cases, it is not uncommon to mix and match different alignments for different structures within a single C/C++ header file. To specify the alignment of a data structure use the following syntax, where `align` specifies an alignment value of 1, 2, 4, or 8. If you want to use the default alignment (8 bytes) omit the `pack=align` portion of the directive completely.

```
/** @dll.struct(pack=align) */
class foo {
    public byte fooByte1 ;
    public byte fooByte2 ;
    public int fooInt ;
}
```


Another important thing that I touched upon last month is the automatic marshalling of strings provided by the VM. That is, when you call a C/C++ function that expects an `LPCTSTR` from Java you simply pass an instance of `class String`. The VM understands that the `class String` type must be marshalled and does so automatically. By default the VM marshals strings in ANSI format but you can specify, on a per class or function basis, whether a string should be marshalled as ANSI, or Unicode. The following example declares a Java struct whose `String` members are to be interpreted in Unicode format.

```
/**@dll.struct(unicode)*/
class WideString {
    String stringA ;
    String stringB ;
}
```

It is possible to specify whether a legacy function expects string parameters in ANSI or Unicode format, for example:

```
/**@dll.import("KERNEL32",unicode) */
public static native CopyFile(String original,
                               String copy);
```

In this case, calling the `CopyFile` function will cause the VM to convert the two `class String` parameters to Unicode format (if necessary).

Although you do have complete control over the choice between Unicode and ANSI, in most cases you will want to use the default option, `auto`. Using `auto` allows the VM to choose the most appropriate format for the underlying platform. If the platform provides a Unicode API, then `auto` is treated as if it were Unicode, otherwise ANSI is used.

While the VM does a majority of the string marshalling for you, there is one caveat that makes passing strings to a DLL or back from a DLL more cumbersome. In Java strings are under control and management of the VM and as such must be considered constant by legacy code. There is no way for a C/C++ legacy function to know how to expand or truncate the `class String` appropriately. In order to pass a `String` to a C/C++ function for modification you must use an instance of the `class StringBuffer` instead. The `class StringBuffer` is very similar to a `char[]` having the capacity to hold a certain number of characters. When the string buffer is created the capacity of the buffer can be specified as in the following code fragment:

```
StringBuffer pathString =
    new StringBuffer(MAX_PATH);
```

Here we are specifying a predefined constant `MAX_PATH` as the capacity of the string buffer. Note that after `pathString` is constructed it will have a string length of 0 (there are no characters stored in the buffer), but once again, the capacity is the value of `MAX_PATH`. After you pass an instance of `class StringBuffer` to a legacy function you can convert it to `class String` using the `StringBuffer.toString()` method.

J/Direct and OLE/COM

As you would expect, the Microsoft VM provides a very nice convergence of Java and COM. Any Java class can be a COM object and any COM object can be a Java class. Various 'wizards' are provided to make all this as simple as possible.

Before you get the wrong idea let me say that J/Direct is not the technology that makes Java and COM work so well together (that technology is the subject of a future article). J/Direct provides intelligent

access to the OLE/COM API functions that are used to create and manipulate COM objects (not the COM objects themselves). The reason that we even need to make a distinction between a Win32 API and an OLE/COM API is that OLE/COM follows certain conventions that J/Direct helps make transparent to your Java code.

If you're familiar with JavaBeans you know that certain design patterns allow introspection to automatically determine a beans properties and events. OLE/COM functions can be thought of in a similar way, as having an OLE/COM design pattern which looks like the following fragment:

```
HRESULT foo(FOOTYPEx fooArg, FOOTYPEy fooArg2,
            FOOTYPEz *fooResult);
```

where the common OLE/COM function returns an error-status value of type `HRESULT`, takes one or more arguments as input and, if necessary, returns a value through a pointer passed as its final parameter. Notice that the argument types are not specifically specified by the pattern, but it should be noted that any string type parameters are Unicode. OLE/COM functions do not support ANSI.

Remember that this is just a design pattern so some OLE/COM functions may not follow it. Those functions would need to be special cased.

J/Direct provides the `ole` modifier which can be used with the `@dll.import` directive to specify that a function follows the typical OLE/COM pattern. This allows the VM to handle all the special OLE/COM semantics so that your code is very 'Javaish', not 'COMish'. For example lets take a simple COM-like function defined in a custom DLL:

```
HRESULT StringConcat(LPOLESTR base, LPOLESTR append,
                    LPOLESTR *pszResult);
```

and its J/Direct declaration and sample usage:

```
/**@dll.import("CUSTOMOLE",ole)*/
String StringConcat(String base, String append);
...
String catString = StringConcat("Hello ", "World");
```

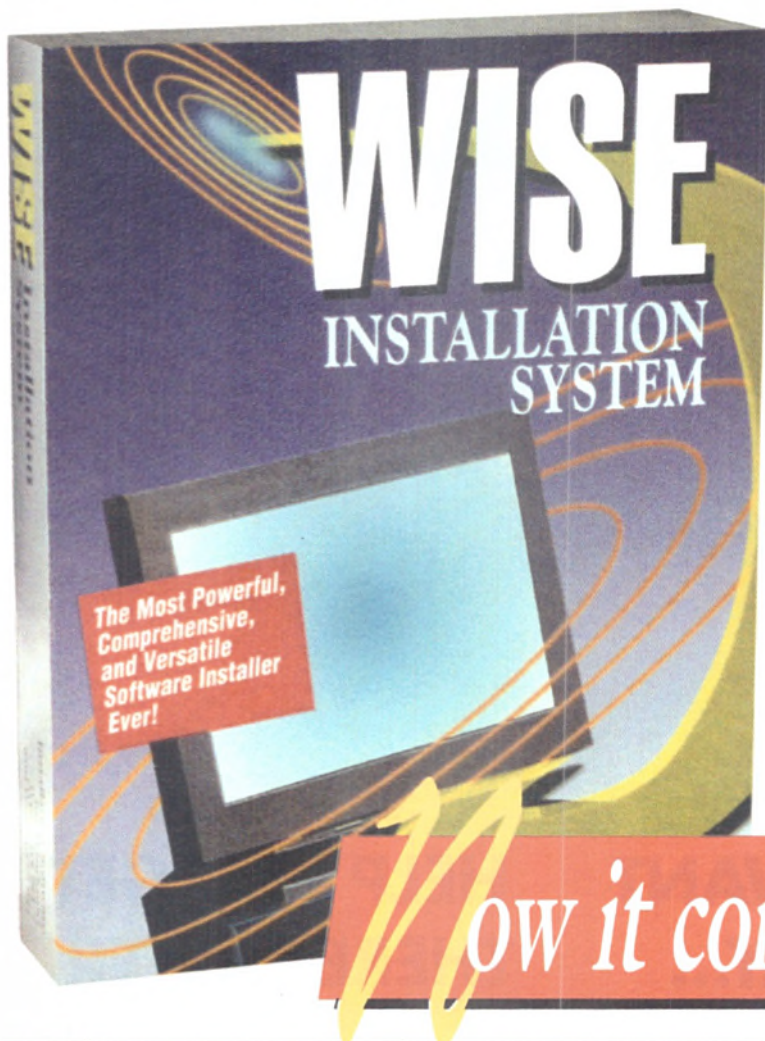
You can see that there is little or none of the OLE/COM semantics forced upon the Java code. It looks like straightforward Java, but underneath, the VM is doing all the work to make the OLE/COM and Java worlds seamlessly blend.

The first trick is that the `HRESULT` return value of the OLE/COM API is managed by the VM. If an error result is returned, then the VM will throw an exception of type `ComFailException`, which your code can catch. Since this is an OLE/COM function the `String` objects will be translated to Unicode format (and back to ANSI as necessary) automatically. The final VM trick here is that because the function returns a `String` type, when the VM sees this, it automatically inserts a `LPOLESTR *` as the final parameter to the OLE/COM API call. If the API completes successfully, the VM converts the return `LPOLESTR` to type `String` and frees the memory allocated by the OLE/COM API for the `LPOLESTR`. *Presto Chango!* A little bit of magic and we achieve the perfect blend of Java and COM.

There are other interesting aspects of J/Direct that are intriguing for Windows development, such as callbacks, and dare I say, pointers. But enough of this J/Direct stuff already. Next month we will be getting back into the normal swing of things, as we look at Sun's latest class library serving, JFC. Stay tuned. ■

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Const correctness

Are you Const correct? Francis Glassborow details the fundamental difference of attitude between true C programmers and their C++ counterparts over this difficult question.

Over much of the last year, I have been encouraging readers to attend ACCU's conference. The editor has suggested that you might enjoy a brief report. I will do my best though I am clearly biased.

There were a number of highlights. Bjarne Stroustrup coped admirably with the fact that I had inadvertently reversed the titles of the two talks he was giving. Many lesser speakers would have exploded on learning less than an hour before speaking that the programme title was for a talk intended to be half the length to a much broader audience.

One of the other things that impressed many of the delegates was how approachable most of the speakers were. Bjarne Stroustrup's skill at responding at an appropriate level is one that others might study and emulate. I should hasten to add that I wouldn't include the other speakers at this event as each exhibited tact and humility when talking informally.

Many attendees thought that Dan Saks' presentation was outstanding among all the excellent ones on offer. Dan had chosen to speak on the topic of `const` correctness. Not only was his presentation impeccable but he had something for almost every member of the audience despite the range of ability, experience and knowledge represented. Several have commented to me that they would go to considerable trouble to hear Dan speak again.

The event was a great success. This can be measured in a number of ways. A tremendous atmosphere made the whole event buzz. We actually had to throw people out at the end of the reception otherwise we would have been there into the small hours of the morning. Blackwells Bookshop did an excellent job in providing the reception and I am glad to say that their efforts were amply rewarded by the amount of business they did.

The delegate questionnaire indicated a remarkably high level of satisfaction with the three key criteria (met expectations, quality of speakers and quality of content). Considering the British reluctance to award an extreme mark the average rating (for each criterion) of 5.95 out of 7 is exceptional by anyone's standards.

More pleasurable for me was the number of people who admitted that they had only decided to come at the last minute out of a sense of duty, but that they were delighted that they had done so.

We have both date and venue for next year's event – September 17 & 18th at the Oxford Union. I am hard at work lining up a high quality programme. If you were there this year, I am sure you will need little encouragement to be there next time. If you were not I think you should give serious thought to ensure that you do not miss future events. The warm and friendly atmosphere of this event made it particularly easy to make new contacts.

Const poisoning or const correctness

One thing distinguishes the true C programmer from C++ programmers: his attitude to the use of `const`. The concept and keyword was originally developed in C++. It was very clear that the type system should be used to allow statically enforced safety with

variables that were not intended to be changed by some specific mechanism.

There were two distinct ideas hidden here. The first is that it should be possible to have constant objects. That is objects that could not change from the time they were created till the end of the program. The existence of such objects had several implications. One of these is that they could be placed in ROM. Another was that they did not have to actually exist unless the programmer did something such as taking an address that forced the existence of actual storage. The certainty that an object could not be changed allows a number of optimisations. However, one consequence of this is that there had to be constraints that ensured that the compiler would detect potential attempts at changing a `const` object.



This leads to the second use of `const`, the qualification that an object cannot be changed via a particular identifier. For example, `const` references and `const` qualified parameters declare identifiers that cannot be used to change the value of the underlying object. That does not mean that the object cannot change, just that this identifier cannot be used to make the change.

One consequence of this is that you cannot pass the address (lvalue) associated with an identifier providing `const` qualified access to an identifier that is not similarly restricted.

Ensuring that your code will not fail to compile under such constraints is what `const` correctness is about. In order to ensure programmers get maximum support in preventing accidental changes, C++ has provided a number of extras. Every effort has been made to ensure that safe conversions are allowed without having to use a cast. A number of subtle requirements relate to multiple levels of indirection. C++ allows as many automatic conversions of qualified pointers as it could specify as being safe. C took a different route which results in casts being necessary for many multi-level conversions even when they are provably safe. If you think this is purely theoretical, consider the restrictions on a function parameter if you are going to pass the command line arguments (`argv`) to it.

Every C++ programmer knows that `const` spreads through their source code. Those who understand software engineering welcome this as it helps them write code that is more robust even if more verbose. Trusting the programmer is fine but many programmers would prefer to have to identify (by a cast) the times they want to be trusted.

Traditional C programmers see `const` in a very different light. Indeed, they talk about `const` variables. C only pays lip service to the idea of a genuinely `const` object in the sense that it can be placed in ROM. They view the spread of `const` through their code as a form of poisoning which in some way damages the traditional 'trust relationship' between programmer and compiler.

A good example of the difference in attitude is shown by the way that C and C++ handle `strchr()`. C has no problem with having a return type of `char *` when the function returns an address within a string that was passed as an argument to a `char const *` parameter. The programmer using `strchr()` will know if the string passed

in was really a `char const *` and if so will avoid using the returned pointer for writing.

To the C++ programmer this is unacceptable because the `const` qualification would be stripped from a `char const *` by passing it through `strchr()`. The solution for C++ was to allow overloading on `const` qualification and provide two prototypes:

```
char const * strchr(char const *, char);
```

```
const * strchr(char *, char);
```

Actually this costs nothing at execution time as we can implement it as:

```
char const * __strchr(char const *, char);
inline char const * strchr(char const s*, char c)
{ return __strchr(s,c); }
inline char * strchr(char * s, char c)
{ return const_cast<char *>(__strchr(s,c)); }
```

When writing or maintaining code it is helpful to understand the philosophy that underpins the language you are using. Note that the cast is certain to be safe because all it does is to remove the `const` qualification that has been acquired as a consequence of passing through `strchr()`.



Last month's problem

Many of us are aware of the need for using casts when manipulating addresses through `void *` in C++. Unlike C, C++ requires a cast to convert a `void*` to a `T*`. We are also aware that it is good practice to use the new style C++ casts. In that context, can you see any problem with the following code?

```
int comp(void const* vp1, void const* vp2) {
    T const* tp1=reinterpret_cast<T const *>(vp1);
    T const* tp2=reinterpret_cast<T const *>(vp2);
    return tp1->compared_with(*tp2)
}

int main(){
    T array_of_T[10];
    // do something to initialise members of array_of_T
    qsort(array_of_T, 10, sizeof(T), comp)
    // do whatever
    return 0;
}
```

Assume that `compared_with` is a suitable `const` member function of class `T`.

This subtle problem will probably not bite you, however you should be aware of the potential for damage and have a policy to ensure that it never happens. Consider:

```
int main (){
    T t;
    T * tptr= & t;
    void * vp1= static_cast<void *>(tptr);
    void * vp2= reinterpret_cast<void *>(tptr);
    cout << (vp1 == vp2)
        ? "equal" : "not equal" << endl; // A
    cout << (static_cast<T *>(vp1) == tptr)
        ? "equal" : "not equal" << endl; // B
    cout << (reinterpret_cast<T *>(vp2) == tptr)
        ? "equal" : "not equal" << endl; // C
    cout << (static_cast<T *>(vp2) == tptr)
        ? "equal" : "not equal" << endl; // D
    cout << (reinterpret_cast<T *>(vp1) == tptr)
        ? "equal" : "not equal" << endl; // E
    return 0;
}
```

What output do you expect from executing this program? Lines B and C should result in 'equal'. There is no requirement for the rest, except that they are well-defined expressions. In other words, this program should not, as far as I know, result in any undefined behaviour. To understand this you need to understand what guarantees are provided by the proposed C++ Standard.

Both `static_cast` and `reinterpret_cast` to `void*` are required to work so that there is no loss of information and so that they are reversible. `void *` variables are required to store data (but not function) pointers without loss of information. However, the two new style C++ casts are not required to preserve information in the same way. If that were the case, there would be no point in having both versions. Granted that the differences are only intended to handle conversions to other pointers to complete types and, generally, only manifest when you are dealing with a complicated type based on some multiple inheritance hierarchy.

The natural cast to use when converting to and from `void *` is a `reinterpret_cast`. In a sense that is what it was intended to do. However, the closest equivalent to a C-style cast is a `static_cast`. This presents you with a problem when passing pointers to `void *` parameters such as the code presented in the problem. As the object code of `qsort()` is probably shared with your implementer's C implementation you would be best advised to stick with C-style casts in such instances. Alternatively, use a `static_cast`.

This is one of those instances where I would be particularly happy to be wrong. Any expert who can quote chapter and verse to demonstrate that using different types of cast to and from `void *` is required to restore a pointer that compares equal to the original would do us all a favour.

This month's problem

The following is the result of some speculation of mine in an article in C Vu (the ACCU periodical) followed by discussion both electronically and over a couple of pints after a C++ Panel meeting. Can the following program terminate early as a result of an assert failure?

```
void fn(T );
void gn(T const &);
int main() {
    T t;
    T tclone(t);
    assert(t == tclone); // A
    fn(t);
    assert(t == tclone); // B
    gn(t);
    assert(t == tclone); // C
    return 0;
}
```

Assume that type `T` has a copy constructor that produces an exact copy and that it has an operator `==` that returns true if and only if the left-hand side and right-hand side are exactly the same. In other words the expression `(t == tclone)` in line A returns true.

If you are a C programmer, ask yourself if you expect any differences between passing by value and passing by pointer to `const` type.

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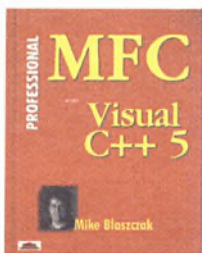
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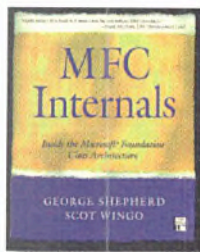
A trio of MFC books reviewed by Gavin Smyth



Everyone who has programmed Windows applications has at least heard of the Microsoft Foundation Classes, or MFC, but not as many have actually used them, partly because the online documentation is not totally satisfactory. Given the large number of books on the topic, all expensive, which one should a competent C++ programmer familiar with the basics of Windows programming choose? Here are three possibilities.

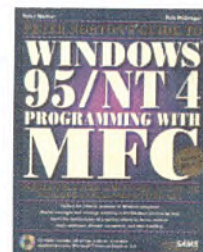
All these books cover the topics you would expect: how to use the MFC, and how the classes relate to each other. Notable common topics include driving Visual C++ (none of the books really mentions any alternative compiler), the document-view architecture and OLE. *MFC Internals* is older than the other two, and describes an earlier version of MFC – the main omission being the Internet classes.

Professional MFC with Visual C++ 5 is definitely not a light bedtime read: it has the highest signal to noise ratio of any programming book I have read for months, but for all that it remains quite approachable. Blaszcak tackles the MFC in a logical manner, though I feel he devotes too much space to the Visual C++ user interface and installation. The description of MFC's document-view mechanism is particularly good, and includes a brief discussion of alternatives. Interestingly, there is no mention of CSocket, etc – maybe these low-level mechanisms are no longer interesting when we have the Internet classes... The book suffers from a high number of typographical errors (not as many as its earlier incarnation, *The Revolutionary Guide to MFC4 Programming with Visual C++*) and, while these are trivial, they are irritating and do cast doubt on the accuracy of the book's contents. The older version of the book was quite a lot cheaper



and possibly better value for money. On to the second one, *MFC Internals*: unless, like Wingo, your job is writing MFC extensions, why would you be interested in the internals of MFC? As I read this book I found myself thinking, 'Ah ha, that's why I have to do XXX'. If I understand why I have to tackle something in a particular way, I am less likely to get it wrong, and Shepherd and Wingo's comprehensive discussion of MFC certainly helps there. The book wastes very little space repeating information you already have with the MFC – routines tend to be described in terms of pseudo-code with references to the source code itself. The highpoint of this book is, I think, the discussion of MFC splitter windows. There is a distinct change of style partway through the book, when OLE is described: instead of just explaining how MFC uses the Windows API, a significant amount of the text explains OLE itself and this feels out of place. In addition, the book covers only MFC 4.0, and database related classes barely get a mention.

Finally, the *Peter Norton's Guide to Windows 95/NT4 Programming with MFC*. I found this book very disappointing. Admittedly, it starts off from a more basic level than the other books, but the treatment of most topics is very superficial, with a lot of repetition and a number of poorly explained or irrelevant topics. I knew I was on to a loser when I found a window C++ class which included as members a pair of functions to convert between integers and strings. Much of the contents is regurgitation of the Microsoft online reference material, including listings from the MFC include files. This book mentions all of the MFC classes, and does include useful topics such



as help file generation, but I would not feel competent at programming MFC after reading this alone. Maybe it is unfair to compare this book with the other two, which are patently directed at advanced programmers, but the back of the Norton Guide does proclaim its suitability for 'casual' users through to 'experts.'

To summarise each book in a single word: Blaszcak is the *how* – how to write MFC programs; Shepherd & Wingo is the *why* – why you have to use MFC in the way you do; and Norton is the *what* – that you can, unfortunately for this book, easily find in the Microsoft online help.

Given the recent additions to the MFC, should you ignore older books? For *MFC Internals*, definitely not: it is a very solid text. In addition, the earlier version of Blaszcak's book is worth rooting out if you want to save a tenner. The only disadvantages are lack of description of newer classes and some explanation of tasks rendered unnecessary by more sophisticated Visual C++ wizards.

Verdicts

Blaszcak

Despite the number of typos, this book is the best source of MFC information you will find. However, I think the new book is much less value for money – I suggest rushing out and buying the old one while it is still in the shops.

Shepherd & Wingo

If you cannot afford the first, or you want something less densely packed (ie easier to read), or you are just plain nosy about MFC from the inside, get this one.

Norton & McGregor

Keep your money in your pocket.

Title: *Professional MFC with Visual C++ 5*

Author: Mike Blaszcak

Publisher: Wrox Press

ISBN: 1-861000-14-6

Price: £56.49

Pages: 980

Title: *MFC Internals*

Author: George Shepherd & Scot Wingo

Publisher: Addison-Wesley Developers Press

ISBN: 0-201-40721-3

Price: £34.90

Pages: 690

Title: *Peter Norton's Guide to Windows 95/NT4 Programming with MFC*

Author: Peter Norton & Rob McGregor

Publisher: Sams Publishing

ISBN: 0-672-30900-9

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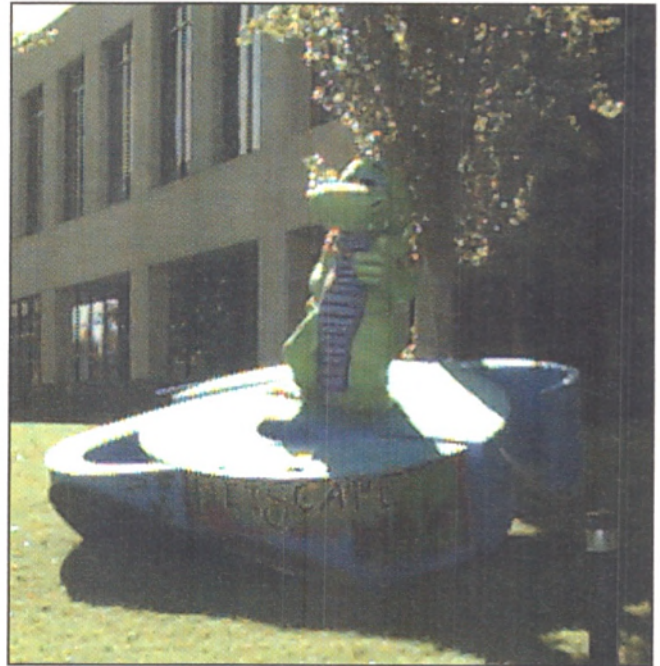
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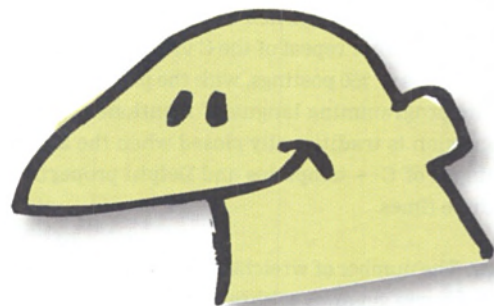
Mozilla stepping over IE4

On the night of the launch of Internet Explorer 4.0, someone dumped the huge IE logo, used during the launch, in front of Netscape's building. Instead of having the heavy metal object removed some Netscape employees tipped it on its side, fixed on the top of it their own mascot: a seven foot tall Mozilla, and painted on the side 'Netscape Now'. Ctrl-break is impressed by this neat hack which brings back fond memories of the many pranks going on at MIT some years ago.



Permission to use this picture was granted by MacInsider, <http://www.macinsider.com>

A compiler with a sense of humour



Ctrl-Break received the following error messages by email, they were attributed to Apple's MPW C compiler. The tipster claims 'They are all real'. Not having a Mac handy we can't test the veracity of this claim. Anyway, if this compiler didn't generate these messages, one should...

- String literal too long (I let you have 512 characters; that's 3 more than ANSI said I should)
- ...And the lord said, 'lo, there shall only be case or default labels inside a switch statement'
- A typedef name was a complete surprise to me at this point in your program
- You can't modify a constant, float upstream, win an argument with the IRS, or satisfy this compiler
- This struct already has a perfectly good definition
- type in (cast) must be scalar; ANSI 3.3.4; page 39, lines 10-11 (I know you don't care, I'm just trying to annoy you)
- Can't go mucking with a 'void *'
- Can't cast a void type to type void (because the ANSI spec. says so, that's why)
- Huh?
- We already did this function
- This label is the target of a goto from outside of the block containing this label AND this block has an automatic variable with an initializer AND your window wasn't wide enough to read this whole
- Call me paranoid but finding '/*' inside this comment makes me suspicious
- Too many errors on one line (make fewer)
- Symbol table full -- fatal heap error; please go buy a RAM upgrade from your local Apple dealer

Stob — Rules Ok

'Moore's law... suggests that the number of transistors that can be fitted on a chip doubles roughly every 18 months.

Moore's meta-law... says that every improvement in the technology of chip-making is followed by a spate of press articles (most of which begin by describing Moore's law)... and that the number of such articles also increases at an alarming rate' – *The Economist* 27/9/1997.

The Mosaic Constant: Wherever you are in the Universe, and whatever velocity you are travelling at, the current version number of both Netscape Navigator and Internet Explorer web browsers is always the same, to within ± 0.02 .

Tosh's First Consequence: If P_l is the price of a laptop PC of a given spec, and P_d is equal to the price of the equivalent desktop PC then $P_l = (P_d)^{1.1036}$ holds true for any laptop, until it is stolen or dropped.

Kernighan's Conundrum: Any mention of Delphi in a Cix C++ conference will set off yet another repeat of the C vs Pascal religious discussion, lasting in excess of 250 postings, with the paper 'Why Pascal is not my favourite programming language' mentioned within the first 50. The discussion is traditionally closed when the argument about the advantages of C++ templates and Delphi properties has been rehearsed three times.

The y2K Quotient: The number of wretched, overhyped Year 2000 stories *Computer Weekly* can get away within a year without appearing ridiculous. NB: this number is generally established to be somewhere between 0 and 1, but CW calculates it as '99' owing to an error in its implementation of the standard algorithm. Where is a y2K consultant when you need one?

Parkinson's Law of Data: 'Data expands to fill the space available for storage'; buying more memory encourages the use of more memory-intensive techniques. Although in these days of 9 GB hard disks being shipped with really rather common or garden PCs, it is getting harder and harder to keep this much-loved old proverb true. But you can contribute. We find that 'backing up' the contents of a few magazines' cover CD-ROMs helps. There's nothing like a crippled version of *Dungeon Keeper* for filling up those idle megs.

Smedley's Measure of Machine Sexiness: Generally acknowledged as the most accurate metric of geek attractiveness of a given machine, it is best expressed thus:

$SMMS = (\text{number of LEDs on front}) * (\text{number of flashing LEDs on front})$

Thus one of the sexiest machines around is the Editor's BeBox, which as I recall boasts two functionally pointless rows of green LEDs on its front which flash, suggestively, when you turn it on. [This is completely untrue as the LEDs do show the activity of both PowerPC CPUs – Ed.]

Finnegan's Deltas of Pentium Pricing: These are the small but annoying differences (or 'deltas') between the price for a given spec of machine on Dell's website, the price given in Dell's advertisement in next month's *PC Pro*, the price given to you verbally by Dell's salesperson, the price he faxes through four hours later and the price quoted in the mailshot you receive the day after your new machine arrives.

Basic's Law of Basic Basic: States that whatever they do with it – hide the line numbers, clean up the variable declarations, 'visualise' it, add objects and a native code compiler – Basic is Basic is Basic is Basic is Basic. And it's rubbish. This law is an alias for 'C++ Programmer's Hubris'. But it's still true, haha.

Test exercises

1. If A buys a laptop worth £1600 and a PC worth £800, while B has a PC worth £2000, a laptop worth £4400, and a mobile phone worth £480, then a) what word does A use to describe B when he believes B is out of earshot and b) what are the letters on the personalised numberplates of B's BMW?
2. Starting from Tosh's First Consequence, derive and prove Aitch-pee's Last Surprise, namely that if P_{HP} is the price of a laser printer of a given spec, and P_T is equal to the price of a replacement toner cartridge then $P_T = P_{HP} - £5.25$
3. Compare and contrast the way that Kernighan's Conundrum operates in a CompuServe forum populated solely by garrulous Americans ('Randy: Hi!!!! <bg>') and a Pascal Usenet group that has been colonised by a small group of Argentinean C++ programmers who learned their English from Herbert Schildt's *The Complete C++ Reference*, Second Edition. Try not to introduce multiple inheritance or dangerous use of the `with` statement into your answer.
4. Which is the sexier machine: a rack mounted hub with 32 connections, or the radiator of the talking car from *Knight Rider*? Include diagrams.
5. Show how the Mosaic constant is derived from Trevor's Axiom of Office Suite package version numbers. Explain this sequence as though to a group of aliens from the planet Dedros IV, where marketing has not yet been invented: Word 1, Word 2, Word 6, Word 95, Word 97.
6. Using proper graph paper, plot a Finnegan curve for the purchase of two P166 laptops with an extra 16 MB of RAM. Now repeat the exercise for a 300 MHz server with second network card. Shade in the area between the graphs in purple.
7. Write a short program in some dialect of Basic. Be sure to make many loud complaints about how difficult it is, and to blame any bugs or setbacks that you endure on the design of the language. When you have completed the program, boast how much easier it would have been to write it in C, and pretend that you are contemplating doing just that. ■

Please send your answers on a postcard to Verity Stob, c/o EXE, 50 Poland Street, London W1V 4AX, or by email to verity@dotexe.demon.co.uk. – Ed.



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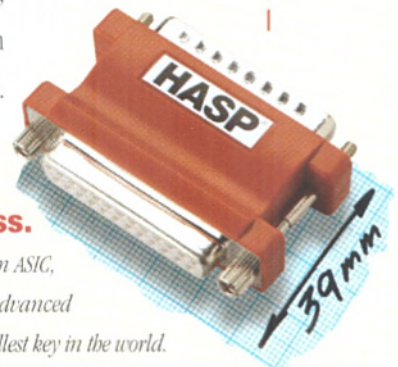
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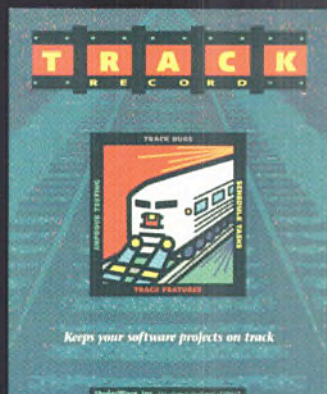
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