THE SOFTWARE DEVELOPERS' MAGAZINE

EXE

ANUARY 1998

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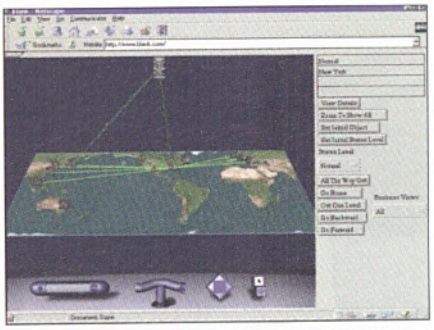

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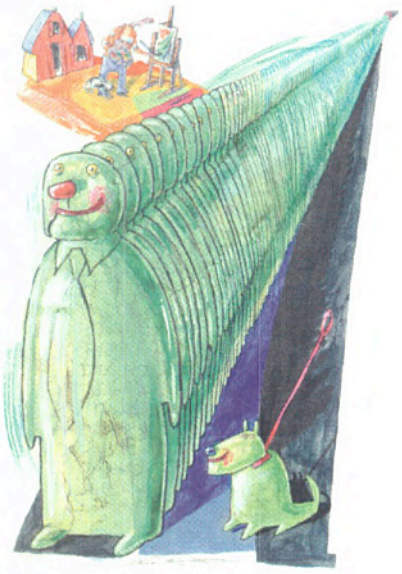

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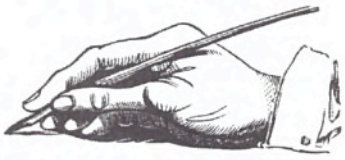

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EXE: The Software Developers' Magazine is independent and not affiliated to any vendor of hardware, software or services. It is published by: **Centaur Communications Ltd, St Giles House, 50 Poland Street, London W1V 4AX**. *EXE* **Advertising/Editorial/Production 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 Photograph:** Franwyn Black **ISSN:0268-6872**

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Enquiry No. Ja3

The standard of standards

C++ finally made it as a standard (see *Hey, we're done!*), Sun has been approved by the ISO as a Publicly Available Specification (PAS) submitter for Java. The World Wide Web Consortium (W3C) announced the release of XML1.0 as a W3C Proposed Recommendation...

Suddenly there's a flurry of standards being approved or near the final steps of approval. But do we really want standards?

Usually by standard we expect a generally agreed specification maintained by an independent body. There are two issues with this definition: how independent the body and process has to be, and how long the whole process takes. If you don't believe in the independence of the organisation guaranteeing a standard then you might as well use any proprietary technology promoted by an industry heavyweight. For instance, do you consider the PAS statute of Sun sufficient not to deem Java a proprietary technology?

It is dangerous to standardise a language too early in its life.

Trickier and more interesting is the question of standardisation time. For any such process requires several reviews. In essence what is standardised is a technology which was developed several months, if not years, ago. The C++ standard took eight years!

Recently, Borland's DavidI was recalling a conversation with Bjarne Stroustrup about the C++ and Java standardisation processes. It seems that Stroustrup was of the opinion it is dangerous to standardise a language too early in its life. Once you have a standard you don't want to change it; this prevents experimentation and potential improvements.

Since Java is so young and Sun still has quite a stronghold on its standardisation process, I would have thought that the PAS statute would have been badly received by most Java tools vendors. To my surprise all the ones I've talked to are very happy with the way it is going. They all feel that Sun is doing a great job with the language. Of course I haven't asked Microsoft...

David Mery

Hell hath no fury like an email spammed

Nothing is guaranteed to make you feel smaller than making a really big mistake; so you can imagine how small I felt, one day in early December, when I discovered that I had inadvertently given out the usernames and passwords of 280 users of EXE OnLine to each of the other 279 people on that particular list. Just to add insult to injury, the unwitting victims of this error were each sent 280 copies of an email which by the end of the list ran into the hundreds of kilobytes in length. To say I was horrified would be the understatement of 1997, 1998 and probably 1999 as well.

We have been using a server-side ActiveX component to send out automated registration emails. Invoking the component is a matter of instantiating it, setting properties for the subject, message text, recipient and sender, and calling `SendMail` to dispatch it. At the start of the design process we used a different component from the one we use now – I replaced the original because it proved to be incompatible with the latest version of the server software we were using. The new component does not clear any of its data when `SendMail` has been called, unlike its predecessor. In fact, as I discovered, the only way to clear these lists is to delete the object entirely as there is no method provided to reset the recipient list. This 'feature' was not in the documentation and as a result I was taken completely by surprise.

The end result was that the recipient list continued to grow instead of being reset, and the mail body text began to repeat instead of being replaced; this is how other people's usernames and passwords came to be sent to the whole group.

As the morning wore on I was heartened by a message from our ISP that only 335 messages out of an original 12000 or so had actually been sent, and the rest were caught in the SMTP queue and deleted. A barrage of 'recipient not found' messages brightened me even more – many of the email addresses were no longer valid. Nevertheless, a number of users were deluged with unexpected mail, and a large number of passwords were compromised.

I expected and did receive many emailed complaints, some polite, some not so polite; all justifiably angry at a gaping breach in our security. I sent out an apologetic email to those concerned, which solicited some kind replies from the understanding, and angry claims that I should have known better and should have tested my work. To protect the security of the affected users, I deleted the accounts for which passwords were disclosed and notified the users accordingly.

Every developer dreads this kind of bug; obvious and yet unexpected. Contrary to some people's impressions, I did (and always do) test my scripts before letting them go live. On this occasion, I tested by using the script to send mail to myself. However, because this test only ran through one iteration of the loop, I didn't spot the problem. In hindsight it's obvious that I didn't do a thorough enough job of the testing, and I have revised my procedures to prevent a repetition.

I'd like to make it clear that EXE OnLine remains resolutely against email spam in all its forms, and committed to keeping all user information confidential. Less than 1% of our user base was affected by this incident, although of course that's one percent too many. Like everyone else, we make mistakes, and as large software houses regularly demonstrate, bugs will creep into code even in the face of rigorous and disciplined testing. To everyone affected by this incident, I offer my sincere apologies.

Neil Hewitt

Building software from blocks

Compuware has signed an agreement to acquire the shares of **NuMega**. It will become Compuware's fourth development laboratory, leading Windows/NT development. Compuware's **QACenter** is the most likely beneficiary of NuMega technology in the 'near term'. NuMega will maintain its own product line and strategy.
www.compuware.com

Support for **VC++ 5.0** has been added to **Look!** by Objective Software Technology. The run-time visualisation and debugging tool provides dynamic views of the structure and behaviour of executing C++ applications.
www.objectivesoft.com

GeoBeans, a library of JavaBeans **visualisation components**, has been announced by **Interactive Network Technologies** for release early in 1998. There are beans for contours, maps, and seismic displays. GeoBeans is based on **Carnac**, INT's object-oriented graphics toolkit.
www.int.com

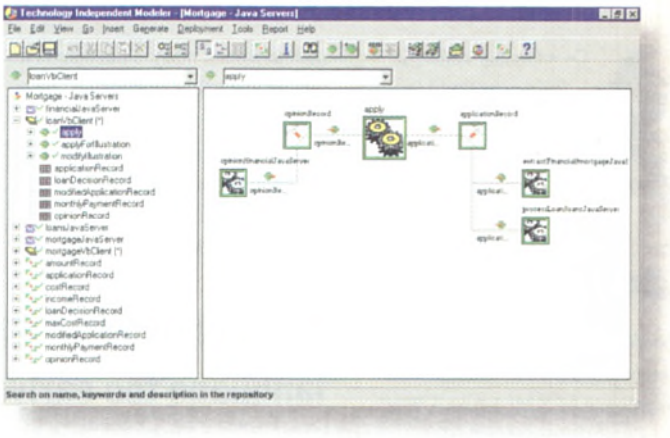
Embedded System Products has released **RTXC 3.2**. The optimised real-time kernel has been modified to take advantage of **ColdFire's** memory saving RISC processor architecture. It also features a compiler binding for Diab Data's D-CC and C/C++ compiler suite version 4.1.
www.rtxc.com

XDB Systems has released **ExpressLane 2.0**. The data access middleware includes configuration and administration features to cut installation times and a new **JDBC** driver for Java performance enhancements.
www.xdb.com

SuperNova's Visual Concepts 1.1 is finally available. It's a component-based development/deployment environment composed of a directory service a modeller handling the metadata, an execution broker with a COM-Corba bridge, and a deployment manager.

Each application is viewed as a set of components, which can be written in any language (C++, Cobol, Java...). The components can be created with any development tool or with SuperNova's Application Developer. Each component is entered in the repository as an encapsulated piece of software with metadata to describe it.

The modeller allows developers to visually join components by matching inputs and outputs of components (name-based matching) or by matching datasets. The metadata associated with each component acts as a glue and helps the modeller (the screenshot shows a graphical analysis of 'glued' components). There's no conflict handling, the first match takes precedence.



The Component Execution Broker establishes communication between components and supports COM, DCOM, Corba, IIOP, and DCE. The broker includes a Visigenic Corba-COM bridge. The deployment manager generates scripts and ftp-s the components to the chosen client or server. Several targets can be identified to run components. A simple round-robin load balancing selects a server at deployment time.

A complete trace of all component interactions can be logged and breakpoints can be associated with any interaction. The debugger just stops the applications when the flow of execution is transferred from one component to another, it doesn't invoke a language specific debugger to delve into the code.

Development with version 1.1 is on Windows NT, deployment is supported on Windows 95, NT, and Unix. Developer licences start at £5,000, and runtime licences at £435.
w www.supernova.com

Suite for rapid prototyping

Version 3.0 of dSPACE's Real-Time Interface (RTI) has been released. It enables code generated from graphical control system block diagrams (modelled in The MathWorks' Simulink/Stateflow/Real-Time Workshop) to run on dSPACE hardware for real-time execution.

The combination of RTI and Simulink/Stateflow/Real-Time Workshop is intended to provide a suite of development tools for the development and rapid prototyping of embedded control systems. Software development and testing of applications can take place concurrently with hardware design.

dSPACE RTI 3.0 starts at £1000 for Windows 95 and NT. The tools will be distributed, in the UK, by Cambridge Control.
w www.camcontrol.co.uk

Its good to talk with ActiveX

Nexus Telecom has released activeX pbX, an ActiveX component which offers developers access to Computer Telephony Integration (CTI). It allows applications to be integrated with Nexus Call Server PBX hardware. It's an ActiveX interface for an office phone system (PBX) and it provides for the integration of telecomm functions into a PC application without requiring extensive programming or telecomms experience. Example applications (for C/C++, VB, and Delphi) include help desks and contact managers for Dial by Name, and automatic record lookup using Caller ID, as well as Voice Mail, Least Cost Routing, Automatic Call Distribution, and management information reporting.

The control links to the Call Server TAPI (CSTAPI) interface that uses 20 message types to implement any application and supports all CTI mechanisms, including 1st and 3rd party call control and logical association between phones and PCs. It has full, application independent, approval and requires no further telecomms certification.

The Nexus Call Server PBX is based on PC cards that slot into a PC server on an organisation's LAN. The current system has a maximum capacity of 12 outside lines and 40 extensions. The PBX hardware costs £2500.

The full activeX pbX package includes TCP/IP networking software, demo applications, source code and technical support and retails at £750 with no distribution or licence fees.

t 01865 847400

VisualAge gets into e-business

The worldwide launch of IBM's VisualAge e-business coincided with UK's first Java exhibition, Java 97. The newest member of the VisualAge family focuses specifically on e-business. It's a suite of existing tools to enable businesses to extend applications and data to the Web. As well as the ability to design and manage web sites, create multi-media graphic applets, and connect to existing legacy systems, it provides the scalability to create a dynamic transaction oriented web application.

The major components of VisualAge e-business (there are 15 in total) include VisualAge for Java Enterprise, NetObjects Fusion, VisualAge WebRunner, Lotus BeanMachine, Lotus Domino Go Webserver, DB2 Universal Developers Edition, and Netscape Navigator.

The key component is VisualAge for Java Enterprise, an application development environment designed to connect Java clients to existing enterprise applications. With its emphasis on support for Java, e-business applications can be ported to any operating system that supports the standard. JavaBeans, applets, and servlets can be created in VisualAge for Java, re-used in BeanMachine, and assembled into Web pages with NetObjects Fusion. All links can be tested with DB2, Domino Go Webserver, and Netscape Navigator before a site goes live.

Version 1, retailing at £2000, runs on Windows 95 or Windows NT 4.0 environments. For system requirements, 64 MB of RAM is the minimum recommended, with a typical installation taking 400 MB. The installation and configuration of TCP/IP is a prerequisite.

w www.software.ibm.com/ad/vaebus

Web server for embedded systems

Enea OSE Systems, from the world of RTOS, has released OSE Web Server. This will enable a network-connected target application to be interfaced with a Web-based GUI. It is compatible with browsers such as Netscape and IE and runs on top of the OSE INET TCP/IP stack, as well as on some third party stacks.

The OSE Web Server generates web pages for display within a browser. It supports the functions of generating HTML Web pages dynamically, using a Web page compiler, and the downloading and uploading of files. The idea is to enable software engineers to use familiar Web browsers as tools for the analysis and management of target devices. Generating HTML Web pages dynamically means that continuous run-time information from a target is displayed in the browser, to be used during debugging or run-time supervision of a field-based system.

The Web page compiler enables running Java applets and files to be displayed in a browser. This feature allows compiled files to be viewed in a tree structure as in a virtual filesystem. If a standard filesystem is needed then this is provided by OSE's embedded filesystem, which supports the uploading and downloading of files via ftp.

w www.enea.se/engelska/index.shtml

Registry support for components

From the world of enterprise component construction, Sterling Software has announced further support for the Microsoft Repository across its COOL family of application development tools. Developers will be able to use Sterling's tools to share component specifications via the Repository.

As well as its model-based AD tool, COOL:Gen, and its component-based OOAD tool, COOL:Jex, upcoming component specification products will also use the Repository.

Developers will be able to create component specifications and pass them to COOL:Gen, COOL:Jex, or to other tools for implementation. Component specifications that have already been developed in COOL:Gen or COOL:Jex may be published to the Microsoft Repository, enabling it to act as a catalogue of business-level components and making these components reusable by any Microsoft Repository-enabled tool.

w www.sterling.com

Code analysis

Smaller companies may have the same problems facing them with Y2K or general maintenance tasks as larger organisations but without the resources. They are targeted by Reveal from Quality Awareness UK. It includes all the functionality of its Legacy Systems Workbench product but the amount of code that can be analysed is limited. It is available for C/C++ and Cobol. Source code is parsed to create a Knowledge Repository incorporating a complete system inventory, metrics, and hypertext links between code objects.

Legacy Systems Workbench itself has been improved. Version 2.5 features a more powerful data field researcher. It runs on Windows 3.1, 95, and NT.

t 0171 328 0300

Sun as PAS

ISO has announced that the majority of its Joint Technical Committee voted to approve Sun's application to become a Publicly Available Specification (PAS) Submitter. In the final ballot, 20 countries voted 'yes', 2 voted 'no' (US and China), and 2 abstained. With this approval, Sun may now begin to submit the Java platform specification for standardisation.

w java.sun.com/aboutJava

Compuware has added Internet and Telnet support to **QALoad**, the server load and performance tester for open systems. It simulates the user activity associated with client/server, **Unix** hosted, applications. **HTTP requests** between a browser and server are recorded and converted to an emulating script.
www.compuware.com

The forum for technical discussions, of the **Embedded Software Association** (ESOFTA), is operational. Intended to improve user-to-vendor communications in the embedded industry for technical issues or problems, services planned for 1998 include a public **software repository** for developers.
www.esofta.com

Pericom Software has announced a new version of its Java-based *teem*world software. The terminal emulator for Java clients includes full 128-bit key encryption to secure host-to-desktop connections, through support of **SSL**.
www.pericom.co.uk/products

The Foundation for Intelligent Physical Agents, **FIPA**, has the goal to establish standards for **agents** and their attributes. FIPA 97 v1.0 is already on its Web site. FIPA 97 2.0 incorporates adaptations deemed necessary to take into account the results of field trials and will be available this year.
http://drogo.cselt.stet.it/fipa/

Sun Microsystems has announced the opening of seven new **Java Centres** across the UK. They are intended to assist companies in developing new business applications using Java. Each centre will have a specific industry focus, covering sectors such as finance, retail, and arts.
www.sun.co.uk/java/jcentre.html

Instruments know where they stand

ObjectStore 5.1, the object database from **Object Design** includes a component server framework, compliance with the XA transaction processing standard and an enhanced, ODMG-compliant **Java interface**. It can be integrated into a Windows environment with Object Design's ActiveToolkit suite.
www.odi.com

Luxent Webworks is releasing **Website-3D**, a suite of ActiveX controls to support the drag and drop of 3D controls into HTML pages. A **preview version** is available for download, including 3D Label, 3D Hover-Buttons, and 3D Group Box components.
www.luxent.com/3d

MapInfo Professional 4.5 reduces the time required to perform some key mapping tasks such as building thematic maps from different data sets, storing queries, adding reports to a map presentation, and working with AutoCad data.
www.mapinfo.com

Version 2.0 of **Developer/2000, Oracle's** scaleable enterprise client/server and **Web development** tool, is available. It now incorporates an integrated set of builders for creating forms, reports, charts, and procedures, without any coding. An Object Library supports reuse of components.
www .oracle.com

Jamba Animator 2.0 is a tool from **Interleaf** to animate static Web sites without additional Java programming. It offers an intuitive point-and-click interface to create animation applets with graphics, sound, and special effects like Zoom and Fade.
www.interleaf.com

National Instruments has announced an upgrade to its LabWindows/CVI virtual instrumentation development environment. Version 5.0 offers improved program execution, wizards to simplify driver development, and multithreaded libraries for advanced system development.

The new Instrument Driver wizard adds 'run-time intelligence' to drivers, enabling the software to track the state of instrument settings at all times. Using this knowledge, the instrument drivers eliminate redundant commands to minimise instrument processing and reconfiguration.

A new DAQ Channel wizard interactively defines the input channel transducers, such as thermocouples and strain gauges, which make up a data acquisition system. The aim is to relieve the developer of handling conversion algorithms and scaling in their code. Wizards can also be used to simplify ActiveX Automation. The ActiveX Controller wizard automatically builds code for controlling ActiveX Servers from LabWindows/CVI programs.

The multi-threaded I/O, analysis, and user interface libraries are aimed at developers requiring thread-level execution control. The libraries enable developers to separate the operations of their programs, such as continuous data acquisition or complex analysis routines, onto different execution threads to improve CPU utilisation or take full advantage of multiprocessor PCs. This is particularly aimed at applications that must continually acquire data but also ensure that no data is lost from user interface manipulation.

The new version delivers 3D data visualisation capabilities for building advanced instrumentation systems as well as interactive debugging. Performance improvements of up to 50% are claimed for GPIB, VXI, and PXI test systems.

Windows NT, 95, and 3.x for PCs and Sun SPARCstations platforms are supported (run-time libraries are available for Hewlett-Packard workstations).
w www.natinst.com

Apptivity 2.0

Progress Software has launched Apptivity 2.0. The tool supports the rapid building of cross-platform applications in 100% Java, enabling developers to create browser-based and client/server database applications. Applications can be deployed to any 1.02 or 1.1 JDK platform and Apptivity is compatible with DB2, Informix, Access, Oracle, or other JDBC data sources.

The new release includes a suite of wizards, an enhanced visual UI, a distributed debugger, and Corba integration. The debugger allows developers to test and debug distributed applications locally and remotely.

Apptivity Developer is priced at £1350 and includes a 5-user server connection.
w www.progress.com/java/apptivity

UI JavaBeans bundle

ProtoView has released JSuite, a low priced bundle of 17 individual JavaBeans to provide a set of UI display and editing components. Made up of five smaller packages – CalendarJ, DataTableJ, TabJ, TreeViewJ, and WinJ component library – JSuite offers a range of components from data validation to date, numeric, and currency formatting. Although an integrated package, each JavaBeans component has been designed to stand alone in an application. The sizes of the components vary from 26 KB to 86 KB. JavaBeans 'Customizers' are also added as an extra feature.

The WinJ component library includes a Numeric Edit, a Currency Component, a Date and Time Edit, a Mask Edit, a Static & Edit Text, Spin Buttons, Combo Box, and Image, Round & Square Buttons.

TreeViewJ adds colour highlighting of nodes, font selection per node, and advanced sorting and searching capabilities to the standard Windows treeview API.

JSuite ships with both JDK 1.02 and JDK 1.1x JavaBeans (JAR files) and is available from ProtoView for £249 (with source code for £995). Each of the packages within JSuite are also sold separately. Free trial versions are available from the Web.
w www.protoview.com

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http://www.SystemScience.co.uk

Java cross-platform development

Dazzler, the **multimedia** authoring program for creating high impact presentations and interactive training modules, has been upgraded to version 4.1. The environment from **Linotype CPS** simplifies the publishing of **multimedia** programmes on the Internet using HTML and Java.
www.dazzlersoft.com

Barring last minute interventions from three or more National Standards Bodies, an **International Standard** for **C++** is expected by March. The WG21/X3J16 committee meeting has reached a Final Draft International Standard (FDIS). The only changes permitted will be format changes required by **ISO**.

TopSpeed and **Pervasive Software** have announced the inclusion of Pervasive's **Scalable SQL** in Clarion for Windows Professional Edition. The database server (both Windows NT and Netware editions) plus two user licences is included in this edition.
www.pervasive.com

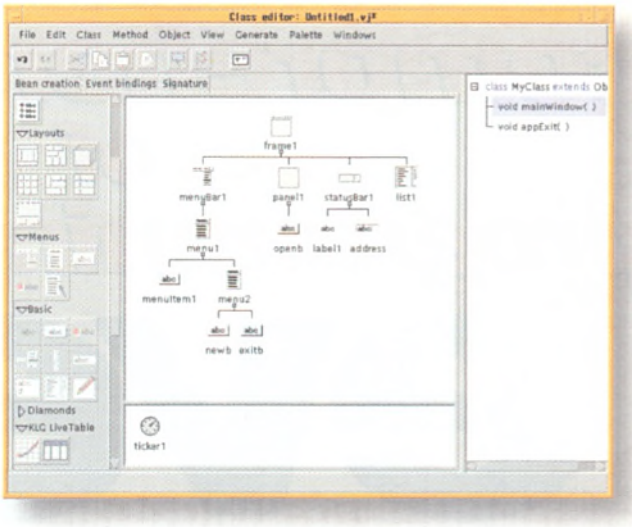
Rational Software has created a Web-based **UML Resource Centre**. The intention is to make the Unified Modelling Language more accessible to software developers. It coincides with the Object Management Group's (**OMG**) decision to adopt UML as an official standard.
www.rational.com/uml/

Rational has also released a new version of its **Objectory Process**, 4.1. This configurable framework for software development attempts to merge the best practices of implementing the **UML** standard with proven solutions for object-oriented and component-based development.
www.rational.com

Imperial Software Technology (IST), makers of the X-Designer Motif-to-Java GUI builder, has announced the first release of its Visaj Java designer. Written itself in Java, it aims to enable developers working with multiple hardware platforms to build cross-platform Java applications. The tool is available on all platforms that support Java, including Solaris, DEC Unix, and Windows 95 and NT. It fully supports JDK 1.1 and the interface from X-Designer has been maintained.

Visaj provides a range of tools for manipulating Java and JavaBeans, including a visual class editor, AWT (abstract windowing toolkit) layout editors, a dynamic event editor, and a resource bundle editor.

The AWT editor wizard speeds the construction of Java user interfaces by providing a point-and-click palette of components and a design tree, which



displays the containment hierarchy. Properties can be set on multiple components and multi-level undo is supported. GridBag and Border layout editors are included. The event editor can dynamically display event bindings and the resource bundle editor enables the creation of internationalised versions of products.

A set of JavaBeans components, called Diamonds, are included. These extend the AWT to provide controls and layouts such as a toolbar, status bar, splitter, and framed panel.

Visaj is priced at £695 per licence, which includes one year of support and upgrades.
w www.ist.co.uk

MapObjects upgraded

ESRI, the makers of GIS software and spatial database management tools, has upgraded MapObjects to version 1.2. This is an ActiveX control and a collection of 35 programmable automation objects.

It works with SDE (ESRI's universal geodata server for storing and managing vector, CAD, and image data) version 3.0 layers and supports new SDE capabilities such as connection to multiple servers, use of annotation, and recordset searching. The new version of MapObjects includes enhancements in support for Windows bitmap files, improved performance in the FindGeoDataSet method, and handling unstructured data sources such as text or Excel spreadsheets.

Version 1.1 users are offered a free upgrade. For new purchasers, ESRI's Data & Maps Volume 1 (1.2 GB of ready to use data) is bundled.
w www.esri.com

20/20 Visualisation

An IRIS Explorer Centre of Excellence has been established at the University of Leeds. The Centre will provide a focus for research and development linked to the IRIS Explorer data visualisation and application builder software.

IRIS Explorer is a visual programming system for data visualisation and animation, designed for scientists and engineers to create applications for displaying and analysing complex multi-dimensional datasets interactively. The Centre is aiming to provide a repository of user-contributed modules available for general use and to support users through the provision of online training materials.

The Centre provides links to sites which offer IRIS Explorer modules for downloading, including the University of Princeton, which has developed modules to support atmospheric and oceanographic research. The new Centre is particularly concerned with the development of World Wide Web projects. One current project, JAVA, is concerned with how best to make use of Java to write IRIS Explorer modules. This would potentially allow Java code, sited at any location on the Internet, to be dynamically incorporated within an IRIS Explorer map. Another project involves VRML (Virtual Reality Modelling Language) to facilitate the publishing of scenes generated by IRIS Explorer on the Web.

IRIS Explorer Release 3.0 is currently supported on Hewlett-Packard, Digital, and Sun platforms (and Silicon Graphics, where it was originally developed), and Windows NT on PCs. It features state-of-the-art 3D graphics including zoom, rotate, highlight, and reconfigure functions, with custom application development tools.
w www.scs.leeds.ac.uk/iecoe

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Software craftmanship

Programming as a cottage industry? Jules doesn't think so.

Even fifty years ago, manufacturing around the world largely proceeded in a manner we would call cottage industry. Raw materials would arrive at a factory, where skilled craftsmen would work them into finished parts. The process was labour-intensive, slow, and difficult to control. But, the great advantage was that, without any economies of scale, short runs and customisation cost very little more than the regular item.

Although production-line techniques have been used for nearly a hundred years, real economies of scale have become practical only recently. It's always been possible to build a sheet-metal press tool and to derive a cost benefit from building it. It's just that, until recently, the cost benefit was such a small part of the finished product that nobody bothered.

Until plastics. Plastics revolutionised manufacturing. And the thing which made them so important was that they were plastic. You can make a single part in literally any shape you want, in a single casting. There are even processes these days which can make voids and articulating hinges in a single shot. Products can be designed whose cases and internal parts are specified almost without reference to how they will be manufactured. Complexity doesn't affect cost, and even size doesn't affect it by much. What affects the cost of a product is the number of distinct parts in it.

But, in order to be effective, plastics rely upon mass-production. We can make parts as complex as we want for no extra cost, once we have a tool. The costs of designing and making a set of tools are astronomical, but if these are amortised over millions of uses, the cost per unit drops to negligible proportions. This is good, because products can be mass-produced cheaply, and everyone benefits.

Well, not everyone. Back in the days of craftsmanship, it may have taken £2000 (of today's money) to make a not-very-good television set, but a skilled individual could be profitable making ten of them a week. These days, a television is ten times as good for a tenth of the price, but it costs a squillion pounds to build the TV factory. Now, one person can't make a living making ten TVs a month no matter how skilled he is; a thousand unskilled people make a living making ten million of them – all exactly alike.

So, if a multinational is going to spend money on tooling up for a new production line, they had better be damned sure that what they're going to make is going to sell. Ten unsold TVs may be a depressing sight to a lone craftsman, but a million unsold TVs is a much more depressing sight for a thousand robots (and one owner). Where the lone craftsman was able to take risks, to refine his product gradually, and to customise it for special orders, the big factory is able to do none of these things.

A customer with a special requirement, who is happy to pay a bit extra for customisation, can't. Where a TV costs £200, nobody can make a living selling TVs for £2000. This is the paradox of mass production; by reducing costs, increasing competition, and therefore increasing customer choice, it reduces product differentiation, and therefore reduces customer choice. Nearly all TVs have Teletext, nearly all have Nicam, almost none multiscan, and not one uses Koch scanning (a simple technology which enables videophones, picture-in-picture, and compression). On the other hand, it is possible for skilled craftsmen to take an existing mass-produced object, and alter it. The alterations will be small and expensive compared to the device itself, but with some basic service notes, something nearly right can be shoehorned into a use the designers never thought of. That's why there's a big difference between a vanilla Sierra and a Cosworth version.

Like many people, I believed that wide deployment of computers would combine the benefits of mass-production with craftsmanship. Computers would (and did) enable just-in-time stock control, parts customisation, and so on. Unfortunately, apart from very high-volume manufacturing and menu-type ordering (eg specifying options and colour for a car) it hasn't happened. Why should it? Computers themselves don't benefit from such things.

One of the reasons why computers seemed exciting is that it's possible to build a production line with no input materials and no physical tooling. For horizontal markets, this is not much use – mass production is a perfectly adequate model. But it opens the possibility of individual craftsmen developing vertical market products without the overheads of manufacturing.

However, unlike in manufactured products, there's no customisation market at all. Word macros and database programming doesn't change the job a program is doing. And, precisely because duplication is so simple an operation, few people are prepared to release source codes and 'service' information, because they'll lose all their best ideas. On the other hand, a considerable input of ideas is needed, and design is expensive and difficult precisely because everyone has to start from scratch every time.

I'm convinced that the only way we can get quality back into software is by taking positive steps to encourage diversity. I thought for a while that intelligent disassemblers could help, but now I'm not so sure. After all, forcing everyone to release source code (as the Free Software Foundation wants), or encouraging everyone to write for interpreters built into silicon (as the Lisp proponents want) won't solve the problem. Most source code is too low level already, and adjustments will be just as difficult as original writing. If the authors of programs can't maintain them any more, how can anyone else? Perhaps programs should be released as collections of components, analogous to hardware chipsets, though for that to work the components would themselves need accessible internal structure.

Whatever, cottage industry can't co-exist with mass-production – the town ain't big enough for both of them. Mass-production offers real benefits if it's done properly; that is, such as to allow craftsmanship in. But, in computers, mass-production isn't being done properly, which is why nothing works right. ■

Jules is a programmer who roars with rage at even quite expensive software. Email jules@cix.co.uk.

Inspiration

Dear Mr. Mery,
Although December is nigh upon us, here in this colonial backwater we have only just received the October issue of EXE. As usual, the arrival of your magazine has resulted in a full day's loss of work – a productivity lapse we could ill afford – as we read funny bits aloud, photocopied unprecedentedly clear technical explanations for future study, and tore out illustrations to route to our art director (whose admiration of Mr. McHenry's work is leavened by annoyance at our nonstop exhortations to 'do like that, can't you?').

Month after month, your magazine reminds us of the potent magic that can be worked by an editorial staff that dares to mix technical accuracy, clarity, wit, fun, and joy. Every issue informs, instructs, and inspires.

I am sure that you, like we, get occasional letters from readers who would prefer to get their information *Microsoft Systems Journal*-style: the straight stuff, unmemorable, unembellished, dry and soporific. Under the weight of such criticism, I have spend the odd night with a pint or two, questioning whether it is really better to give information more impact and make it more memorable by serving it up in a lively way. I have considered whether it might be better to give up and put together the boring journal that so many readers seem to want. Your magazine has done so much to rekindle my commitment during those dark hours.

Please extend my admiration to everyone who has anything to do with putting EXE together. You have been an unwitting source of inspiration to your American colleagues.

Best wishes
J. D. Hildebrand
Editorial Director, Windows Tech Journal, VB Tech Journal

A really unexpected letter which made our month! It gives me the opportunity to publicly thank Kate Adams, our production manager, for all the hard work she puts in creating the layout and commissioning (and often creating) the illustrations every month. And Kate has managed this feat for over 10 years! Colin McHenry created last May, in a record three-months, most of the redesign but is not involved in the day to day running of EXE. – Ed.

Borland JBuilder

Dear Sir,
It would be wonderful to receive a wedding quilt from Borland, with each member of staff adding his or her own individual touch. However, we must be content with product releases. John O'Connell in your November issue had allowed himself to become frustrated with the terrible documentation but even this has its compensations.

I have spent the morning working the filter and locate examples in the *Programmer's Guide*. The latter worked first time and the former allowed me to explore the product in some depth. When I had found their worked example, not quite where the manual said it was, I could compare my version and theirs to find that what I needed was the `Variant` class. These things stick in quite a different way if you have to work at them a little.

Since I have been working in a 16-bit environment, my old copy of Borland C++ version 4.5 now fits me like an old glove. I have never yet got the hang of version 5.0 but perhaps I will now that JBuilder has shown me how data aware controls work. The database person who set out to explain them in the C++ manual found them too familiar to need explanation and so explained the bits of the development environment that I knew and he had had to reach for.

But it will be nice to get hold of the *Component Library Reference Manual*.
John Marshall
postmaster@accurate.compulink.co.uk

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

New programs for old

Dear Sir,
I was extremely unhappy to read the article in the July 1997 issue, page 25, entitled *New Programs For Old*. (Ok, it takes me a long time to get through my reading pile!)

I have great sympathy for the author's underlying point, which I take to be that code littered with side effects is difficult to read and maintain, I take great exception to his example. The behaviour of the code fragment quoted in figure 1

```
if ( ++i && i--) x = 1;
```

is undefined. (ISO 9899:1990 Section 6.3 Expressions refers). It is not permitted to use the increment and decrement operators, against the same object, more than once between a pair of sequence points. As a result his side effect removal routine ought to report that the code is invalid. It is wrong to suggest that this bugged code can be fixed by any machine-based transformation. It is necessary to investigate what the original programmer actually intended, and write something conformant to achieve it.

If this is the standard of research in our Universities then I want them spending my tax pounds differently.
Richard Howells
R_A_Howells@compuserve.com
Yes, well spotted. Of course, most compiler implementations do not observe the ISO standard. When the concern is to 'transform out' side effects, it is important to define transformations which work on the source as accepted by the local development environment, rather than that expected by the standard. I'm most grateful for your keen observation, but I feel that I must add that your remark about research funding is really rather unjust.
Mark Harman

Bill

Dear Sir,
I was intrigued to notice on a recent visit to the States that Bill Gates is now being called William H. Gates whenever he is mentioned in the press. I feel that this is yet another indication of Microsoft's increasing remoteness, as mentioned in your November Soapflakes.
Tim Bergel
tim@ced.co.uk
It is quite common in the American press to quote full names and the full name of Bill Gates is indeed William H. Gates III. As for the meaning of the H, this remains a mystery... – Ed.

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Talking Corba

ORBs, OMG, IORs and IIOP. The technology of distributed objects is swamped with acronyms. Nicola Baldini, Michele Bini, and Duncan Wilcox navigate the concepts and terminology to show how Corba can simplify client/server development.

Distributed objects are an important trend of client/server computing as businesses and homes become increasingly wired to the Internet. Just like object-oriented programming brings both abstraction and power to programmers, distributed object technologies bring both abstraction and power to programmers in client/server environments.

Whereas object-oriented languages add compiler generated glue and some syntactic sugar to their procedural counterparts, distributed object technologies also add goals derived from the heterogeneous network environment they operate in: language-independence, platform-independence, and cross-vendor compatibility.

Corba (throughout, we will explain this and many other acronyms) is emerging as *the* open distributed object technology; most of the players in the market are part of the Object Management Group (OMG), the organisation controlling the specification. (It is worth noting that Corba is not a product per se, but a set of service and protocol specifications.) Notably absent is Microsoft, which promotes DCOM (Distributed Component Object Model) – its own distributed-objects product that doesn't conform to Corba specifications, although gateways and porting tools exist.

Interfaces and implementations

An Object Request Broker (ORB) is an API for interconnecting objects across a network. It's an abstraction that hides communication details and can take the form of a library, server process, or anything else the particular implementation requires. An ORB will route requests to execute object methods from a client to an object implementation. For ease of use, the client will typically use a stubbed local object that mimics the remote one.

Corba stands for Common ORB Architecture. As of version 2.0, Corba defines the Internet Inter ORB Protocol 1.0 (IIOP), a network protocol designed from the ground up for efficient, reliable, and optionally secure object related communications.

Clients address server objects through Interoperable Object References (IORs). These are pointers used to refer to an object across the net. In the IIOP context, an IOR encodes the IP address and TCP/IP port numbers the server is listening on, and an object key identifying a specific object on the server.

We have introduced the communication infrastructure, but ORBs need to know how to use a remote object and its properties. This is achieved through the Interface Definition Language (IDL), which describes object interfaces. An IDL source only contains the equivalent of declarations; it's unrelated to the language in which the object will be implemented and doesn't contain any implementation detail.

To implement a Corba object, the IDL source is translated to a program skeleton in the target language, in a process called mapping or language binding. This creates a set of source files describing the IDL interfaces we declared, together with other support objects. OMG publishes standards to map IDL to C, C++, Cobol, Ada, and Smalltalk; mappings for other languages are in the works. (The OMG hasn't finalised the Java mapping yet. We are working to the March 1997 draft but it is unlikely that the final draft will differ too much, at least the parts on client-side mapping, ie object usage.)

```
module Crisis1 {
typedef long cid;

struct crisis {
        cid id;
        string description;
        };

exception outOfResources { };

interface iterator {

        crisis curr() raises (outOfResources);

        void next();
        // After last() returns TRUE
        // the iterator is no longer valid.
        boolean last();
        };

typedef sequence<crisis> cseq;

interface Repository {
        exception notPresent {};
        void ping();
        void add(in string d)
                raises (outOfResources);
        void remove(in cid id)
                raises (outOfResources, notPresent);
        long len();
        void retrieve(out cseq s)
                raises (outOfResources);
        iterator iterator()
                raises(outOfResources);
        };
};
```

Listing 1 – IDL source for WCManager.

```
class iteratorServant extends Crisis1._iteratorImplBase
{

private ORB orb;

private Vector data;
private int i;

public iteratorServant(ORB oorb, Vector d) {
        orb = oorb;
        data = new Vector(d.size());
        data = d;
        data.trimToSize();
        i = 0;
        }

public Crisis1.crisis curr() {
        return ((crisisWithEquals)
                data.elementAt(i)).value();
        }

public void next() {
        if (i < data.size())
                i++;
}

public boolean last() {
        if (i == data.size()) {
                orb.disconnect(this);
                return true;
                }
        return false;
        }
}
```

Listing 2 – JavaIDL source of a server

Corba and the web

HTTP (Hypertext Transfer Protocol) was designed with simplicity in mind, and simplicity is indeed its great strength. However, while HTTP's lack of state preservation across sessions allows for very simple and efficient servers, anything but simple client/server applications are very complex to develop. This has forced web application development into a cumbersome mix of data fields hidden in HTML pages, CGI scripts, and cookies.

Corba solves all this, maintaining state information through persistent objects and persistent object references, and improving performance and latency over HTTP through IIOP. There are some issues to be resolved, including widespread availability of free tools (if Apache's success is any indication) and details such as IIOP compatible firewalls, but the pieces are falling in place. Java applets accessing Corba objects over the web is already a cross-platform, vendor-neutral, reality.

While the World Wide Web Consortium is working on HTTP-NG (Next Generation), which promises to be more efficient than HTTP, we can easily envision an IIOP-based web. Quoting Marc Andreessen, the Netscape cofounder: 'We expect that over the next few years IIOP will become as ubiquitous as HTTP and CGI.' And he should know, since the Navigator browser includes Visigenic's Visibroker Java ORB.

Free implementations of Corba

Many Corba implementations exist, either commercially or freely available. Some of the free ones are backed by large academic institutions or big companies that have chosen to promote Corba for strategic reasons. Some implementations attain a good level of performance and are reliable enough to be used as a foundation for serious, mission-critical, projects.

Why then should you buy a commercial product? Corba offers more than just inter-object communication facilities (ie the ORB). OMG also specifies a large collection of services, referred to as the Common Object Services Specification (COSS). These include the naming service (an object directory), the event service (for asynchronous communications), the persistent object service, the transaction service, and the object trader service (to find objects based on functionality). These services, built on top of basic ORB functionality, free the developer from the burden of reinventing the wheel and offer standardised access to high-level features.

Free implementations usually support only the basic services, typically because part of the COSS specifications has not settled down. While a commercial producer has the resources to closely follow the draft with its implementation, free developers, as always short on manpower, usually wait for the final specification.

However, the cost of commercial Corba products is quite high, sometimes in the range of thousands of pounds. You could struggle to justify such an investment just to evaluate the technology. Some ORB vendors recognise this, and offer free licenses of their products for non-commercial use, allowing you to experiment. On the other hand, a free ORB may fit your needs better than a commercial one. For example, the fastest ORB implementation, reportedly, is a free one: the Oracle/Olivetti sponsored, omniORB.

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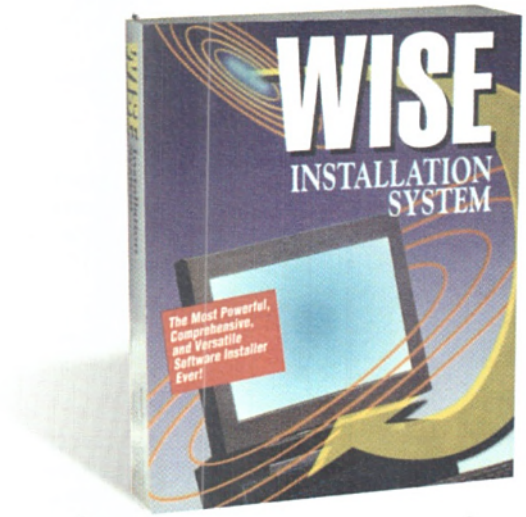

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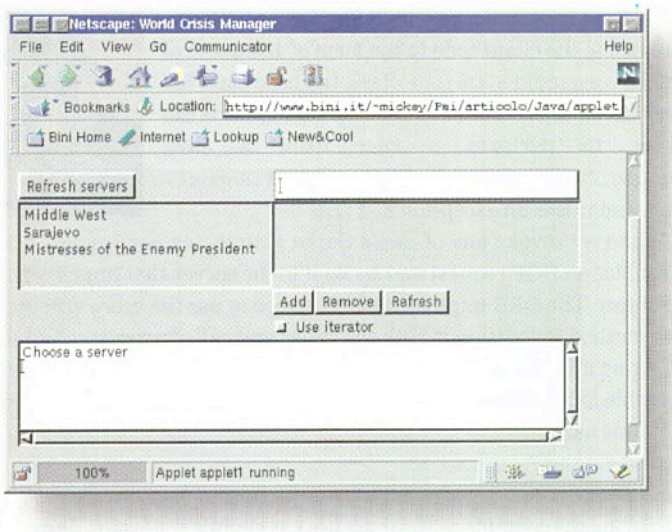

Figure 1 – JavaIDL run within a browser.

JavaIDL examples

We have developed the Java examples in Listings 1 and 2 with JavaIDL, Sun's Corba language mapping and ORB for Java. Although JavaIDL is a good product it has a few shortcomings (mostly due to its immaturity; as we write it's still in beta). It has some problems when run from within browsers, even though it works fine from the appletviewer (see Figure 2). Secondly, it only offers bare-bone functionality: a Java ORB, a COS naming service and the IDL to Java translator, which only runs under Solaris or Windows (apparently it's written in C++, though the final version will be pure Java).

While it is possible to develop incompatible (but standard-compliant) C++ mappings, all Java ORBs that conform with the final OMG specification will have to be compatible down to `.class` file level. This is important for web use because it reduces the amount of custom library code that an applet has to download. Additionally, JavaIDL will be the official ORB included in the next iteration of Sun's JDK (version 1.2) so it will certainly become very widespread.

The best way to navigate the rather complex concepts and terminology is to introduce the ideas behind the code snippets in the Listings.

The scenario: as a member of a superpower Intelligence Agency you are granted clearance to interact with WCManager™, the World Crisis Manager, a facility to circulate the rumours that agents and analysts, scattered all over the world, have collected and analysed! The facility is built upon independent rumour mills (servers), with each one dedicated to a specific topic, eg 'MiddleEast', 'Sarajevo' or, even, 'Mistresses of the Enemy President' (see Figures 1 & 2). Each Intelligence member can connect to any server, adding and removing rumours at will. Each server will be implemented as a Corba object, of course.

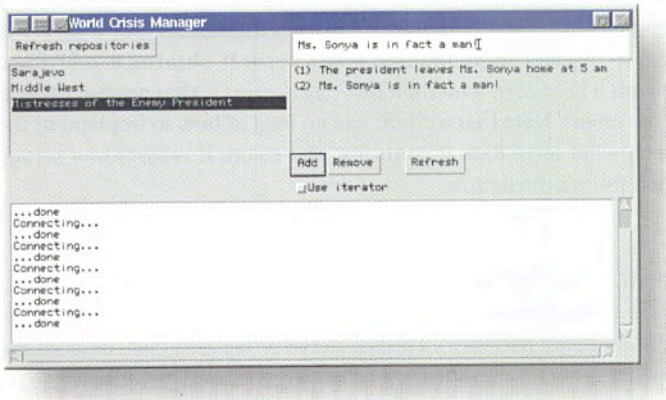

Figure 2 – The World Crisis Manager.

The client

As you can see in the WCManager IDL source (see Listing 1), IDL files resemble a set of C++ declarations. The `module` construct declares the `Crisis1` name space (akin to a C++ namespace or Java package) that will contain the declarations enclosed between the braces.

You might notice IDL constructs that are similar to their C++ equivalents. However, fixed length strings are a built-in type of the Corba IDL and can be specified with the `string<n>` syntax. The IDL provides both fixed and variable length sequences containing data of a generic type, using the `sequence<type>` syntax.

Unlike Java classes or C++ `structs`, IDL ones cannot declare methods (called actions in Corba jargon); they are reserved for objects. Corba objects are instances of some interface, and are complementary to `structs`: they can have action members but not data members. The rationale is that while `structs` contain the data passed around, interfaces model access to objects: any data that an object may contain is a detail of its implementation, so it can't stay in the IDL.

It's often hard to design a good interface for an object, but it's even harder for a remote object

Parameters to object actions can have one of three specifiers: `in`, `out` and `inout`. You can think of `in` arguments as regular pass-by-value arguments and `out` arguments as a way to let an action return data in addition to its return value. The `inout` argument is similar to pass-by-reference, except that in fact the whole argument is moved through the network to the caller and then back.

Corba exceptions are important in encoding possible network communication failures, in addition to server defined ones – you should always be prepared to catch exceptions when calling an action of a Corba object. These exceptions, declared through the `exception` keyword and associated with actions through the `raises` keyword, are somewhat like `structs` in that they can have data members and no actions, but they can't be passed to or returned from an action.

The Java mapping tool, *idltojava*, produces a set of `.java` files, grouped in a directory named Crisis1. (We used Crisis1 as the name for the IDL module and an IDL module maps to a Java package, which in turn is stored in a directory.) A quick look at the files shows that each IDL interface `T` is mapped to three Java classes: `T` is the IOR container and allows us to invoke the actions through stub methods, `THelper` provides some utility functions such as narrowing (a form of casting), and `THolder` which is used when the type is passed out of, or returned from, an action. These Java classes enable us to work with remote Corba objects almost like we would with local Java ones. For the sake of simplicity, we will often omit exception handling.

Interfaces for remote objects

It's often hard to design a good interface for an object, but it's even harder for a remote object. The reason is the method invocation and

Corba IIOP and Java RMI

Why use Corba when Java already offers its own standard for distributed object support, namely Remote Method Invocation (RMI)? RMI is well integrated with Java and surely adding some `extends Remote` in your Java source is easier than messing with IDL files? Apparently Corba and Java offer the same functionality: they both allow you to treat remote objects (nearly) as if they where local.

The answer is that RMI is tightly bound to Java and no easy way exists to connect to servers (or from clients) using other programming languages, such as C++. Corba is designed with language neutrality in mind: armed with IDL alone, you can connect to a server without even knowing if it's written in Java or in C++ (or in Cobol...).

A programmer familiar with RMI will feel at home with Corba under Java, both support the notion of interface/implementation separation and Corba objects can be used in Java with ease. While a Java-only project can successfully use RMI, it's advisable to choose Corba if other languages are used too.

The bottom line is: Java is a formidable product to deliver platform-independent objects, so it's an ideal choice, especially for clients. On the other hand it's possible that you must use some legacy server code, or that performance requirements will lead you away from a pure Java implementation. In these cases Corba will provide the much-needed glue to connect objects in an heterogeneous environment. Sun itself recognises this. It recently announced that RMI will be re-implemented to use IIOP as its underlying protocol, in addition to the native JRMP protocol, so that Java code can access Corba objects.

data transfer overhead inherent in network communication. This mitigates against having many, fine-grained, methods that have a high overhead, but also against few, coarse-grained, methods that transfer a lot of data. In fact, the sample IDL has a weak design that we'll uncover soon.

The `init()` method of the ORB class (that is part of the Corba packages) connects it to the outer world, possibly helped by the argument array that the application or Applet received:

```
ORB orb = ORB.init(args, null);
```

Note that the ORB is local code; it will act as a gateway towards any Corba object we'll refer to, hiding the communication that it will perform to contact that target's ORB.

We are ready to contact a Repository which will be stored in a suitable object:

```
protected Crisis1.Repository rep;
```

This `rep` is an IOR container. We receive its address through the naming service (which we have hidden with its complexities in the `namingSupport` class):

```
public void contactServer(String name) {
  try {
    rep = Crisis1.RepositoryHelper.narrow(
      namingSupport.resolveName(orb,name));
  }
  catch(org.omg.CORBA.BAD_PARAM ex) {
    message.appendText("Uhm, '" + name + "' is not a
      Crisis1::Repository\n");
  }
}
```

The naming service, contacted through the `resolveName()` method, associates names with IORs . These IORs are returned to the client code in the form of instances of the `org.omg.Corba.Object` class, the base class for every Corba object. The `narrow()` method contacts the server to perform a cast from a Java `org.omg.Corba.Object` to a Java `Crisis1.Repository`, and raises an exception if it fails.

When we invoke one of `rep`'s Corba actions (eg `rep.ping()`), it assembles an IIOP request and sends it to the server that implements the object. The ORB implementation is free to use the more efficient Java method invocation if both the caller and called processes run in the same address space. Performing actions on object stubs will resemble local method invocations. Adding or removing a rumour is as simple as:

```
rep.add("Some string");
rep.remove(id);
```

Retrieving the contents of the repository is slightly inelegant, but still easy:

```
Crisis1.cseqHolder s = new Crisis1.cseqHolder();
rep.retrieve(s);
for(int i = 0; i < s.value.length; i++)
  list.add("(" + s.value[i].id + ") " +
    s.value[i].description);
```

Here we use a holder class (which is simply a Java support class, not a Corba object). Corba calling conventions assume that the caller will allocate space for the output arguments – a holder is little more than a wrapper around its value, in this case an array of contacts. Finally, we retrieve the contents using the iterator interface. It's even easier to use, as we don't need to mess with the holder class:

```
for(Crisis1.iterator i = rep.iterator(); !i.last();
        i.next()) {
  list.add("(" + i.curr().id + ") " +
    i.curr().description);
}
```

Unfortunately, implementing a thread safe iterator on the server is more complex than implementing `retrieve()`. Moreover, and this is the design flaw we mentioned, the iterator interface is a net-hog. Instead of retrieving the whole content of the repository with one action invocation, we retrieve elements one by one, using four action invocations for each item (two `curr()`, `last()` and `next()`). That's clearly not optimal; in a real application the correct interface would return a sequence of values, such as `retrieve()`.Why did we show the iterator even though the sample makes sense without it? Apart from giving a good example of a bad design, it demonstrates an important principle of Corba. Namely, there is no such thing as direct (ie in the client's native language) creation and destruction of Corba objects. The client doesn't work with objects, but with *references* to objects implemented elsewhere. It obtains a reference through a `factory`, a method like `iterator()`, that creates objects for the client. Note that a client has no idea of how to implement the object, what local data it contains, and so on; it resorts to a server which knows the details.

The server

To implement the Repository interface, we must create an object to handle incoming requests (conventionally called a servant in the Java Corba-mapping parlance). The `RepositoryServant` class extends the `Crisis1._RepositoryImplBase` class, generated by idltojava.

```
class RepositoryServant
  extends Crisis1._RepositoryImplBase {
```

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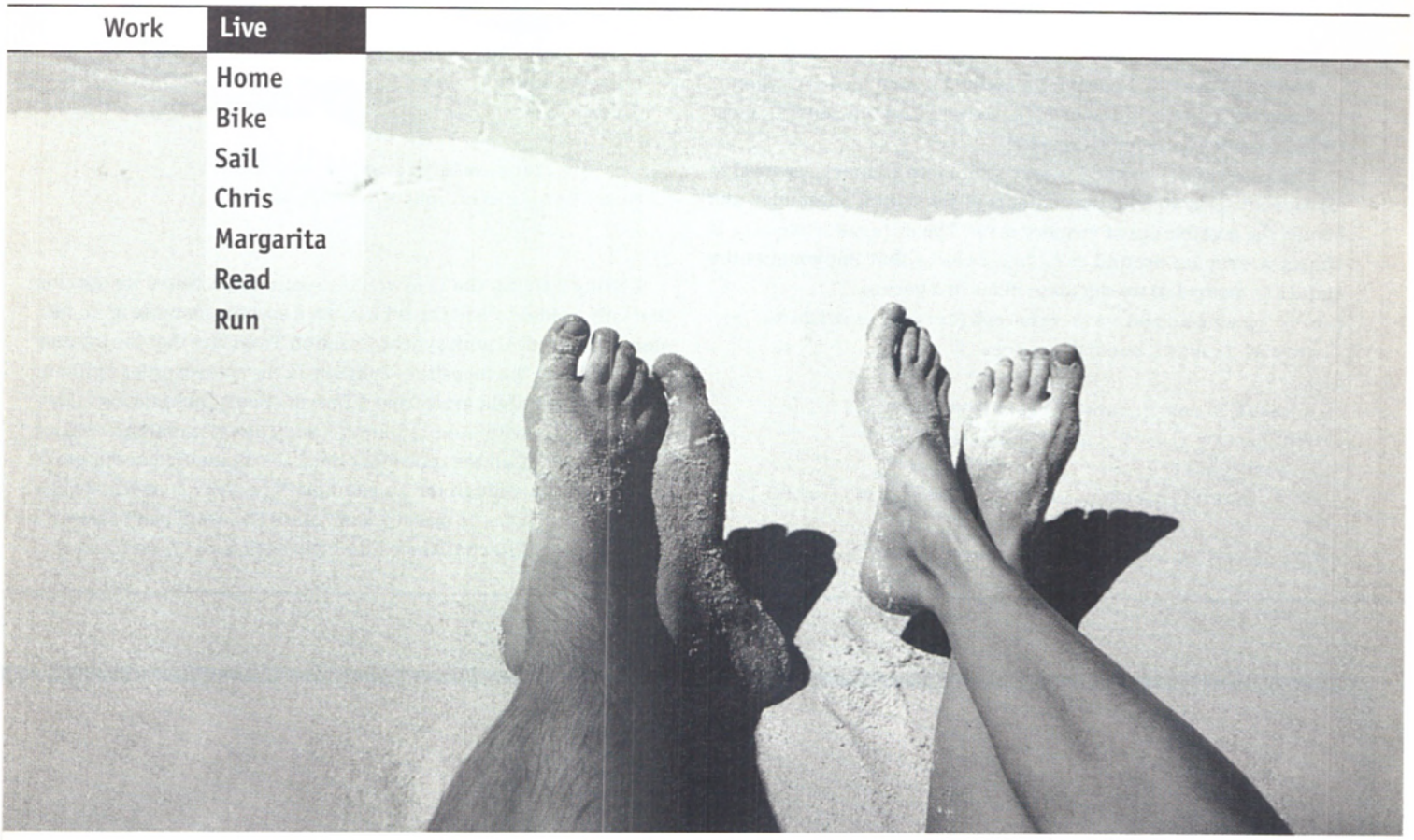

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```
  private ORB orb;
  private Vector data;
  // Java has no typedef, so cid maps to int
  private int unique_id;
  ...
```

All the details of the communication protocol are hidden in the base class and we can pretend the methods are local. Let's start with a simple method:

```
public synchronized int len() {
  return data.size();
}
```

The only caveat is to declare a method `synchronized` when it accesses object data, since JavaIDL servers (and, in general, most ORBs) are inherently multithreaded.

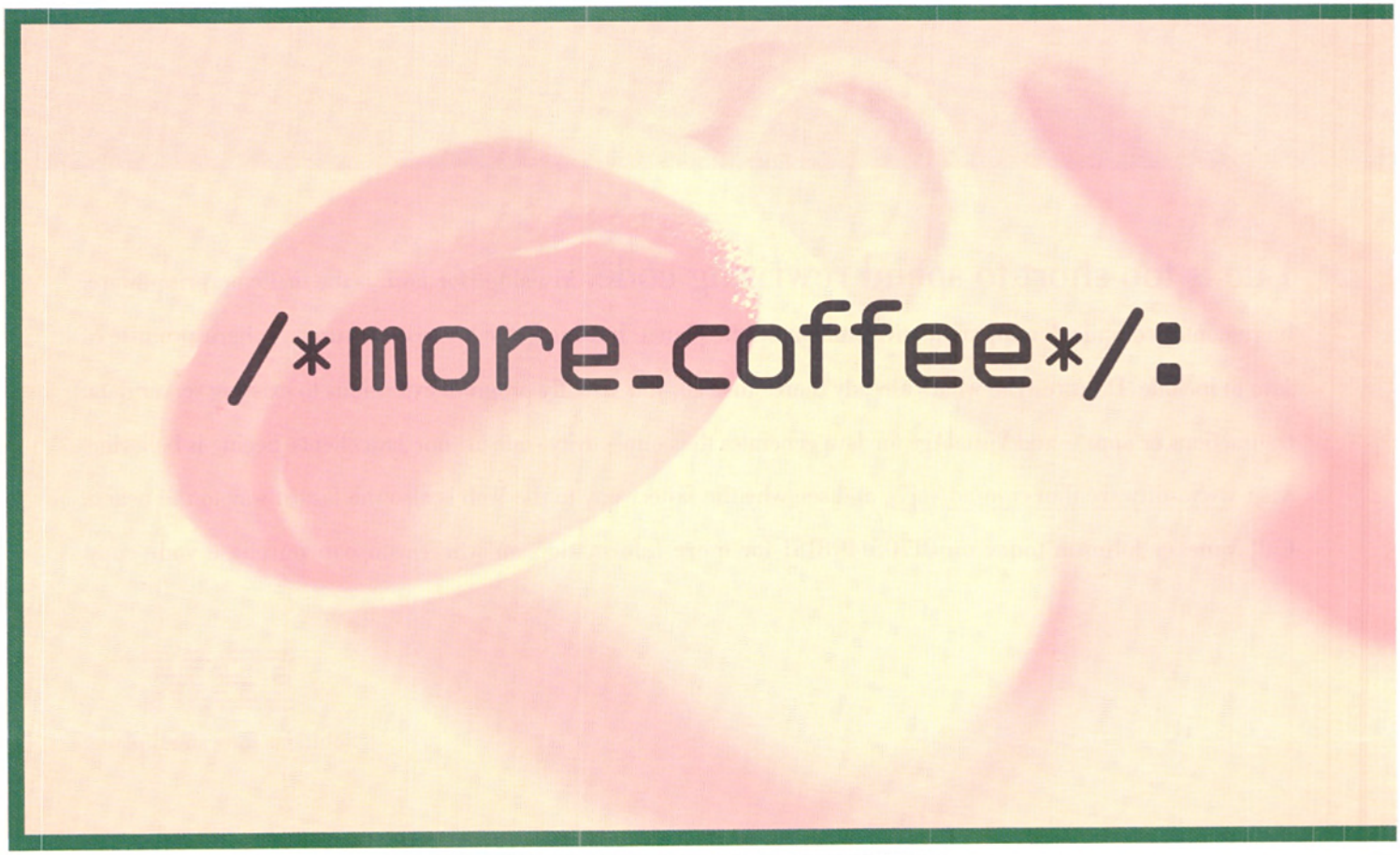
The `retrieve()` method is only a bit more complex: we need to allocate an array to hold the contents of the output parameter, and handle the possible out-of-memory error. The `crisisWithEquals` is simply a wrapper around `Crisis1.crisis` that implements the `equals()` method so we can place items in a `Vector`.

```
public synchronized void retrieve(Crisis1.cseqHolder s)
  throws Crisis1.outOfResources {
try {
  s.value = new Crisis1.crisis[data.size()];
  for (int i = 0; i < data.size(); i++)
    s.value[i] =
      ((crisisWithEquals)data.elementAt(i)).value();
  }
catch (java.lang.NullPointerException ex) {
  throw new Crisis1.outOfResources();
  }
...
}
```

On the other hand, the `iterator()` method returns an object. That is, a Corba object, so we will need an `iteratorServant` class, too.

```
public synchronized Crisis1.iterator iterator()
  throws Crisis1.outOfResources {
try {
  iteratorServant i =
    new iteratorServant(orb, data);
  orb.connect(i);
  return i;
  }
catch(java.lang.NullPointerException ex) {
  throw new Crisis1.outOfResources();
  }
}
```

Listing 2 shows the `iteratorServant` class. Since we assume that only a single client thread will use a specific instance of an iterator, we won't deal with synchronisation. To ensure that the iterator walks through the repository contents in the correct order (without problems that might arise from different clients interleaving `add()` and `remove()` with `next()`, `curr()` and `last()` calls) the iterator makes a copy of all the repository data. It's an inefficient but quick solution, good enough for an example. The `last()` method calls `orb.disconnect()` to destroy itself since the client can't destroy a Corba object. Alternatives could have been a `self_destruct()`



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method in the iterator interface or a `destroy()` in Repository. Now that we have implemented the interfaces in this Corba module, we can write the server proper. It all happens in the class `main()` method. First, we initialise the ORB:

```
ORB orb = ORB.init(args, null);
```

We then create a servant for the repository and tell the ORB that we want to hold the object on its behalf:

```
RepositoryServant repo = new RepositoryServant(orb);
orb.connect(repo);
```

We register the object in the name service (using the wrapper) so that the clients can find it:

```
namingSupport.bindObjectToName(orb, repo, name);
```

Finally, wait forever while the servant handles incoming requests:

```
java.lang.Object obj = new java.lang.Object();
synchronized (obj) {
  obj.wait();
  }
```

Building blocks

What we have covered is a practical subset of Corba. Hopefully it is enough to get you bootstrapped into this Lego world. We'll discuss Corba further, with more attention to Corba services and C++, in a future issue. ■

Nicola Baldini, Michele Bini, and Duncan Wilcox work on databases and data mining applied to decision support system applications in client/server environments. You can reach them at www.psitrust.com.

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http://www.w3c.org/

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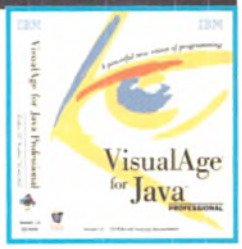

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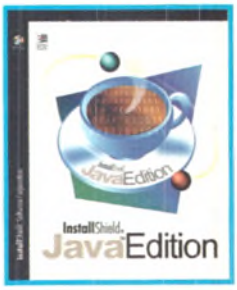

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The method of OO modelling

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Booch, Rumbaugh, and Jacobson all previously had their own object-oriented analysis and design notations, published independently. Mark Collins-Cope takes a look at the Unified Modelling Language notation, the emerging standard they designed together.

You're proficient in C++, Java, or another object-oriented language. You're designing class hierarchies, using inheritance, and manipulating complex pointer relationships to store the necessary links between your classes. You've probably drawn blobs on whiteboards (representing classes in some way) with connecting lines to indicate the relationships between classes (inheritance or other). Perhaps you're feeling the need for a more formal notation to express your designs – using something that is language independent, and that enables you to consider the important aspects of design leaving the particular detail for later. Have you considered the emerging standard of UML?

The starting point is Object Modelling, a technique which enables you to focus on class structure, inheritance, etc, while avoiding language specifics, such as pointer dereferencing. This is the central technique of UML. It is a language independent notation allowing the specification of classes, their data attributes (private) and methods (public), inheritance, and other more general relationships between classes. The notation itself is simple to grasp (see Figure 1), however this hides the somewhat more subtle thought processes underlying a *good* model.

The best way to understand the notation is to look at an example. See Figure 2 for an Object Model showing a simple banking system, containing classes for `Head-Office`, `Branch`, `Accounts` held at that `Branch`, and the `Customers` whom the `Accounts` belong to.

Examining this Object Model in more detail, we can see the following information about our class structure. Firstly, a `Head-Office`

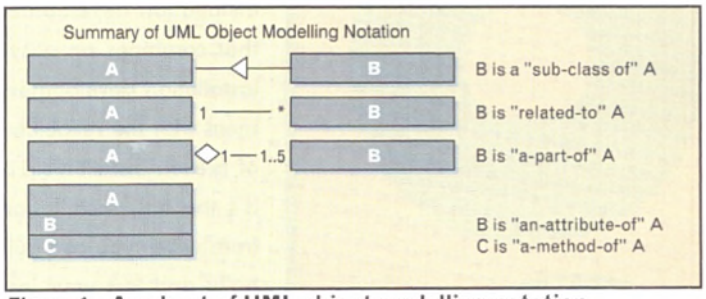


Figure 1 – A subset of UML object modelling notation.

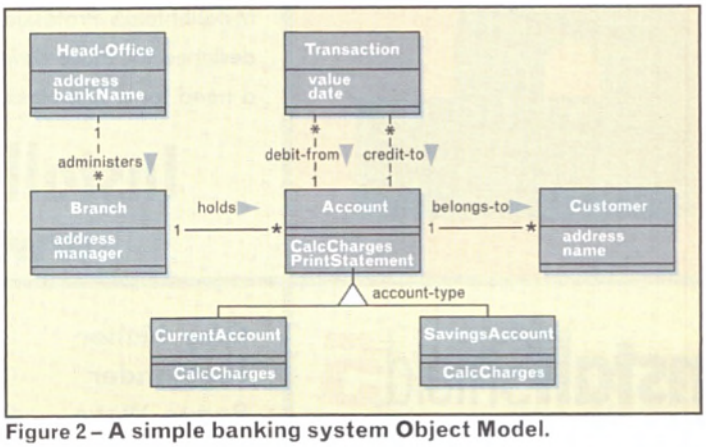
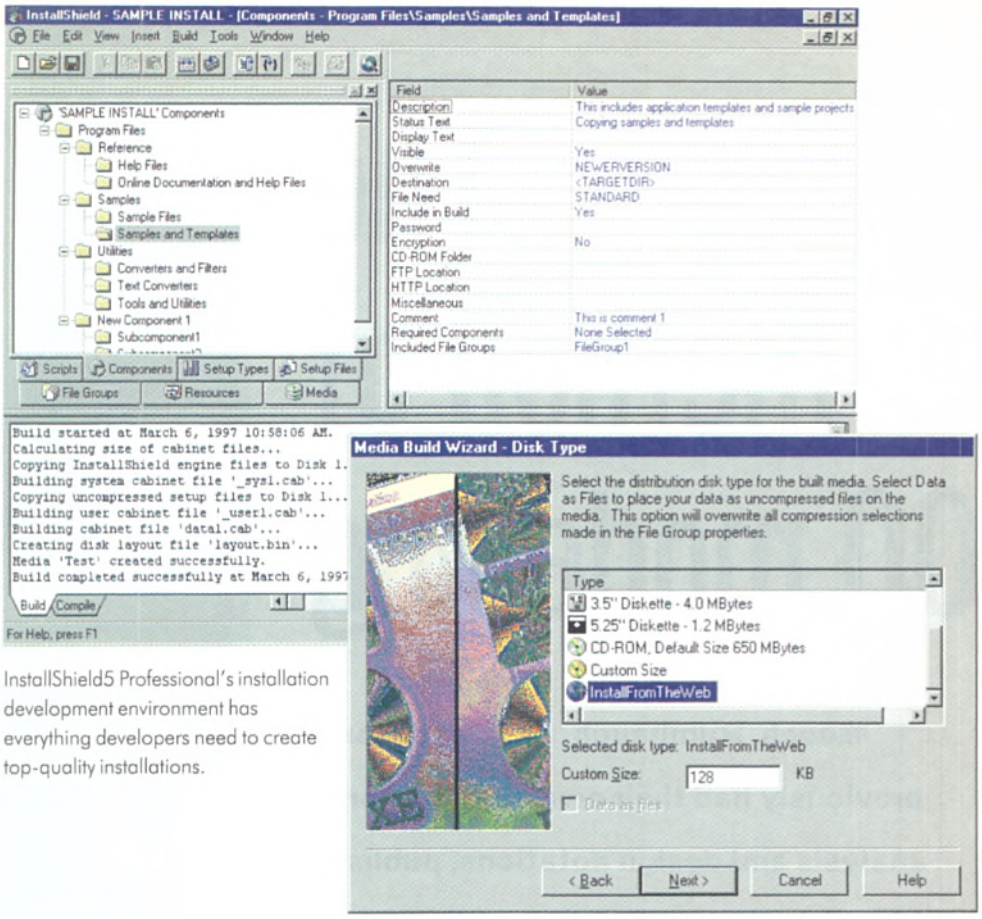


Figure 2 – A simple banking system Object Model.

POWER



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class (containing bankName and address fields, otherwise known as attributes) 'administers' an unspecified number of Branch classes, while a Branch is 'administered-by' exactly one Head-Office. (The little black arrows indicates the direction in which the name given to a relationship should be read.) On the diagram this relationship is represented by the line from the Head-Office class to the Branch class which is labelled 'administers'. The 1 at the Head-Office end of the line shows that exactly one Head-Office is associated with each Branch. The * at the Branch end of the line shows that a Head-Office 'administers' many Branches.

Similarly, a Branch class (which contains manager and address attributes) 'holds' many Account classes, while each Account class 'is-held-by' exactly one Branch. An Account class has a CalcCharges method (also known as operations or member functions) defined. This method, when invoked, will look at the detail stored within the Account object and apply the appropriate (undoubtedly extortionate) charges to the Account. The second method, PrintStatement, will take the details of the Account and print them out.

The inheritance 'triangle' (labelled 'account-type') shows us that our system knows about three types of account. These are the basic account (here a virtual class called Account), and two specialised accounts (the CurrentAccount and SavingsAccount) which are derived from Account. The fact that CalcCharges is shown in both sub-classes indicates that its implementation is re-defined for these classes (in C++ terms it is a virtual function). Charges on a SavingsAccount are calculated in a completely different manner to charges on a CurrentAccount. Implicit in the decision to use inheritance, and redefine methods in sub-classes, is the fact that the system, when implemented, will use the polymorphism features of the target language (C++, Java, etc). This enables all Accounts to be treated in a single coherent fashion, regardless of the particular charges mechanism involved.

Each Account 'belongs-to' exactly one owner – the Customer class on the diagram. Customers, on the other hand, may have many Accounts. It's worth noting here that because an Account may 'belong-to' a Customer, both CurrentAccounts and SavingsAccounts may also belong to a Customer. In other words, the 'belongs-to' relationship between Accounts and Customers is inherited by the CurrentAccount and SavingsAccount classes. This fact simplifies the diagram considerably, removing the need for these relationships to be noted explicitly. The simplification will also be apparent in our final implementation of the system.

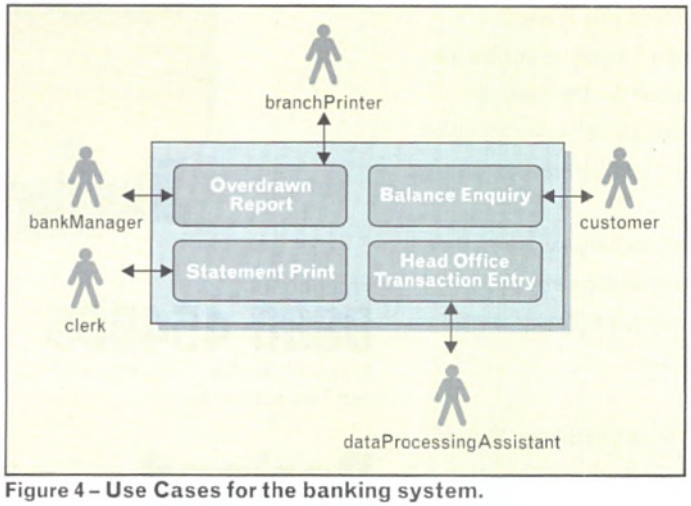

Figure 4 – Use Cases for the banking system.

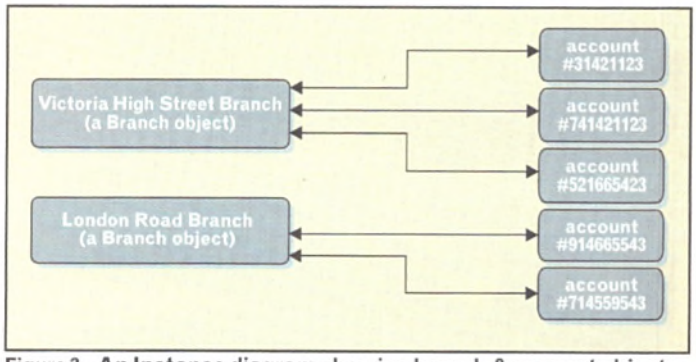

Figure 3 – An Instance diagram showing branch & account objects.

Finally, you can see that there are *two* relationships shown between the Account and the Transaction classes. This is because, in our banking system, each individual transaction (credit, debit, etc) must have two associated accounts – the account the money is 'debit(ed)-from', and the account the money is 'credit(ed)-to'. This enables the bank to record exactly where each transaction has come from, and gone to, so to speak.

This last point brings out an interesting feature of what is being shown on an Object Model: clearly it wouldn't make sense for each Transaction to be 'debit(ed)-from' and 'credit(ed)-to' the same account – no money would be transferred! Obviously, although the lines (relationships) are shown to the same Account class, they do not (necessarily) represent links to the same Account object at run-time.

Instance diagrams

A relationship shown on an Object Model indicates that some kind of run-time link will exist between two *instances* of the classes shown on the Object Model. Thus, the Branch to Accounts relationship should be read as follows:

An instance of the class Branch will be linked to (zero to) many instances of the class Account, while an instance of the class Account will be linked to (one and only) one instance of the class Branch.

This can be shown more clearly by the instance diagram in Figure 3. Instance diagrams are used to assist in understanding and clarifying Object Models and they also give quite a hint as to how relationships can be implemented in C++!

By now, you may be beginning to see how Object Models can assist the analysis/design process. They assist in the clarification of the relationships that should (somehow) be represented in a software system. The important point to note is that we are first working out *what* relationships we need to represent in our system ('belongs-to', etc), without worrying too much about exactly *how* they should be stored. Put another way, Object Modelling allows us to focus on exactly *what* problem we are trying to tackle, before we look at the best way of implementing our model in a particular programming language.

Object Models and C++

Okay, that's fine, you may say, but how do Object Models relate to C++ or Java, exactly? Let's look at a subset of our previous example composed of just the following four classes: Transaction, Account, CurrentAccount, and SavingsAccount. Our implementation must enable us to represent the fact that any particular Account has two sets of Transactions associated with it. The Account, CurrentAccount and SavingsAccount classes are easily mapped to the C++ (or Java) inheritance mechanisms:

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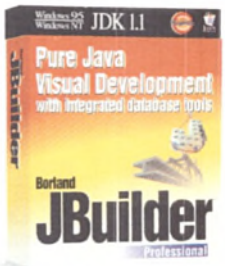

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```
class Account {
  /* … data … */
public:
  virtual void CalcCharges();
  void PrintStatement();
};

class CurrentAccount : public Account {
  /* … any additional data … */
public:
  virtual void CalcCharges(); /* re-definition */
  /* use the base class PrintStatement method */
};

class SavingsAccount : public Account {
  /* … any additional data … */
public:
  virtual void CalcCharges(); /* re-definition */
  /* use the base class PrintStatement method */
};
```

The `Transaction` class may be implemented as follows:

```
class Transaction {
  long value; /* stored in pence */
  date_t date; /* date of transaction */
public:
  /* Access and Update functions */
  Date(date_t); /* set */
  date_t Date(); /* get */
  Value(long); /* set */
  long Value(); /* get */
};
```

This leaves us with the 'debit-from' and 'credit-to' relationships to be implemented. Here we have a number of choices: linked-lists, collection-classes, and (dynamically bounded) arrays of pointers. These could all be used to represent the relationships.

```
class TransactionList {
  TransactionList * next; /* ptr to next element */
  Transaction * data;  /* store transaction here */
public:
  void Data(Transaction *); /* set */
  Transaction * Data(); /* get */
  void NextItem(TransactionList *); /* set next ptr */
  TransactionList * NextItem();     /* get next ptr */
};
```

For brevity, a linked-list class with a somewhat limited interface is used in this example – although this may not be the best choice.

Amending our `Account` class definition to use this class gives us the following new definition:

```
class Account {
  TransactionList * debitedFrom;/* from Tx list*/
  TransactionList * creditedTo  /* to Tx list */
public:
  virtual void CalcCharges();
  void PrintStatement();

  /* new methods to manipulate Transaction list */
  DebitTx(Transaction *);     /* Add a debit Tx */
  CreditTx(Transaction *);    /* Add a credit Tx */
  Transaction* NextDebitTx(); /* Iterator:get debit */
  Transaction* NextCredTx();  /* Iterator:get cred */
};
```

Use Case Details:Overdrawn Report

Used By:

- Bank Manager

Inputs:

Details what information flows from the user to the system for this particular Use Case.

- *theBranchSortCode* – The Sort Code of the branch for which the report is required.
- *theOverdraftPeriod* – how long an Account has been overdrawn before it is forms part of the report.

Outputs:

Details what information flows from the system to the external environment, in this case the printer!

- *overdraftReport (to branchPrinter)* – structured as follows: customer name; current overdraft; period overdrawn (days);
- Printed for all accounts that have been overdrawn for a period greater than *theOverdraftPeriod*, and which have not already been reported (on another report) in the last 30 days.

Pre-Conditions:

What validity checks or constraints apply on the inputs (or the internal system as a whole, in some cases).

- *theBranchSortCode* – must be a branch sort code held within the system.
- *theOverdraftPeriod* – must be a number between 0 and 100 days.

Post-Condition:

What changes does the Use Case make to the internal system state.

- Updates the *reportedOnDate* field of overdrawn accounts.

Figure 5 – Use Case Detail.

```
};

/* sample method implementation */
Account::DebitTx(Transaction * theTx) {
  /* add a new list at the beginning */
  TransactionList * tmpTxLp = debitedFrom;
  debitedFrom = new TransactionList;
  debitedFrom->NextItem(tmpTxLp);

  /* now put the transaction data into the list */
  debitedFrom->Data(theTx);
};
```

Although this is a somewhat simplistic implementation, it demonstrates the point that the model shown in Figure 2 is easily translated into C++. Of course, better implementations of the 'debit-from' relationship are possible. But the fact that the `Account` class interface completely hides the underlying implementation of this relationship means that we can improve on our first cut implementation at a later date with little impact on our overall system code. In other words, use of the `Account` class interface has limited the impact of the relationship implementation method: something we strive to achieve when writing object-oriented based applications.

Implementation notes

A few other points are worthy of note at this stage. Firstly, the linked list class contains *pointers* (references in Java) to `Transaction` objects. This is implicit in our Object Model, and is what the system's users would expect. To see why, consider the case when a new `Transaction` value is entered in error. The `Transaction` is linked to two accounts ('debit-from' and 'credit-to'). If the `Transaction` object is shared, only one object need be modified to rectify the situation. Using two objects would either mean that the system has to update two objects (equals more coding work), or that the user has to update two `Transactions` (equals greater potential for mistakes).

Although our Object Model 'debit-from' relationship uses a linked list, there are many alternatives to this choice – including the use of a relational database to underpin the system. The point is, however, no matter what mechanism is used, we are actually trying to implement a 'many-to-one' relationship between an account and a transaction. It is *this* relationship that exists in the banking problem domain *not* a relationship involving linked lists or collection classes. Object Modelling enables us to spot the relationship required by the problem domain, and then choose the best way of implementing it.

So far, we have only implemented the 'debit-from' relationship in one direction – from the `Account` class to the `Transaction` class. Our model does not (yet) specify in which direction the relationship will be traversed. If we need to traverse the relationship in *both* directions – getting from the `Transaction` to the related `Account` – our implementation will prove insufficient, and some form of double pointer schema may be needed. Much work would be saved by knowing this before starting to write code.

Lastly, other factors may influence the choice of implementation: do we need a direct form of access – for example, using a `Transaction` number to go directly from the `Account` to the relevant `Transaction`? If we do, then a linked-list will prove an inefficient choice of implementation. Again, it would be very useful to know this type of information *before* trying to implement the relationship.

Obviously, we need to consider the wider requirements of our system before we can come up with the *right* implementation of our 'debit-from' relationship (not to mention the many other classes and relationships that might be required). We can't produce a good design for a system unless we consider *all* the required functionality – in detail. *Use Cases* provide the mechanism for doing this.

Use Cases in UML

Use Cases are used to document system requirements. They provide a useful technique, in conjunction with Object Modelling, to clarify exactly *what* the system is supposed to do. Let's take a look at the requirements for our banking system: the Use Case diagram in Figure 4 highlights two important areas.

Firstly, the required business functions – that is, the type of operation you'd expect to find on the menu of the application once it had been developed. In this case, we have identified the following functions: bank managers need to periodically print out a report detailing all the customers who are overdrawn, to appear on the branch printer; customers may use the system for balance enquiries; data processing staff use the system to do basic data entry (transactions on accounts); and clerks may periodically request statements on behalf of customers;

There are four distinct types of user of the system: bank managers; clerks; data processing assistants; and customers. Each *type* of user typically has its own particular set of requirements for a system: hence identifying user types assists in identifying all the required system functions.

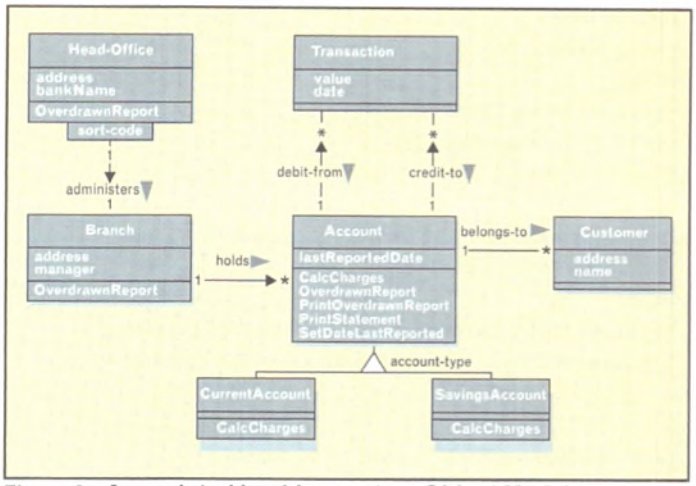

Figure 6 – An updated banking system Object Model.

The Use Case diagramming technique allows us to make a first cut at defining the system requirements, and will help in presenting these requirements back to the users of the system. It also partitions the system into atomic business functions, which may be used as a basis for costing the system, or for planning a phased system delivery. In this case, each successive phase would deliver further batches of Use Cases.

Further information is still required, however, to tie down the detail of what each business function does. Use Case Detail, as shown in Figure 5, provides this information (explanatory notes are shown in bold italic). As work progresses on the Use Cases, the requirements of the system become clearer. This enables the Object Model to be updated in parallel, helping us make sure our model (and the subsequent implementation in the chosen language) contains all the necessary classes and class inter-links.

Sequence Diagrams

While we're nearer to resolving some of the issues identified at the end of the discussion of implementing Object Models, a number are still outstanding. We still can't be sure in what *direction* the relationships must be implemented or whether we have identified all the methods or what implementation of the links will best suit the use to which they'll be put. To sort out the remaining issues we'll need to look in more detail exactly how each Use Case will be implemented, using *Sequence Diagrams*.

Performed on a per Use Case basis, these examine the flow of method calls within a system. To achieve a complete analysis requires that each individual Use Case be examined, although in practise they may only be selectively examined. The Sequence Diagram in Figure 8 shows the *Overdrawn Report* Use Case defined earlier.

The *Overdrawn Report* Use Case is thus implemented as follows. The `Head-Office` object has methods which correspond to each Use Case – in this case an `OverdrawnReport` method. The `Head-Office.OverdrawnReport` method locates the relevant `Branch` (as determined by the Use Case input: `theBranchUseCase`) and cascades the request to the `Branch` by calling *its* `OverdrawnReport` method. The `Branch` object in turn passes the request on down to *each* `Account` it holds (using the `OverdrawnReport` method)! Each `Account` then checks if it has been overdrawn for greater than the period specified by `theOverdraftPeriod`, which is passed as an argument to the `Account.OverdrawnReport` method (the detail of this is not shown – but involves summing up all the `Transactions` it holds, and checking the date on which it last became overdrawn). If appropriate, the `Account` then calls one of its *own* methods to print

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the report (detail not shown), and resets its `lastReportDate` attribute, again using its own method. Finally, the method calls unwind until the Use Case is complete.

Reviewing the Object Model (see Figure 6), we can see a number of additions resulting from the completion of this Sequence Diagram. The `OverdrawnReport` methods have been added to the `Branch` and `Account` classes. A `lastReportedDate` attribute and associated methods have been added to the `Account` class, along with a `print-OverdrawnReport` method. The 'administers' relationship, between `Head-Office` and `Branch`, has been qualified to indicate that 'direct access' via the `Branch` 'sort-code' is required across the link (thus assisting in link design). Note the consequent change in the multiplicity of the relationship from many-to-one to one-to-one. Lastly, we have added directionality to many of the links (eg see the arrow-head on the `Branch` to `Account` link).

Of course, we've only looked at one Use Case, so it's likely the model will change further as more sequence diagrams are developed.

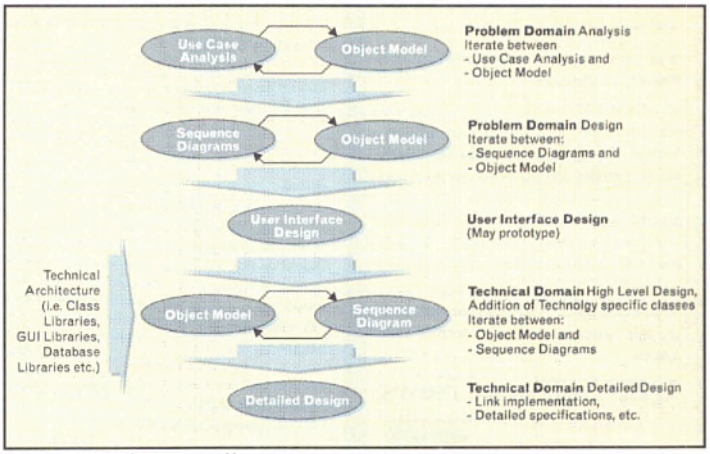

Figure 7 – The overall process.

The overall process

Use Cases and Sequence Diagrams both add to the integrity and completeness of our Object Model, and a good Object Model provides a firm foundation for a good design and hence a good implementation of the system. (See Figure 7.)

A number of terms help us to review the overall process. Firstly, *Problem Domain Analysis* is concerned with capturing requirements and producing a first cut Object Model. Typically, the Object Model will be incomplete, having only a subset of the class attributes and methods defined.

Problem Domain Design is concerned with finalising the detail of the problem domain parts of the Object Model, and results in an Object Model with a complete set of Problem Domain specific classes, attributes, and methods.

User Interface Design is the first step that focuses on the *Technical Domain* aspects of the problem. It involves taking the Use Cases, as defined earlier, and designing a Graphical User Interface appropriate to the technical architecture chosen for the project (MS Windows, X/Motif, etc). Typically, you would expect to find one controlling dialog box (which may use other subsidiary dialogs) for each Use Case in the system. Some prototyping may be appropriate at this point in the project. For

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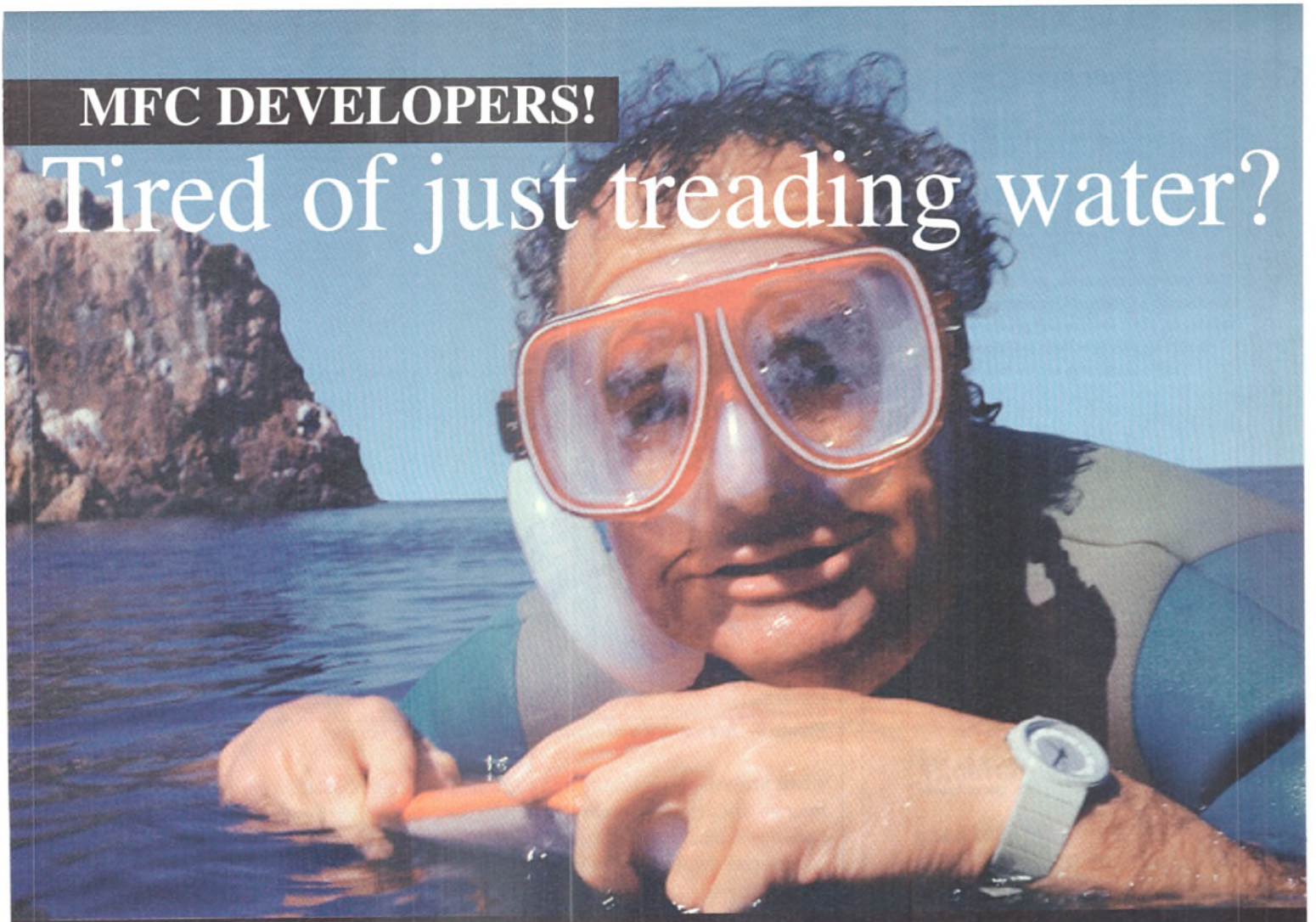

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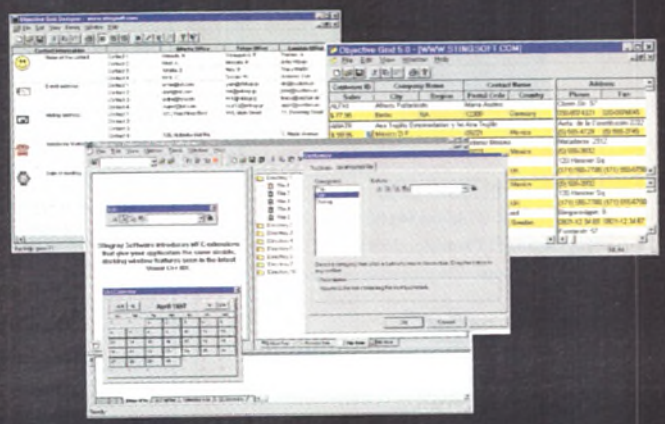

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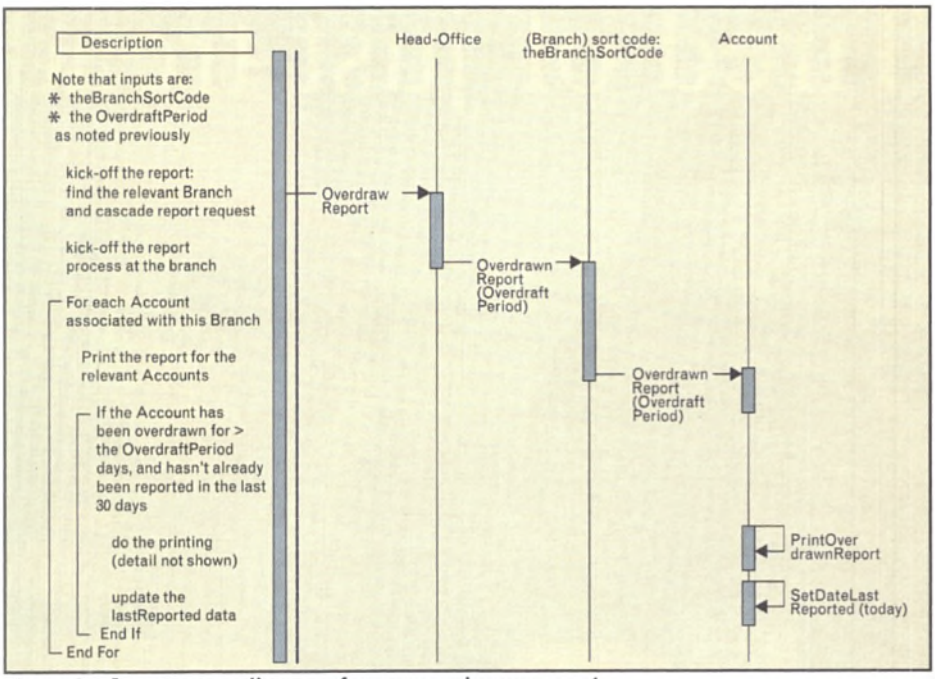

Figure 8 – A sequence diagram for an overdrawn report.

small projects, prototyping and UI design may be undertaken in parallel with Use Case development. With any prototyping, of course, there will always be a degree of iteration involved.

Technical Domain, High Level Design focuses on adding classes to meet the technical needs of the project and is driven by the technical architecture of the project. Classes may be GUI related, DBMS (object or relational) related, distribution related (CORBA, DCOM, etc), external systems related, or may provide an interface to internal system components such as printers. Previous Sequence Diagrams may be updated to confirm the validity of the technical design. In particular, you would expect to see GUI classes appearing between the System Boundary and the Problem Domain classes.

Finally, *Detailed Technical Design*, looks at link implementations, detailed data typing of attributes, full specification of all methods (including parameters), etc. The end result is a complete design of the full system.

The separation between *Problem Domain* and the *Technical Domain* aspects of the system is useful in large projects, allowing the focus of those working on the project to be clearly divided. For smaller projects (one or two persons for a couple of months) the two domains may be merged, if desired. Use Cases may be used in phasing a project; the process shown earlier does not prohibit this. A project with 50 Use Cases could be structured in three phases, for example. The object-based structure of the application lends itself well to this approach.

The benefits

We've taken a look at the Use Case, Object Modelling, and Sequence Diagramming notations of UML, how Object Modelling maps to object-oriented programming languages, and shown how these notations hang together to complement each other. (A number of other UML notations are not covered in this article.)

I hope you can see that object-oriented analysis and design offers a number of potential benefits in an object-oriented based development environment. These include: better modelling of the problem domain (equals happier users); better overall software design with a strong focus on class structure; more flexible and maintainable systems through better class partitioning; good documentation (the notations themselves) – and a single central overall design notation (the Object Model); and assistance in tying down requirements.

May the method be with you! ■

Mark Collins-Cope is Technical Director of Ratio Group Ltd., a consultancy and training company specialising in object-oriented related methods, languages and technologies including OOA/D using UML, Java, C++, Design Patterns. To contact Mark please call 0171 386 9600, email markcc@ratio.co.uk, or visit www.ratio.co.uk. Some of the diagrams come from Ratio Group material.

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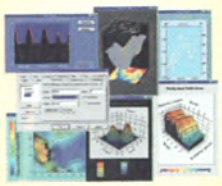

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Scripting the fall-out from browser wars

How can a Web developer avoid designing content for use with a specific browser but still take advantage of latest features? Peter Collinson investigates.

I avoided using JavaScript on my web pages, until recently. There wasn't sufficient incentive to get involved because what the language seemed to offer was limited. My perception was that JavaScript was mostly used to place pointless messages in the browser status line, replacing the URL the browser puts there by default.

I knew that Netscape had created JavaScript, and that the language and its abilities had matured with time and with each main release of its browser. Microsoft had reverse engineered its version, creating `Jscript`, making the usual mistake of changing things, so that different scripts are needed for each browser family.

In the endless browser wars, many aspects of accessing the Web page via JavaScript have diverged further. With the release of Internet Explorer 4 (IE4), Microsoft has leapt ahead of Netscape's Navigator 4. Although it's possible to use both browsers to position HTML elements at absolute positions on the viewer's page, IE4's solution is considerably more general.

Another problem was that the main book available, O'Reilly's *JavaScript, The Definitive Guide*, is an excellent reference document but not really an approachable teaching guide. I needed a book which attacked the topic using the 'get stuck in and *do* something' approach. Nick Heinle's new book *Designing with JavaScript* is exactly what I wanted to bootstrap my interest (see *Further reading*).

Some ground rules

I am deeply unhappy with Web sites which tell me that I must use a particular browser, or even a particular plug-in. I am simply inclined to go somewhere else. On the sites that I build, I want to be able to generate something reasonable for everyone who visits. By reasonable I mean that every viewer should be able to see the content and navigate the site, irrespective of their browser. I may be able to offer some viewers an enhanced image because they are running a particular browser, but the enhancements should not prevent the site from working.

How far you go to accommodate users is an interesting question to which there are no good answers, just compromises. Do you worry about supporting text-only browsers, like Lynx? Well, it depends on the site. My most recent site contains some full screen images that certainly will not work with Lynx. However, it's still possible to use Lynx to navigate the site. Are you designing for a specific end user platform? Many people create pages that look nice on their own machine, and forget the world contains a plethora of machine types, screen sizes, and screen resolutions. On the other hand, does your design work on a standard 640x480 laptop with 256 colours?

When I started using JavaScript, I wanted to ensure that the program embedded in the Web page was invisible to browsers that didn't understand it. This is easy, it turns out; you insert a script into the page using something like:

```
<SCRIPT LANGUAGE="JavaScript">
<!
   code
//>
</SCRIPT>
```

The first line introduces a script with a known language. It will be ignored by browsers that don't deal with scripts or with that language. The next line is an HTML comment, so the text from there to the end of the comment (>) will be ignored by these browsers. The HTML end of comment is preceded by `//` which is a start of a comment in JavaScript, so this line will be ignored by the active script. The script is terminated in the usual way, by the `</SCRIPT>` tag.

Rollover images

Rollover images allow you to replace one image on the page with another, controlled from a script that's driven by an event. The usual event to trap is `MouseOver`, the movement of the mouse over an element of the screen. This feature was first provided in Navigator 3 and remains in Navigator 4. It is implemented in IE4. Thus we also have to worry about browsers that understand JavaScript but will fail horribly when you attempt to create a rollover image. We need a way of detecting which browser is in use and the version number of that browser. Luckily, JavaScript provides an easy way of doing just this.

```
imageLoad = false;
bN = navigator.appName;
bV = parseInt(navigator.appVersion);
if ((bN == "Netscape" && bV >= 3) ||
   (bN == "Microsoft Internet Explorer" && bV >= 4))
   imageLoad = true;
```

As you can see, JavaScript uses an object-like syntax to set and interrogate aspects of its own environment. This world has become known as the *Document Object Model* but again it differs between IE and Netscape. The World Wide Web Consortium (W3C) is working to harmonise things; in the browser wars, W3C is the last best hope for peace.

Some objects are common to both types of browser and a standard object `navigator` returns information about the browser: its name and version. If we are dealing with an appropriate browser and version then the variable `imageLoad` is set to `true`.

Now we know whether our browser can handle rollover images, we can generate some code to load images in preparation for using them later:

```
if (imageLoad == true) {
   btoff = new Image();
   btoff.src = "but.off.gif";
   bton = new Image();
   bton.src = "but.on.gif"; }
```

Each image is loaded into a new `Image` object, setting the `src` property to the URL of the file. The bits that comprise the image will be

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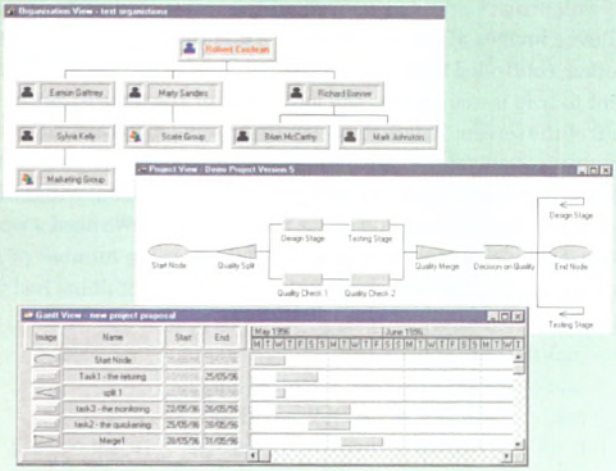

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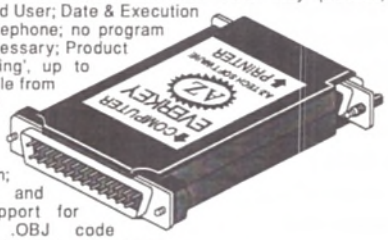

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pulled from the server and loaded into the browser cache. The names of the objects intentionally follow a pattern: a file stem and then `on` or `off`. We can now create action routines that change the image:

```
function imgOn(imgNm) {
  if (imageLoad == true)
    document[imgNm].src =
      eval(imgNm+"on.src"); }
function imgOff(imgNm) {
  if (imageLoad == true)
    document[imgNm].src =
      eval(imgNm+"off.src"); }
```

These two routines simply change the named image in the displayed document to a new value. This is stored in the `document.images` property array which can be indexed by the name of the image. The `document[`*name*`]` syntax is a shorthand reference.

We are ready to plant references in the HTML document to invoke the changed images:

```
<! set the target for the button >
<a href="destination.html"
  onMouseOver="imgOn('bt')"
  onMouseOut ="imgOff('bt')">
<IMG NAME="bt" SRC="but.off.gif"></a>
```

First, note that this is entirely normal HTML and if a browser that doesn't understand JavaScript processes these lines then it will just ignore them, putting an image on the screen. The only change to the image (`IMG`) definition is to supply a name `bt` that is used to name the instance in the object hierarchy on the page.

The link definition has two event handlers added. It will call the appropriate routine when the mouse cursor enters the active area on the screen (`onMouseOver`) and when it leaves (`OnMouseOut`). There's a little bit of JavaScript nicety here: the language accepts both double and single quotes to enclose string constants. In the HTML section of the page, HTML makes considerable use of double quotes, so the JavaScript routines are called with single quoted string constants.

In practice, all works well although I have found some inconsistencies between the way that different browsers handle transparent GIFs (Netscape 3.0, on my Windows NT system, gets it wrong).

Dynamic HTML

The latest buzz phrase on the Netscape and Microsoft Web pages is *Dynamic HTML* or DHTML. The main idea is to give authors considerably more control over the objects on the displayed page. For example, objects can be placed in absolute positions on the page and their attributes, like colour or font, can be altered dynamically from scripts.

On the surface, the Microsoft and Netscape implementations look considerably different. Microsoft, having implemented a full Document Object Model, allows page authors intimate access to anything on the page, permitting dynamic changes while the viewer looks at the page. Netscape has exported a few more things to its object model, but is putting its trust in the idea of layers. Think of these as sheets of glass, on which you paint objects, that can then be waved in front of each other. In the Netscape model, you load the parts of the page between `<LAYER>...</LAYER>` tags and then mess with them.

On a first reading, there doesn't seem to be much in common between the two approaches. However, existing standards created by W3C are being followed, and much of the dynamic HTML is based on the definition for Cascading Style Sheets (CSS). It turns out that a layer in Netscape can also be created from a style sheet, without the use of the `<LAYER>` tag, and the same style sheet will work in IE4 to create the same objects (or nearly).

The original idea of style sheets was to permit the separation between the content of a document and its mark-up. Each tagged object on the page, such as a heading, would have an entry in a local style sheet that would specify local attributes of that tag. If you wanted all your headings to be green you could add the following at the start of your document:

```
<STYLE TYPE="text/css">
<!
H2  { color:green; }
>
</STYLE>
```

It's possible to pull in the style sheet from a local file should you wish to share it among a bunch of documents. You can also add a local style to a specific object:

```
<H2 STYLE="color:green">
Text
</H2>
```

The text that the tag pair encloses would turn green.

You can create an individually named style, which in normal use can characterise something about the document. However, it's mostly used for supplying positioning information:

```
<STYLE TYPE="text/css">
<!
#Banner {
  position:absolute;
  visibility:hidden;
  width:auto;
  top:8px; left:10px; }
#Page {
  position:absolute;
  width:auto;
  top: 50px; left: 10px; }
>
</STYLE>
```

This defines a style for a banner that will appear at the top of the page and a style for the remainder of the page. The banner will be positioned 'absolutely', relative to its containing page, appearing 8 pixels down from the top and 10 pixels in from the left. Actually, when the page is loaded, the banner will be invisible, because we are going to mess with its position with a JavaScript program.

Gliding banners

The HTML that defines the page looks like:

```
<DIV ID=Banner>
<h2>Banner contents</h2>
</DIV>
<DIV ID=Page>
Page contents
</DIV>
```

The ID attribute ties the section of the page to the `Banner` or `Page` style definition. Notice that this code will continue to function for browsers that don't understand style sheets. The `STYLE` stuff will be ignored, and the page will be shown 'as is' and everyone will be happy.

IE4 and Navigator 4 will see the style sheets and interpret them in their own way (both support the same set of style keywords, thanks to W3C). I've found some differences though. IE4 is happy to deal with sizes for `top` and `left` as simple numbers, whereas Navigator 4 wants to see a specification including units (pixels in the example). IE4 doesn't set things up properly unless you specify `width:auto`.

Okay, so what are we going to do in the script? Well, here's an application which slides the header onto the page from the left:

Further reading

Three books from O'Reilly and Associates *HTML: The Definitive Guide* by Chuck Musciano and Bill Kennedy (2nd edition, ISBN 1-56592-235-2); *JavaScript, The Definitive Guide* by David Flanagan (2nd edition, ISBN 1-56592-234-4), and the book that started all this, *Designing with JavaScript* by Nick Hienle (ISBN 1-56592-300-6). This book has a website (*http://www.webcoder.com*) run by Web Review.

Netscape's HTML information starts at *http://www.developer.netscape.com/library/documentation/communicator/index.html*. The files are available in PDF format, so you can print and search them easily. Microsoft's information is available on the MSDN library CD if you are a member, and on the net at *http://www.microsoft.com/msdn/sdk/inetsdk/help/contents.htm*.

The World Wide Web consortium is at *http://www.w3.org*.

Oh, the site that I've developed is *http://www.londonfancybox.co.uk*...

```
SCRIPT Language="Javascript">
<!
var id;
bN = navigator.appName;
bV = parseInt(navigator.appVersion);
dHTML = "no";
if (bN == "Microsoft Internet Explorer" && bV >= 4)
  dHTML = "MS";
else
if (bN == "Netscape" && bV >= 4)
  dHTML = "NS";
```

The initial part of the code tests to see what version of what browser we are running. We are going to use the `dHTML` variable in the script to distinguish between the two document object models. Here's the function that is called when the page is loaded:

```
function StartGlide() {
  if (dHTML == "MS") {
    document.all.Banner.style.pixelLeft =
      -document.all.Banner.scrollWidth;
    document.all.Banner.style.visibility =
      "visible";
    id = setInterval("Glide()", 50);
  } else
  if (dHTML == "NS") {
    document.Banner.left =
      -document.Banner.clip.width;
    document.Banner.visibility =
      "visible";
    id = setInterval("Glide()", 50);
  }
}
```

Both branches of the `if` statements move the banner image left by its own width and make it visible. They then set an alarm timer firing every 50ms and call another routine called `Glide`. The `Glide` function does the work of moving the image onto the screen:

```
function Glide() {
  if (dynamicHTML == "MS") {
    document.all.Banner.style.pixelLeft += 25;
    if (document.all.Banner.style.pixelLeft >= 10) {
      document.all.Banner.style.pixelLeft = 10;
      clearInterval(id);
    }
  } else
  if (dynamicHTML == "NS") {
    document.Banner.left += 25;
    if (document.Banner.left >= 10) {
      document.Banner.left = 10;
      clearInterval(id);
    }
  }
}
```

Now all we need to do is place a call to `StartGlide()` in the `BODY` tag to be called when the page has loaded:

```
<BODY onload="StartGlide()">
```

We've taken care that the routines will do nothing unless the appropriate browser is used, so a call to this routine from, say, IE3 will be okay and nothing bad will happen.

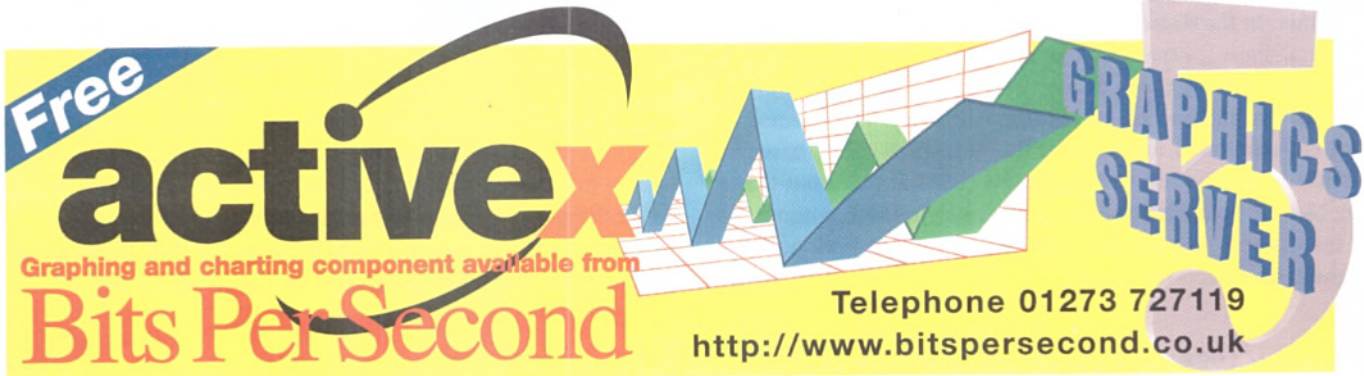
Relative positioning

All this seems simple, but represents a couple of days frustration to get things to work. I wanted the original page to be laid out *normally*, and then just apply these cosmetic changes in the appropriate browsers. My original idea was to use relative and not absolute positioning, which is an option. I found that when I did this, Netscape inserts a huge ugly vertical gap between the two `DIV` sections on the page. The gap didn't exist on IE4, nor on an older version of Netscape. All attempts to set an attribute to eliminate this gap failed.

The problem at present is that Netscape doesn't provide a full Document Object model. For example, it seems impossible to find the absolute (left, top) co-ordinates of an image that is placed on the screen. You can only deal in layers or in style elements acting as layers. If the layer contains several objects, and you may want to do this for reasons of backwards compatibility, then you cannot easily find the location of an object in the layer.

I am sure that this will all change, that we will get a fully operational addressable model in both browsers. It just ain't there yet. ■

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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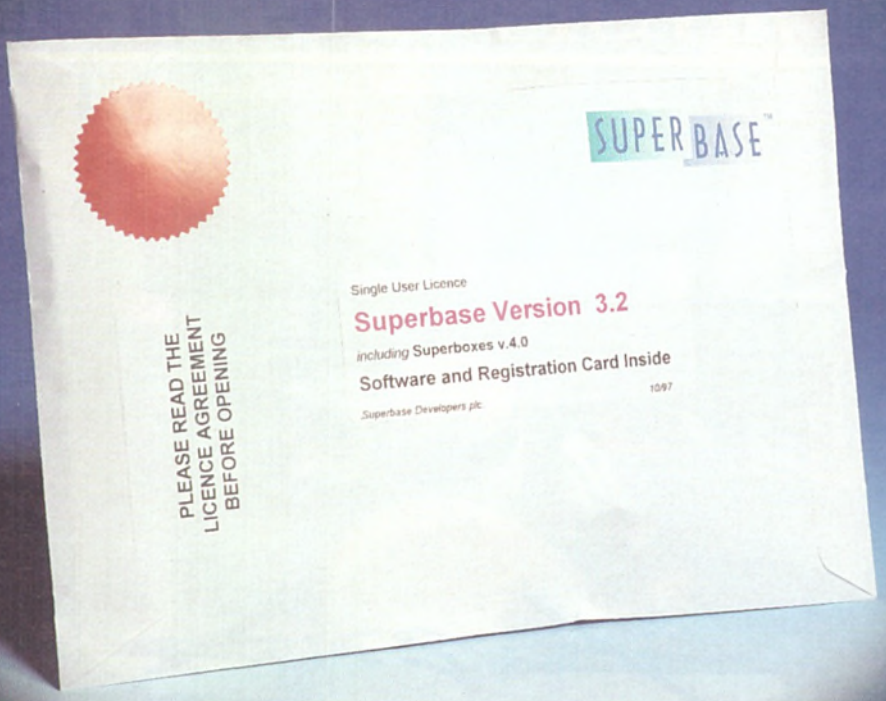

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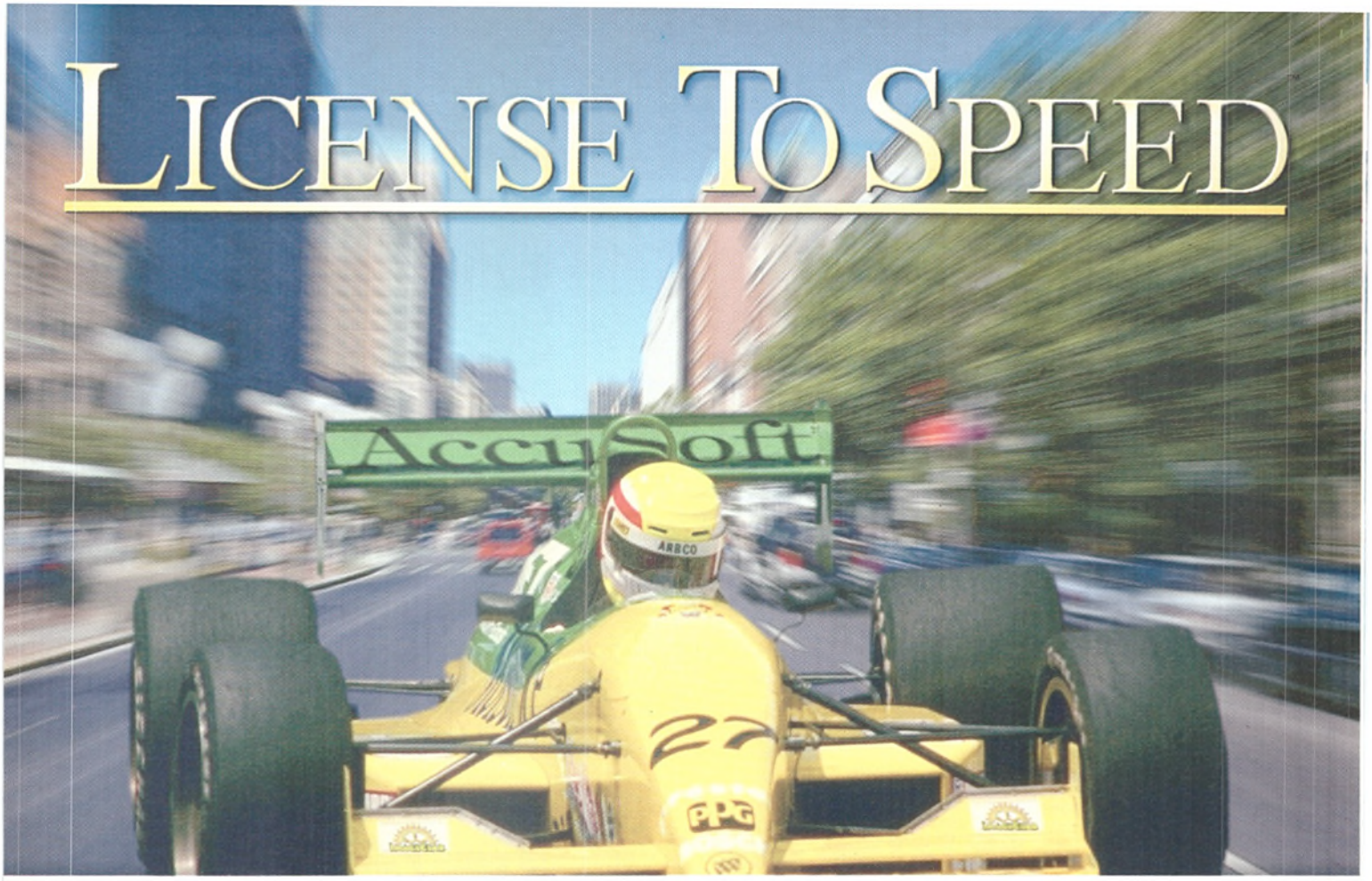

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Spirit of Delphi

Borland's Delphi is not GNU. But its community of users seem to have imbibed a little of the Free Software Foundation's spirit. Will Watts explains.

There is a huge amount of good, useful, free or nearly-free Delphi material on the Web – as far as I can tell, much more so than for any other visual environment. This includes, in my experience, Java, although obviously Delphi has a long way to go before it matches that fine language's enviable stock of not-quite-working implementations of Tetris.

This article is a celebration of some of the noblest Delphi efforts. Although there are many, we have limited ourselves to three examples because, as your Editor observed to me at the outset, a long list of URLs makes for finitely good reading. So: if you are a Delphi programmer and you haven't encountered any of this stuff, start warming up your modem's engine now. Old Delphi lags, who are already familiar with them, I hope will be interested to learn some of the background. Visual C++ types will not encounter much of interest here, but should read it anyway: you will find it morally improving. Lets get started.

Enter the Jedi

One of the drawbacks of Delphi is that, although it is possible to make pretty well any call you want into the Windows API, Borland does not necessarily include the Pascal source and explanatory documentation that you need to do it. As Windows has moved on and its APIs have multiplied, so Delphi has lagged further behind.

It was to address this problem that the Jedi Project was launched. Tim Hayes, a programmer in Birmingham, Alabama, US, is one of the co-founders and project director. He explains how things began:

'It all started back in September. One of the people on DDJ-Thread [a mailing list for Delphi programmers hosted at *listproc@zdtips.com*, send 'subscribe ddj-thread'] complained about how Borland was behind in making newer APIs available for Delphi. Many people echoed this concern and said they were considering switching to Visual C++.

'I suggested getting together the organisation and resources together to start a community [Windows] SDK to Delphi conversion going and put the results out to the public. If anybody was interested they should email me. I said I would keep a list of people who were interested, and then maybe we could hit an IRC channel one night and discuss how to make it work.

'From there it took off. After a couple days, with over 50 messages a day on the DDJ-Thread about the project, we started to get complaints from others on the list. We had the IRC meeting a week after it started, to thrash out important points in real time. It went on for 8 hours, but we worked out a basis for what we were doing.'

How is the Jedi Project organised?

'We split people up into four categories: C to Pascal converters, testers, help file authors, and Web developers/resource administrators. At Keith Anderson's suggestion, we have formed teams which contain two or three conversion people, four or five testers, and two or three help file writers, with one team supervisor in charge of up to four teams. The supervisor keeps track of the teams so the Jedi admin can keep track of the progress without watching all of the teams personally. Keith created individual team mailing lists so that team members could communicate and work out problems and keep track of each other.

'With this structure we have got TAPI converted and under testing, and the help file is being written too. We now have teams 2 and 3 formed and 4 to 10 are being put together.'

Apart from TAPI, what else does Jedi hope to do?

'This is still in the works. The basic plan is to hit all the major Windows APIs not already done by Borland. MAPI, CAB API, RAS, OpenGL, DirectX, and there are a lot more. And we are going to get D1 [16-bit Delphi 1] programmers to start on the APIs missed by D1. And we plan to start on component wrappers for the APIs too.'

Can't fault the Jedi for lack of ambition, then. By the way – what is the significance of the name?

'It stands for Joint Endeavor of Delphi Innovators. We (the rebels) are fighting to bring Delphi up to equal with the Visual C++ programmers (the Empire).'

Hmmm – perhaps best to leave that bit out of an application to license the Microsoft header files.

The Jedi Project is constructing a web site at *http://www.delphi-jedi.org*, if you would like more information on the project, email *c3po@delphi-jedi.org*.

Poles apart

Jedi is one of the fledgling Delphi efforts on the Internet; one of the best established and favourite Web sites of Delphi cognoscenti is the Delphi Super Page (see box on page 49 for a description). The DSP is run in his spare time by a 34 year old Polish molecular biologist, Robert Czerwiński.

Most of us have some experience of the pain of trying to keep even a small Web site up to date. Just how much spare time does the DSP take?

'I can answer that almost exactly. Now that I cannot manage the DSP online – ' [because he no longer works at Warsaw University, where the website is hosted] ' – I have to go to ICM and: (1) read the email with uploads, (2) transfer files from the DSP ftp incoming directory to NT, (3) run a Delphi program I wrote to update the DSP database, and fix the mistakes in the file descriptions, (4) run another Delphi program to build all the DSP pages, (5) pack all files (ie upload archives, HTML, and a Paradox database) into big zips that can be

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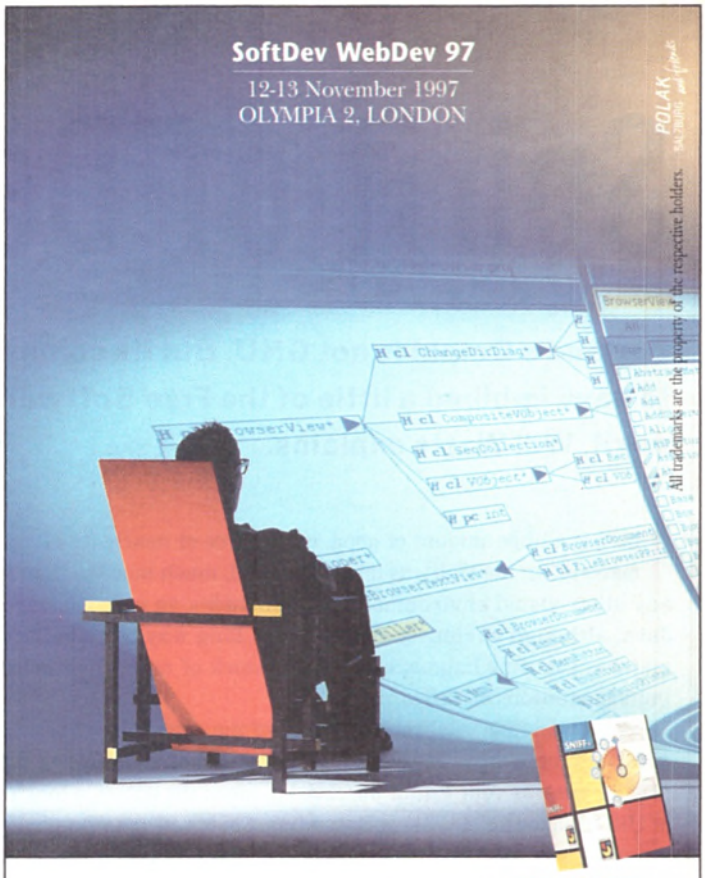

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transferred via rftp, (6) transfer these to a Unix box through a firewall, and (7) execute a Unix script that unzips all the files, converts all file names to lower case, and moves them to appropriate directories. Plus the time I spend writing and maintaining my utilities.

'Since I have to make a journey to update the DSP, I do it rather rarely – once a week is a good effort. On average, 40 files are uploaded to the DSP and it takes me five to six hours to do the update.'

This seems like rather a lot for a family man who also has a programming job and a PhD thesis to keep on the boil. Why does he do it?

'Well, everyone should do something for others. I

Super duper

There are over 2,500 files on Robert Czerwiński's Super Page site, he estimates, occupying 550 MB of disk space – not a bad collection, when you consider that everything is compressed, with the majority being ZIP archives. But, as has so oft been noted in other contexts, size doesn't matter. The important thing is whether you can actually find anything.

Czerwiński knows this, and also knows how to run a tight web site. Every entry comes with a two or three line description in standardised format, decorated with Michelin Guide style hieroglyphics indicating things like compiler compatibility and source web site, and there is a search engine to enable you to go after specifics. If you are 'just browsing', the files are carefully categorised in deep hierarchy, with 16 functional categories at the lowest level: 'Data Base Programming', 'Print, Print Preview and Reporting Tools', 'Experts and Property Editors' and so on. There are tools to enable you to navigate the site off-line using a Paradox database, but what with browser caching and this deep hierarchy, I've never needed them.

But the real pleasure of the thing is to have a nose around – it's as much fun as rummaging around the shelves of a good second hand book shop. Here is a selection of (lightly edited) entries I have pulled from the Delphi 3 section, chosen because they look useful, clever, interesting, odd, or even touching. If nothing in this list grabs your interest as a Delphi programmer, I think it's maybe time to reconsider that career switch to accountancy. For the rest of you, the URL is: *http://sunsite.icm.edu.pl/delphi/*. Off you go!

- **barnosrc.zip** (114,003 bytes) Barcode Printing Component. Delphi 1,2 & 3. Code 39, code 128, interleaved 2 of 5, Posnet, EAN, FIM etc. Prints on any canvas, extra components for quick reports. Auto scaling & positioning.
- **bsplines.zip** (124,645 bytes) Component for handling and displaying BSplines. This component also has the feature to INTERPOLATE the original vertices. The component is originally used for designing shiphulls. (Nothing special. But I would appreciate it if you would just send me an e-mail)
- **ccardver.zip** (2,021 bytes) A credit card number and expiration date verification class
- **delfhdwr.zip** (109,497 bytes) This archive is a collection of drivers, source code and educational documents showing how to do direct hardware I/O in Delphi Versions 1, 2, and 3. Includes info on joystick and LPT port programming. Download and LEARN!
- **delforex.zip** (231,123 bytes) DelforExp is a customisable source code formatter expert. It can improve the indentation, spacing, capitalisation and the use of blank lines of Delphi 3.0 source code. At default, the style of the Borland source code is followed closely.
- **delphpyt.zip** (23,977 bytes) Components to use PYTHON scripting language in a Delphi Form. PytDLL is interface to python14.dll. PytRun is a component to start scripts, and to extend PYTHON with DELPHI functions.
- **delzip12.zip** (207,350 bytes) Freeware Zip-archive support.
- **excel.zip** (16,561 bytes) TExcel is a component to produce output tables directly into MS Excel, including formatting, commands, macro calls, etc. TExcel is free so long as it is not in commercial use. When it produces income for you, please send me some portion of your income (at least $50). Thank you.
- **fngb1401.exe** (76,933 bytes) Fnugry RASNotify is a simple component that can be used to notify your application when RAS connection becomes available or lost. It also allows developer to easily enumerate all RAS connections, query connection name, device or status.
- **gensql.zip** (388,427 bytes) Generic BDE SQL Chucker. Throws SQL at BDE supported databases. Times results. Prints table structures.
- **gestedit.zip** (3,112 bytes) This is a TEdit Component with chars filter and text align. Ver. 1.0, added 15-Nov-97, WARNING! The code is provided as is with no guarantees of any kind! Use this ay your own risk – you are the only person responsible for any damage this code may cause – you have been warned!
- **gotoweb.zip** (38,127 bytes) This component allow you to launch from your application your favourite browser like Netscape Navigator or Internet Explorer and to go on an Url or to send an e-mail.
- **macro.zip** Macro is a keyboard macro recording component. Allows you to easily implement macro recording in editors etc.
- **mwpaspar.zip** (7,462 bytes) A Pascal parser.
- **ntsupas1.zip** (31,434 bytes) Unix-like 'su' command for NT. Runs commands from NT console while impersonating another user. Source shows how to program NT's Security API.
- **num2word.zip** (16,573 bytes) This component converts long integer numbers into UK-English.
- **qs15_d3.zip** (245,146 bytes) Delphi 2/3 VCL Component for visual creation of SQL-queries. Enables the user to create SQL-queries by simply putting together English sentences with the mouse. The following languages are also supported: Norwegian, Spanish, French and German.
- **resumer.zip** (107,400 bytes) TResumer is a tool for deferred activation of desired action.
- **rgnctl.zip** (103,619 bytes) TControlShaper Control region Designer. Component to give visual Controls or TForms a non-rectangular look using API function SetWindowReg.
- **rtf2html.zip** (5,203 bytes) Procedure which converts RTF to HTML.
- **sndxbr2.zip** (13,265 bytes) SoundexBR is an implementation of the Soundex algorithm adapted for the Portuguese language.
- **sysinfo.zip** (206,885 bytes) This is the latest release of my nicely-famous TSysInfo component.
- **tfire21.zip** (0 bytes) TFire shows a blazing fire in its client rect. User can modify colour, heat, rate etc. All these properties could be modified in designing time, changes can be seen immediately.
- **w95files.zip** (4,297 bytes) Functions to copy, move and delete files like Windows 95 explorer, showing flying files.
- **winstate.zip** (10,781 bytes) Tracks the window state of another app outside of yours. Has events for OnStateChange and OnStateCheck. Reports minimised, maximised or normal.

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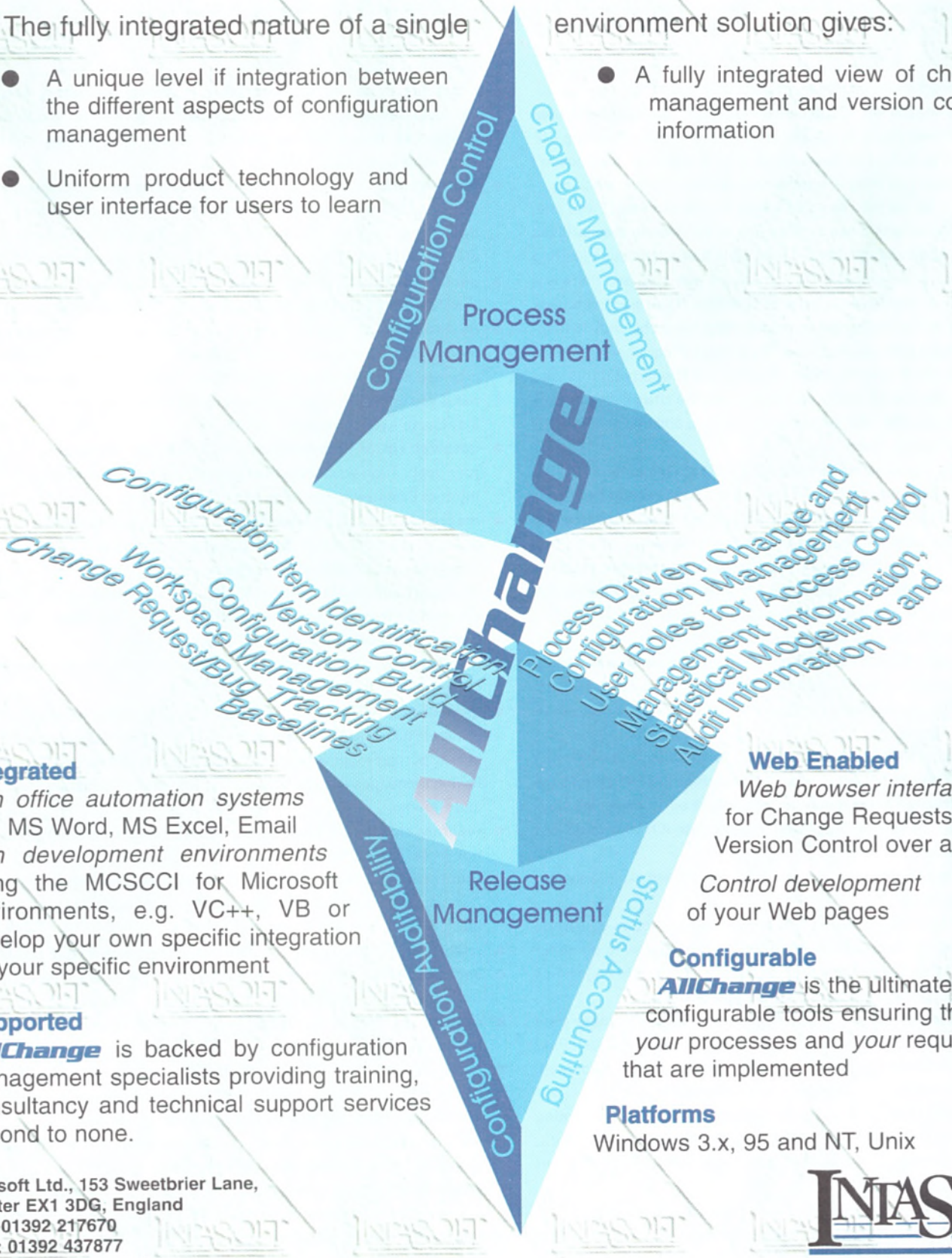

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The RxLib freeware library – a Russian delicacy

RxLib is a huge library, comprising 54 VCL components filling three Delphi tabbed bars. Considering that the source code is compatible with Delphi 1 through 3 and C++ Builder too, and is consequently riddled with `$Ifdef`s, it is meticulously tidy and professional, with occasional to-the-point (English) comments. It reads very like Borland's own VCL source, although the modules are smaller. And, another difference from the VCL, you get the whole lot – your first task after unpacking the archive is to compile it.

But what does it do? Lots of things. There are a few 'I've always wondered if you could do that' type controls, but lots and lots of 'Wouldn't it be handy if?' efforts. This is practical stuff. RxLib is notable for a large quantity of database code, which tends not to interest much your average Delphi guru in the street, who prefers to concentrate on more esoteric things when looking for the subject of a lecture or magazine article. But database code is fiddly, requires hard-to-acquire expertise of the BDE, and in my experience of writing programs for paying customers is required rather a lot in real life.

Anyway, here are some highlights to give you a flavour.

TDBIndexCombo Owners of the well known and much admired commercial Delphi library InfoPower will be familiar with this idea: a combo box which, when dropped down, enumerates all the indexes on a `TTable` and allows you to select one. In effect, this allows users to change sort order on the fly. And you don't have to write code to support it.

TRxDBGrid Enhanced data aware grid with the ability to store the user's preferences for column orders and widths (INI file or registry, you choose). The column headers can become buttons – allowing one, say, to implement an alternative way of switching indexes – giving you two events, button down and button up. You can also set the colour of individual cells, and for memo fields, picture fields and the like, the grid will show glyphs to display instead of the unimpressive default '(BLOB)'. Delphi 3 features, such as multi-row selection, are included for the benefit of 16-bit Delphi 1 users. Again, I am aware that InfoPower users are yawning at some of this, but hang on – there's plenty for you too.

TMemoryTable Somewhere, deep down inside the bowels of the BDE, there is a function named `DbiCreateInMemTable`. Admittedly, it has some limitations – no BLOBs, no autoincrement fields, no indexes and no ability to delete records. 'But surely', I cried happily when I first discovered it, 'this is the answer to my prayers. I will be able to use all those nice, powerful database-aware grids to edit, display and generally abuse my non-table based data. All I have to do is knock together a little `TTable` inherited component, put in a call to `DbiCreateInMemTable` to kick things off, and I shall be well sorted.' Then I had a look at the BDE API Help, and the source code for `TTable`, turned Dulux white with a hint of apple, and went back to my hobby, which is to write the definitive raw hex ActiveX component.

The Rx boys are made of sterner stuff. Drop a `TMemoryTable` and an ordinary `TTable` (perhaps pointing at a CSV ASCII file) on a form, write a little code along the lines of

```
MemoryTable1.BatchMove(Table1, batCopy, 0);
```

and you are sorted. They have even fixed the inability to delete records – albeit by the rather desperate approach of creating a second in-memory table and copying all the records except the one you don't want. How about index support for the next version, lads?

TRxSpinEdit Oh no, yet another SpinEdit control... except this one has spin buttons made by a diagonal split through a square. These occupy about the same screen space as the standard miniscule, not-quite-large-enough-to-click-on-first-go-without-my-specs variety, but are much easier to use. This component can be used to edit both integers and real values (a property controls the number of decimal places natch). Of course, this means that its `Value` property is a `double`, which means that you must cast it before use. Which reminds me of...

TConverter A non-visual component which holds a value which can be interpreted as most of the standard types – think of it as the 1990s OOP upgrade of that Pascal horror the variant record type. Like `TField`, it has a set of methods which you can use to retrieve and assign values, plus properties which let you control the text formatting of dates and real numbers. You can also suppress exceptions generated by unsuccessful conversions. One for the polymorphs, and parsers of text streams.

TDateEdit A combo box with a date mask that drops down a calendar. Also available in a database-aware flavour. Simple, to the point, useful.

TCurrencyEdit 'Will – why should we need this when we already have Borland's fine and versatile `TMaskEdit` control?' Meet me back here after you have used `TMaskEdit` for numeric input in a real application.

TFormStorage One of the components that Igor Pavluk cited as a favourite – 'Good idea' he says. So it is. This non-visual component enables you to store pretty well any properties of any components associated with a form into an INI file or the registry. All you need do is choose which, using an ingenious property editor. Its versatility justifies binning all previous mechanisms for restoring forms to last-used condition.

TSpeedBar Not wishing to sound blasé, but this does all the usual drag-drop runtime configuration business, as you would expect. When used in conjunction with `TRxSpeedButton` and a suitable bitmap it can produce that annoying 'decorated button bar' effect popularised by Internet Explorer 3. Not for me, but punters must like this sort of look.

The Routines Overlooked, I suspect, by the majority of English-speaking users of RxLib, the library contains a rich stock of functions of the type that should really ship with Delphi. The StrUtils unit, for example, includes `ReplaceStr` (replace all occurrences of one string with another); `Left-`

could waste my time watching TV, but I prefer to spend it this way. Moreover, I really appreciate the support of Delphi fans who send me tons of emails with congratulations that I manage the best Delphi site ;-)'

But why Delphi? Is it particularly popular in Poland?

'I have no idea, but I was unable to find a Delphi position here, perhaps due to a lack of formal programming training. It is strange, but many people, mostly Unix oriented C/C++ programmers, still think that Delphi is a toy.'

Lucky we don't have to put up with such childish prejudices in the UK... But wait a moment – if he is not working as a Delphi programmer then what...

'I answered an advert for a Delphi job, but when I turned up, they said they only had a place for a Cobol programmer. OK, I said, how hard can it be to learn Cobol? Indeed, it isn't a complicated language – at least for things I need to code here at work. Just MOVE, MOVE, MOVE.'

So does he get any time for Delphi programming?

'Lets face it. After eight hours of Cobol I am really too tired to code in Delphi. It is just for me, for fun and I would like to keep my Delphi knowledge as long as I can. Who knows what the future will bring?'

Finally, I asked which was his favourite archive on DSP.

'This one is absolutely incredible – RxLib. Please do find RxLib's authors' names, as they really should be mentioned here.'

A fine choice, which I share, and I had already contacted...

Three guys from Russia

RxLib (see other box on page 51) is the work of Fedor Koshevnikov, Igor Pavluk, and Serge Korolev, who are all employed by the Master-Bank in Moscow. Pavluk agreed to act as spokesman to field my questions. So how did they come to start using Delphi?

'We've used Delphi from its autumn 1994 field test releases. We've always tended to use Borland Pascal products. Turbo Pascal and Borland Pascal were very popular in education. Because of that, and also Delphi's fine quality, there are a huge number of Delphi developers in Russia.'

I asked what 'RxLib' stood for.

'Initially it stood for [R]OSNO VCL e[X]tensions Library. Nowadays it just means RxLib. We used to work together as corporate developers at the ROSNO insurance company. We developed the library because we needed the components to use in our applications and it was interesting to produce something serious.'

Given RxLib's complexity, and the amount of effort put into it, why didn't they market it as shareware?

'We don't ask for money because actually there is no shareware market in Russia. And to have financial interests outside is a problem in our country too. You have to dedicate yourself to it. We've placed the library on the Internet to get moral satisfaction from our work... and it does us no harm when looking for jobs. We got our current job as the RxLib authors.'

And the bank's role in this?

'We are Master-Bank employees. RxLib is our own. Other members of the bank development team also use the library in their projects. The bank is aware that it takes some of our time to develop

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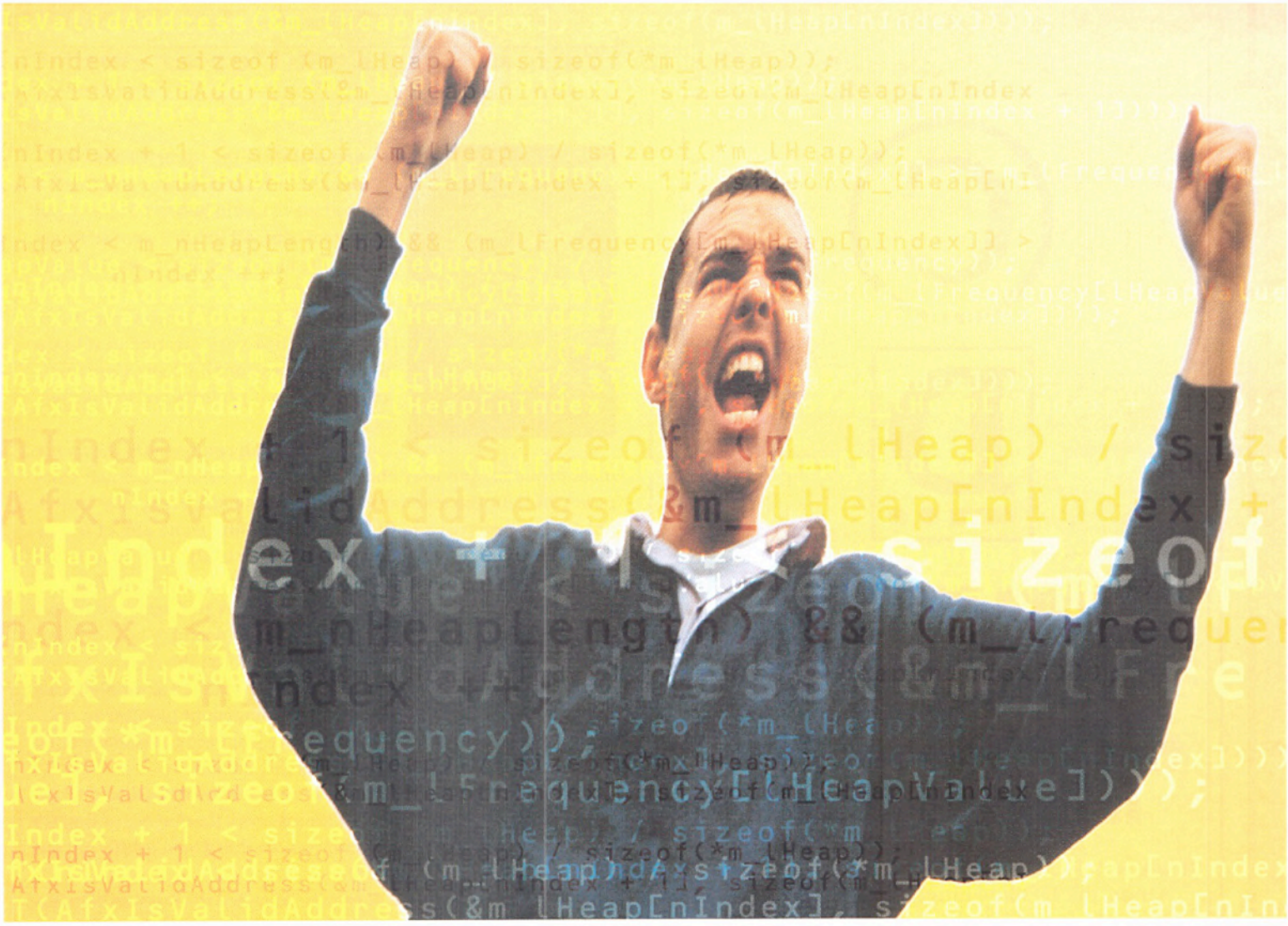

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and maintain the library. That's all.'

Imagine a Western bank taking such a relaxed view! I switched to talking about the actual code. All RxLib's identifiers and comments are in English – was this standard practice?

'Yes it is, for identifiers anyway. Russian words look very strange in a Latin font. Unprofessional, I'd say. Comments in our internal projects are in Russian, of course.'

I asked which components they were most proud of, and they chose `TRxLookupCombo` ('It's much more powerful than the standard Delphi component, especially in Delphi 1.0'), `TFormStorage` ('It lets you read and write any of a component's published properties with virtually no code'), the ComboEdit line of controls ('Very useful and popular. Well implemented. It's strange that Borland has not created such controls.') and `TRxQuery` ('It's a kludge, but extremely useful.').

Could we look forward to new versions of RxLib?

'Yes, we have a few changes from the [current] 2.32 version. Bug fixes, new routines and a `TCalcEdit` component (similar to `TDateEdit` but with a popup calculator). We just need to decide to build the new version. Still no English help file, though.'

Ah yes, the help file. Whenever I see RxLib mentioned on the Net, praise is usually tempered with whining about the absence of English documentation. Under the circumstances this would tee me off, but the Rx boys are more tolerant.

'I partly understand these people. They find the Russian help file, and they think that an English one is also available. It is not absolutely clear in our Readme and on our Web site that an English version does not exist.' [Oh yes it bloody is – WW] 'There is a reason for their disappointment.'

A modest proposal

There is an uneasy contrast between Borland's desired image of itself, as a manufacturer of high end, high value tools, and the kind of effort I have been describing. I don't suppose Borland will be offering Robert Czerwiński a 30-day free trial version of Delphi Enterprise (entry level pricing: US $45,000) to put up on the Delphi Super Page. Not this week anyway.

I don't begrudge Borland in its attempts to push the perception of its products upmarket; indeed I support them. I hope that it makes enough money out of rich corporations so that all the Delphi team can build themselves huge marble-floored, earthquake-proof, luxury villas on the steep sides of Scotts Valley.

But when it comes to spending this year's marketing budget, may I humbly suggest a deserving cause? It would be a really nice gesture – surely an American speciality – if Borland flew a few of its most ardent supporters, people who through their freeware efforts have done a really good job of promoting Borland tools, to join in the annual Stateside bash that is the Borland Developers Conference. It might not impress the account executives, nonetheless I feel sure that Borland would get a good return on its PR dollar.

■

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Between Java and C++...

Tom Guinther contemplates the design chasm which separates Java from C++ and which should prevent developers forcing a C++ design metaphor into the Java world.

Many Java programmers are also C++ programmers and many C++ programmers also program in Java. While it is possible to move fluidly between the syntax and mechanics of the two languages, crossing the design chasm that separates them can be a difficult process. While I often implement my serious development work in C++, I find myself using Java as an advanced modelling and prototyping tool.

Alas, unless you are willing to design in a very narrow range you will find that there is a down side to this approach. This is primarily due to the major, and well noted, differences between the two languages. These differences include enumerated and parameterised types, operator overloading, exception handling, and the C/C++ preprocessor. Within reasonable limits, C++ allows for very powerful and precise control over implementation details and metaphors. Java on the other hand is designed to be less complex. This reduction in complexity comes at some loss of expression and some loss of power, but the cleaner more straightforward implementation gains a certain elegance and maintainability which cannot be ignored.

A portable Registry interface

Recently the Windows Registry API has been at the forefront of my daily implementation issues. I work on a variety of Windows platforms and environments, each of which has a slightly different interface to the Registry. What I originally wanted was an interface which was portable among the different environments but I wanted a metaphor that was very different from the Registry API itself. To achieve my goal in C++ I made judicious use of its operator overloading capability to define my own methods for the array operator (`operator[]`). This type of functionality is similar to the standard 'Dictionary' data structure where values are looked up by a key name. The abbreviated C++ code listed below exemplifies the flavour of my design.

```
// 'fake' type for casting for string [] overload
typedef const struct __x_regstrval *RegStringValue ;
class RegistryKey {
   // by default treat the "named" entity as a key
   RegistryKey *operator[] ( const TCHAR *keyName );
   // explicitly treat the "named" entity as a key
   RegistryKey *operator[] ( RegKeyType keyName ) ;
   // access a value as a DWORD (default of 0)
   ULONG operator[] ( RegDWordValue keyName ) ;
   // access a value as a string (default of NULL)
   TCHAR * operator[] ( RegStringValue keyName );
   ...
};
```

The class `RegistryKey` provides a full interface to the Windows Registry API but, to keep things simple, only the overloads of the array operator are shown. Each overload takes the equivalent of a string that represents a sub-key or value of the Registry key. In order to differentiate between value and keys, as well as different types of values, a special set of types are defined (`RegKeyType`, `RegDWordValue`, `RegStringValue`, and `RegBinaryValue`). By using one of these types (via casting) different overloads are invoked that look for and return the appropriate type. It may not be obvious that the `operator[]` is using a string type as an index. For example, to open a subkey named 'subkey', do the following:

```
RegistryKey *phkeySubkey = hkeyKey [ "subkey" ] ;
```

Remember that in C++ the type `RegStringValue` does not have to have a real definition if it is only referred to in pointer form. Finally, the following code is an example of how using the `RegistryKey` feels.

```
#define DESCRIP_VALUE ((RegStringValue) "Description")
#define VERSION_VALUE  ((RegDWordValue) "Version")

const TCHAR *AccessMyRegistryKey ( ULONG &dwVersion ){
   const TCHAR * pszDescription = NULL ;
   RegistryKey
         hkeyMyKey("\\HKLM\Software\\MyRegistryKey");
   if (hkeyMyKey.Success()) {
      pszDescription = hkeyMyKey [ DESCRIP_VALUE ] ;
      dwVersion = hkeyMyKey [ VERSION_VALUE ] ;
   }
   return pszDescription ;
}
```

When thinking about how this would translate to Java, the use of operator overloading caused obvious problems. Although Java itself overloads the `operator+` for class `String` it does not allow user specified operator overloads. My first answer was that I would use a more normal `GetValue()` type of functionality while still using special types to force the overloads to work out. Because Java does not allow references to types that are not fully defined the special types would need to be classes that essentially 'wrapped' a string. Thinking in this vein the obvious solution seemed that class `RegStringValue` should actually be a string, ie be a subclass of class `String`. Unfortunately, this won't work because class `String` is declared as `final`.

In the end I decided to give up. Not because I couldn't find a solution that would have worked but I realised I was forcing a C++ design metaphor into a Java world. Quite simply the APIs should be similar but they don't have to be the same. Take what works in each language and use it to best effect. If you try to force it you end up with a Picasso, something completely outside the realm of normal perspective.

The Java way

Not to be deterred, I immediately set out to get my Java fix in a less serious but no less interesting way. With a blank canvas and open mind I wrote RegDump a simple console utility that will dump a key and all its values and sub-keys to standard output. Without preconceived notions about how I was going to implement the RegDump functionality I was

able to gain a bit of insight about how Java changes my development approach.

First of all, because this is a Windows specific program and I wanted to keep things as simple as possible, I used Microsoft's J/Direct technology to access the Windows Registry API. If you are not familiar with J/Direct you might want to refer to two of my previous columns (October and November 1997) that describe J/Direct in somewhat gory detail. Without J/Direct it would have been impossible because I would never have taken the time and effort required to access the Windows Registry using JNI (Java Native Interface).

In case those issues aren't handy, J/Direct is a technology which allows Java applications to easily interface to C/C++ code (such as the Win32 API). By providing a J/Direct native function prototype the Microsoft Java VM can automatically provide data marshalling between the VM and the C/C++ code, as well as automatically handling various synchronisation and garbage collection issues. Those not familiar with J/Direct might notice that on more than one occasion an array of size one (1) gets instantiated. This is how the VM works. When you want to pass a pointer to an integer, pass an array of size one and then reference the integer value using array index 0.

I have broken the Windows specific items into two classes, class `WinBase` that includes common things such as error codes, and class `WinRegistry` that encapsulates the Registry specific definitions. Two things of interest are that in class `WinBase` there is an overload of `FormatMessage` which is a Java method that hides some of the unused complexity of the native Win32 API `FormatMessage`. And, in class `WinRegistry`, there are three overloaded versions of `RegQueryValueEx`. Each of these functions take slightly different data types depending on the type of the data we are querying. Even though Java sees three methods J/direct sees one and maps them all to the Win32 API call `RegQueryValueEx`. This is a good example of a design difficulty that disrupts the C++ and Java harmony. In Java it is difficult to coerce types to a common or even 'typeless' type (the C/C++ `void *`). Three overloads are necessary because Java will not allow types `int[]`, `byte[]` and `char[]` to be cast to a 'typeless' buffer.

Java exception handling

Following the J/Direct function prototypes are two exception classes. They are not very powerful but whenever I develop Java code I instinctively start looking at how to deal with error handling, especially via exceptions. I love the Java exception handling facilities `try/catch/finally` and I have been using the very similar Microsoft structured exception handling (SEH) `_try/_except/_finally` successfully for many years. That is in stark contrast to how often I use the C++ `try/catch` exception mechanism, which is never. I think C++ exception handling is poorly designed.

The first class `RegistryException` extends `Exception`, which means that it is a checked exception. Java requires you to provide a handler for checked exceptions and they must be declared in the `throws` clause of methods that throw the exception. In this case, `RegistryException` is a superclass for other Registry-related exceptions to extend. This allows the methods of base classes to specify `throws RegistryException` so that future subclasses can more easily extend the superclass's functionality (an override in a subclass cannot throw an exception unless the superclass specified a compatible `throws` clause). The critical functionality that `RegistryException` provides is that it can map obtuse Win32 error codes into more legible Win32 error strings via the Win32 `FormatMessage` API. The second class, `NoBaseKeyException`, is an extension of `RegistryError` which is thrown when the key that is specified to be dumped does not begin with one of the four standard Registry sub-keys (eg, \HKEY_LOCAL_MACHINE).

Registry value and key

The next classes are `RegistryValue` and `RegistryKey`. The `RegistryValue` represents one named value of a key. During construction it queries the Registry to find the value, determine the type of data, and then read that data into the appropriate member. Because there are three basic types of data the class has three separate members but only one will be used. This is typically where a C++ programmer would use a union to indicate that while there are three logical fields, there is only the need for one physical field. The value can be obtained as a `String` by calling the `toString()` or `GetDataString()` methods. For most applications you would definitely want to be able to access the value in its actual format!

The `RegistryKey` does most of the grunt work needed by `RegDump` which includes opening Registry keys and enumerating sub-keys and values. The primary constructor is somewhat complicated by the fact that the user needs to specify a proper root key to be identified and stripped away from the rest of the key name. The root (or base) key is converted to one of the predefined Registry handles (see class `WinRegistry`) and any sub-key name is saved as the key name. Although this code is somewhat ugly it would be much uglier if it weren't for the power of the standard Java class `String`. It makes light work of finding and parsing the base key names. It is yet another significant divergence between basic C++ and Java implementations; C++ does not really provide a powerful, built-in string type. This is a bit of a blessing since the overuse of strings in Java leads to serious performance and memory problems. Because C++ takes a much more basic approach to character and string manipulation two programs with essentially the same functionality would have very different performance and memory characteristics. This is a difference in philosophy, not interpretation, JIT, or native code execution speed. Using a Java profiler I was able to determine that on some runs over 100,000 primitive string operations were performed (`String.append()` the largest offender, using up to 40% of the CPU time).

Finalize

There is at least one flaw in the `RegistryKey` class design. It will never be thread safe, for two reasons. One, the string buffers allocated for the key and enumeration values are static as well as instance specific. I designed it this way for very a specific reason: decreased memory usage. Because the class `RegDump` recursively walks through many nested levels of keys and values it is very difficult for the garbage collector to collect anything (ever!). You will note that I specifically close the Win32 handle of each key when I am through with it. Normally you might do this in your `finalize()` routine (as I did.) Unfortunately, when, how, and where `finalize` gets called is much too vague for me. In most test runs `RegistryKey.finalize()` was never called. Occasionally it was called during program exit. The second reason this class will never be thread safe is that the enumeration index variables are also instance specific.

All the code and project stuff for `RegDump` is available on EXE Online. Please drop me a line if you have any questions or to tell me what interests you about Java.

■

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

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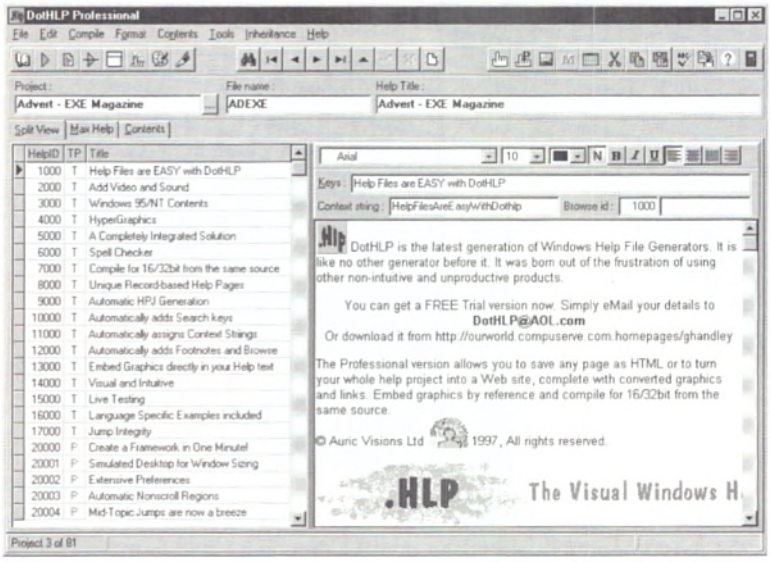

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Hey, we're done!

After seven years of work the end is in sight for a C++ International Standard and Francis Glassborow foresees a decade of stability.

Around 9pm Eastern Standard Time on Thursday, November 13th, Josée Lajoie, IBM representative and frequent HoD for Canada, uttered those words ('Hey, we're done!') during the AT&T reception for delegates attending the WG21/X3J16 meeting in Morristown, New Jersey. The printed word cannot do justice to the mixture of surprise and delight that she managed to pack into that simple exclamation. What Josée was commenting on was the realisation, which was dawning on all of us, that the next day we would reach the momentous vote that would promote our working paper to a Final Draft International Standard (FDIS). After seven years of hard work we had achieved the first major stage of what we had set out to do. Barring collective insanity from three or more National Standards Bodies, an International Standard for C++ will be delivered in the middle of 1998. It will be almost exactly what we delivered at Morristown. The only changes permitted from now onwards will be correction of typos (and only those that cannot conceivably change the meaning, so if we forgot a 'no' somewhere, too bad) and format changes required by ISO.

I have no doubt that many will seize on this document with howls of delight as something that they can rip to shreds. Any such attempt will do the C++ community a serious disservice. The document will provide stability for the next ten years. Of course we will find mistakes/ambiguities that need correction/clarification (that is what defect reports are for – the Ada standard received over 2000 in its first ten years). There are many areas that we would now like to work on, so that in about six years we will be able to work on the next major revision based on a sound foundation of practical experience.

If you are interested, one feature that I am sure will be in the next round is garbage collection though you should note that there are already garbage colection tools that bolt onto today's C++ source-code. I also hope that work will start on parallel C++.

Two things will positively help those wanting to master the use of C++; buy *The C++ Programming Language, 3rd Edition* (rapidly heading towards its fifth printing in less than six months) and consider getting involved in the standards process. As the latter will be focused on handling defect reports, involvement will certainly deepen your understanding, as well as bring you into contact with people who have a much better than average knowledge of C++ (considerably better than most training course presenters).

Memory management part 2

Last time I tackled aspects of memory management where you wanted to create collections of dynamically created objects. This time I want to consider the problem where you need to create a singleton object or grab hold of an instance of a polymorphic type, created by some form of factory function returning a pointer (possibly of some smart variety).

Until the C++ Standards Committees made their final decision about the UK objections to the specification of `auto_ptr<>` in Committee Draft 2 (we considered it far too dangerous for use) I could not write this item. Much to the relief of the UK technical experts, and many others who had come to understand the cause of our objection, the behaviour of `auto_ptr<>` has reverted to that intended by the Committee Draft 1 version (CO1). This is not the place to explain why that version failed originally, however I would like to publicly record my appreciation for the hours of work put in by many technical experts finding a way to restore the behaviour. In particular, I would like to mention Greg Colvin who kept us focused on technical issues and Bill Gibbons who came up with a new idiom to fix the problem. I'll tackle the idiom itself at some later date, but for now please note that `auto_ptr<>` is not designed to work in containers (arrays, `vector<>`, etc). If you try to use it in these it may appear to work satisfactorily but the resulting software is very fragile and liable to runtime failure (because of hanging pointers and references).

This problem is far less likely with the CD1 version where you are likely to get compile time errors if you try to use it in a container. This was one of the reasons that the UK campaigned so hard to get the CD1 behaviour restored.

For the time being you may need to be able to distinguish between implementors that are providing the CD1 (and FDIS) behaviour and those providing the CD2 form. Fortunately, there is a simple test to discover if your implementation provides the safe version. Try to compile the following (with whatever header files your implementation requires):

```
int main(){
  const auto_ptr<int> test(new int);
  auto_ptr<int> unsafe(test);
  return 0;
}
```

If this code compiles then you have the unsafe version and you should only use `auto_ptr<>` with extreme caution (never pass it to another function even by reference, be vigilant that you do not use it in a container).

Let me give you an example of where using an `auto_ptr<>` can help keep your code clean and simple. Consider:

```
class Smile;
class Cat {
  Smile * handle;
public:
  // general interface for the class
  Cat & operator = (Cat const &);
};
```

In other words, the function I am interested in is copy assignment for a class that has a pointer as a data member. How should I implement this efficiently in a context of exception handling? Study the following:

```
Cat & Cat::operator = (Cat const & rhs){
   Smile * temp = (new Smile(*rhs.handle));// line A
   delete handle;                          // Line B
   handle = temp;                          // Line C
   return * this;                          // Line D
}
```

Line A makes a copy of the object pointed to by `rhs.handle` (it does not matter if this happens to be, or to overlap, the object pointed to by the left-hand operand's `handle`). Line B frees the current object pointed to by `handle` before line C replaces it with the newly created copy. Finally we follow the standard idiom and return a plain reference to the left-hand operand.

In the context of exception handling, where can this simple function go wrong? I do not know of any way to cause an exception by copying a pointer or by returning a reference, so line C and line D are trouble free. If line B fails, you have far more serious problems because that means the destructor for `Smile` has thrown an exception. If you write or use code where destructors can throw then you are in far deeper trouble than simply handling leaking resources.

So line A is the only potential source of problems. If that line throws an exception then we want to do any necessary local cleanup before letting the exception leak outwards. If `new` itself fails then there is no cleanup to do (but note that this approach to copy assignment leaves both the operands in their original condition). But what if the constructor of `Smile` throws (and there are good reasons why our constructors might throw)? In such a case, we want a programming style that ensures a correct cleanup however complicated it might get. Once we have `auto_ptr<>` to use we can avoid cluttering our code with extra `try` blocks by replacing line A with:

```
auto_ptr<Smile *> temp( new Smile(*rhs.handle));
```

and line C with:

```
handle = temp.release();
```

Now our pointer to the copy of `*rhs.handle` is kept encapsulated safely until we are ready to transfer it to its final destination. If you are worried by the call to `release()`, that is specified not to throw.

Can you do any better? Well you might consider making `handle` an `auto_ptr<Smile *>` but you might find this was not as efficient as you wanted. The principle advantage would be that you no longer need to explicitly `delete handle` in any process as the object pointed to would be automatically destroyed as appropriate. Hence, you would not need to write a destructor.

And finally, let me counsel you against using `auto_ptr<>` for polymorphic types in containers. I know that these types have to be handled via some kind of pointer when they are collected but `auto_ptr<>` is not designed for this (despite what you may see in more than one compiler's help files) and will fail at the most inconvenient moment. Ideally, polymorphic types are provided by a surrogate, proxy, or handle class. If you have to use them when the designer has not finished the job you will need to create a counted pointer or some similar device. I'll explain another time why Standard C++ does not provide a counted pointer template.

Last month's problem

Look carefully at the following code and consider why it should not work.

```
struct X {
   int i;
   X & operator = (X &);
   X(X &);
};
X fn(X x){
   return x;
}
int main(){
   X x, z;
   x.i=5;
   X y(fn(x));
   z = fn(x);
   return 0;
}
```

Did you look carefully at the two member functions of `X`? Notice anything unusual? The parameters of both the copy constructor and the copy assignment are unqualified references to `X`. The first instinct is to suppose that this just means that you cannot copy `const X` objects. Not a common restriction but certainly one that we might sometimes want. For example, suppose that I want the process of copying to transfer responsibility from the object copied. That would mean that the copying process changed the copied object; fine if it's modifiable but surely an error if it's marked as `const`.

What this means is that we have a motive for distinguishing between normal copy semantics and non-`const` (modifiable) copy semantics. Now let me focus your attention on `fn()`. I know that the function is silly but I wanted the minimum code that would exhibit the problem. First calling `fn()` requires that the parameter is copied (passed by value). There is no problem with this as long as the value comes from a non-`const X`, which it does this time.

In order for the return statement in `fn()` to execute the value must be copied to the return value. The fact that this copy would normally be elided is irrelevant, the compiler just checks that it can make the copy if necessary. So everything works fine for `fn()` and you finish with a value of type `X`. Just to confuse you, such values are technically called *rvalues* (they are the things you find on the right of assignment statements). On the other hand a reference is an *lvalue* (the type of thing you find on left of an assignment). There is a rule in C++ that says that rvalues may only bind to `const` references. That makes perfectly good sense because an rvalue is just a value not an object and so any attempts to change it would be lost.

If you have followed me so far you will see what is coming: the return value from `fn()` cannot bind to the unqualified references that we have specified as the parameters of the two copy functions. In other words there is a side effect to specifying that a type has non-`const` copy semantics; you cannot copy a value except through a named object with that value.

This month's problem

What is the connection between the different parts of this column? Can you think of any way to resolve the problem of providing non-`const` copy semantics for return values?

■

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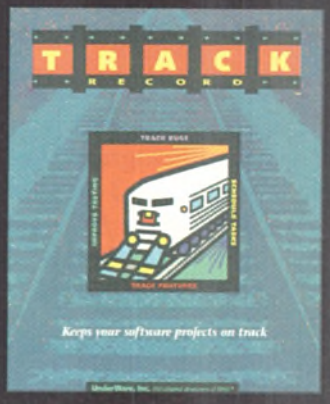

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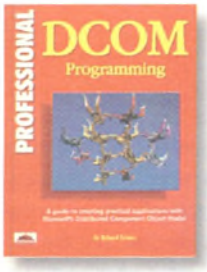
Professional DCOM Programming Reviewed by Gavin Smyth



Dr Grimes' book shows how to tackle DCOM (Distributed Component Object Model) programming and examines many aspects of distributed processing related to DCOM. The presentation of the book continues the high standards of Wrox's Professional series, although there are a few errors. There is no accompanying disc, but complete source code can be found on the Wrox Web site (*http://www.wrox.co.uk*), as can an errata sheet. The author does not waste paper with complete code listings.

The intended audience need know little about DCOM or distributed processing, but quite advanced C++ skills are required. The book is very dense and detailed; it's not a light read, but it is comprehensive. However, there is possibly an excess of cross-referencing and repetition; I lost track of the number of times I was told that DCOM is based on DCE RPC.

Only about a third of the book actually deals with DCOM. There is a large introduction covering the requirements of distributed processing and a comparison with similar or overlapping technologies such as Corba and Inferno. Next, COM is described, and then, finally, we get to DCOM programming. After extending COM objects and communication to DCOM, the author wanders into the world of security, NT services, and multi-threading. All three of these chapters have little direct link to DCOM but they set the scene for the few pages that do describe their interaction with DCOM programming. The final chapter is a brief introduction to Microsoft's Transaction Server and how it drastically simplifies aspects of DCOM. The fact that much of the book covers topics around DCOM, instead of DCOM itself, emphasises that DCOM is not actually that much more than COM. The book feels quite 'bitty' and if you are aware of many of these other topics, you may not feel the book is very good value for money.

Some significant areas of the book essentially repeat Microsoft documentation, such as the IDL syntax and COM interface listings. However, other areas describe facets of DCOM that would otherwise be difficult to fathom, such as the difference between programming for NT 3.51, NT 4.0 (with different service packs), and Windows 95.

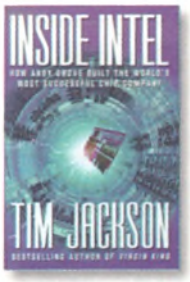
The code examples in the book are mainly written in C++, though Visual Basic does get a mention. The nature of COM programming suggests that the Microsoft compiler would be the sensible choice because of all the language extensions, and the author supports this view. In general, client code uses MFC (Microsoft Foundation Classes), for the user interface coding, and server code uses ATL (ActiveX Template Library), for its increased flexibility. One project combined both in the same program, which was quite interesting.

While this is a comprehensive and useful book, another Wrox COM book, *Professional C++ 5 ActiveX COM Control Programming* (see October's EXE), covers the internals of COM in much more depth (though without providing as much context). The other book, I feel, is better value for money for the competent C++ and Win32 programmer.

✓ *Verdict: Average.*

Title:	*Professional DCOM Programming*
Author:	*Richard Grimes*
Publisher:	*Wrox Press*
ISBN:	*1-861000-60-X*
Price:	*£46.99*
Pages:	*540*

Inside Intel – How Andy Grove Built the World's Most Successful Chip Company Reviewed by Philip Harris



There seems to be an insatiable demand for books about the big names in the computer industry. Apple, IBM, Hewlett-Packard, Nintendo, and of course Microsoft, have all been covered at least once. These books usually come in one of two types; the life story of the entire company or a warts and all account of the development of one particular product. 'Intel Inside' falls very neatly into the former category.

Beginning in 1968, with the formation of the company by Bob Noyce and Gordon Moore, and ending in mid-1997 with the latest of many lawsuits, this is the first book to document Intel's rise to power. It won't be the last though. Intel provided no assistance in the writing of the book and went out of their way to prevent business partners and employees, past and present, from giving interviews.

And it's easy to see why. The history of Intel begins gently enough with a string of technical innovations but quickly degenerates into lawsuits, harassment, and lawbreaking. If Jackson is to be believed, Intel makes even Microsoft seem angelic.

Intel is totally different to companies like Microsoft and Apple. Formed by two middle-aged, respectable men and well funded from the outset, Intel has always had a more disciplined and rigid approach. Intel does share one attribute though, an incredible will to win. This aggressive nature permeates the company and the majority of the book consists of descriptions of lawsuits, over zealous security officers, and shouting matches.

From the beginning, Intel is pitched as the creation of Andy Grove. Noyce and Moore are given relatively little coverage (Intel's lawyers get the most) and the strict environment of Intel is attributed to the Hungarian's management style. This may be a little unfair, but Jackson seems to be aiming for controversy with this book. Grove has more to offer in the way of colourful management style than the founders whose brief appearances hint at much gentler temperaments.

While Intel's aggressiveness is generally entertaining, the story of Intel seems less personal than that of other companies. There's little coverage of the founders in the development of the company (the death of Bob Noyce from a heart attack is only mentioned in passing). Jackson has concentrated on Grove's approach to business rather than the company's technical achievements. Without the input of Intel's management, the result is a dose of rather negative publicity. Whether a more co-operative Intel would result in a more balanced view has yet to be seen but I'm sure it won't be long before someone else has a crack at the Intel nut.

✓ *Verdict: Recommended.*

Title:	*Inside Intel – How Andy Grove Built the World's Most Successful Chip Company*
Author:	*Tim Jackson*
Publisher:	*Harper Collins*
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CLIENT/SERVER

Course	Date	Days	Cost	Place	Company
Introduction to Client Server Computing	To suit	4	1425	London	LTREE
Client/Server & Distributed Computing	Regularly	3	1095	Call	QA TR
Architecture & Design of Enterprise Systems	Regularly	4	1395	Call	QA TR
Building Enterprise Systems with Microsoft Technology	Regularly	3	1095	Call	QA TR
IT Infrastructure Implementation & Management	Regularly	4	1395	Call	QA TR
Application Development Using Borland Delphi 3 Client/Server	19/01/98	5	1360	London	PYGM
Application Development Using Borland Delphi 3 Client/Server	23/02/98	5	1360	London	PYGM
Client/Server Systems: Analysis & Design	3/3/98	4	1425	London	LTREE

DATABASE

Course	Date	Days	Cost	Place	Company
Database Analysis & Design	Regularly	3	1045	Call	QA TR
Building a Data Warehouse	Regularly	4	1395	Call	QA TR
Microsoft Access Development	Regularly	3	875	Call	QA TR
Introduction to Microsoft Access	Regularly	2	550	Call	QA TR
Programming with Microsoft Access Basic	Regularly	2	595	Call	QA TR
SQL Language	Regularly	2	630	Call	QA TR
Microsoft SQL Server & Transact-SQL Programming	Regularly	3	945	Call	QA TR
Microsoft SQL Server 6.5 Administration	Regularly	5	1475	Call	QA TR
Implementing a Database Design on Microsoft SQL Server 6.5	Regularly	5	1475	Call	QA TR
SQL Server 6.5 Advanced Systems Admin	To suit	2	595	London	PYGM
Accelerated Training for SQL Server 6.5 Systems Administration & Implementation	To suit	5	1500	London	PYGM
Oracle Courses	To suit	5	1675	London	LTREE
Microsoft SQL Server: Hands-On	To suit	4	1425	London	LTREE
Object Oriented Databases	To suit	4	1425	London	LTREE
Visual Basic 5 & ActiveX for Enterprise Apps	To suit	5	1675	London	LTREE
Microsoft Access	To suit	4	1425	London	LTREE
Relational Databases	13/01/98	4	1425	London	LTREE
Oracle Developer/2000	19/01/98	4	1675	London	LTREE
System Administration for SQL Server 6.5	02/02/98	5	1450	London	PYGM
Performance Tuning & Optimisation of SQL Server 6.5	02/02/98	5	1500	London	PYGM
Hands-On Microsoft SQL Server System Admin	2/2/98	5	1675	London	LTREE
Hands-On Microsoft SQL Server System Admin	3/2/98	5	1675	Edinburgh	LTREE
SQL Server 6.5: Hands on Training	13/03/98	1	330	London	PYGM
System Administration for SQL Server 6.5	16/03/98	5	1450	London	PYGM
System Administration for SQL Server 6.5	05/01/98	5	1450	London	PYGM
Implementing a Database Design on SQL Server 6.5	09/01/98	5	1450	London	PYGM
Developing Client/Server Apps for SQL Server	09/02/98	3	995	London	PYGM
Implementing a Database Design on SQL Server 6.5	09/02/98	5	1450	London	PYGM
Developing Client/Server Applications for SQL Server	09/03/98	3	995	London	PYGM
Implementing a Database Design on SQL Server 6.5	09/03/98	5	1450	London	PYGM

GENERAL

Course	Date	Days	Cost	Place	Company
Hands-on X25	102/98	4	1425	London	LTREE
Wide Area Networking & Telecommunications	To suit	4	1425	London	LTREE
Indentifying & Confirming User Requirements	To suit	4	1425	London	LTREE
Implementing the Year 2000 Conversion	To suit	4	1425	London	LTREE
Implementing ISDN Data Networks	13/1/98	4	1425	London	LTREE
Practical Software Testing Methods	27/1/98	4	1425	London	LTREE
Solution Development Discipline	02/02/98	3	995	London	PYGM
Solution Development Discipline	02/03/98	3	995	London	PYGM
Supporting SNA Server 4.0	16/02/98	5	1360	London	PYGM
Wide Area Network Troubleshooting	17/2/98	4	1425	London	LTREE
ISDN for Telecommunications	17/2/98	4	1425	London	LTREE
Implementing Computer Telephony Integration	3/2/98	4	1425	London	LTREE
Designing Component Solutions	09/02/98	3	995	London	PYGM
Supporting SNA Server 4.0	09/03/98	5	1360	London	PYGM
Designing Component Solutions	09/03/98	3	995	London	PYGM
High Speed Wide Area Networks	10/3/98	4	1425	London	LTREE

GROUPWARE & OFFICE SYSTEMS

Course	Date	Days	Cost	Place	Company
Lotus Notes/Domino R4.5 Application Development 2	Regularly	4	1375	Call	QA TR
Lotus Notes/Domino R4.5 Application Development 3 & LotusScript	Regularly	4	1375	Call	QA TR
Lotus Notes/Domino R4.5 Application Development 1	Regularly	3	1045	Call	QA TR
Lotus Notes/Domino R4.5 System Administration 1	Regularly	4	1375	Call	QA TR
Lotus Notes/Domino R4.5 System Administration 2	Regularly	2	695	Call	QA TR
Introduction to LotusScript in Notes/Domino	Regularly	3	1045	Call	QA TR
Microsoft Exchange Server Enterprise Support	Regularly	5	1495	Call	QA TR
Supporting Microsoft Exchange 5.0 - Core Technologies	Regularly	5	1475	Call	QA TR
Groupware Development with Microsoft Office Technologies	Regularly	5	1495	Call	QA TR
Domino Administration for Lotus Notes 4.6 & the Internet	Regularly	2	695	Call	QA TR
Internet Development with Lotus Notes Domino 4.6	Regularly	3	1045	Call	QA TR
VBA Programming with Microsoft Excel	Regularly	4	1275	Call	QA TR
Installing & Supporting Office 97	To suit	2	595	London	PYGM
Microsoft Exchange Developer Series - Overview of Collaboration Development	02/02/98	2	595	London	PYGM
Microsoft Exchange Developer Series - Overview of Collaboration Development	02/02/98	2	595	London	PYGM
Microsoft Exchange Developer Series - Overview of Collaboration Development	2/03/98	2	595	London	PYGM
Microsoft Exchange Server 5.5 Series - Concepts & Administration	16/02/98	3	995	London	PYGM
Microsoft Exchange Server 5.5 Series - Design & Implementation	23/02/98	5	1450	London	PYGM
Microsoft Exchange Server 5.5 Series - Concepts & Administration	16/03/98	3	995	London	PYGM
Mastering Office 97 Development	16/03/98	5	1195	London	PYGM
Microsoft Exchange Server 5.5 Series - Design & Implementation	23/03/98	5	1450	London	PYGM
Microsoft Exchange Developer Series - Overview of Collaboration Development	30/3/98	2	595	London	PYGM
Overview of Microsoft Exchange Server 5.5	09/02/98	1	330	London	PYGM
Overview of Microsoft Exchange Server 5.5	09/03/98	1	330	London	PYGM

GUI DEVELOPMENT

Course	Date	Days	Cost	Place	Company
Application Development using Borland Delphi V3	Regularly	5	Call	QA TR	
Advanced Programming with Visual Basic Enterprise Edition	Regularly	4	1295	Call	QA TR
Building Object-Oriented Applications with PowerBuilder V5	Regularly	3	1055	Call	QA TR
Fast Track to PowerBuilder V5	Regularly	4	Call	QA TR	

Course	Date	Days	Cost	Place	Company
Microsoft Visual Basic Primer	Regularly	1	295	Call	QA TR
Application Development using Visual Basic	Regularly	4	1275	Call	QA TR
Programming with JavaScript	Regularly	2	625	Call	QA TR

INTERNET

Course	Date	Days	Cost	Place	Company
Creating & Configuring a Web Server using Microsoft Tools	Regularly	3	995	Call	QA TR
Internetworking with Microsoft TCP/IP on Win NT 4	Regularly	5	1375	Call	QA TR
Internet Fundamentals	Regularly	3	995	Call	QA TR
Intranet Design & Migration	Regularly	3	1045	Call	QA TR
Internet & Intranet Security	Regularly	3	1045	Call	QA TR
Building an Effective Web Site	Regularly	3	1045	Call	QA TR
Netscape SuiteSpot Server v3	Regularly	5	1495	Call	QA TR
Internetworking with TCP/IP	Regularly	4	1245	Call	QA TR
Programming with Visual Basic Script	Regularly	2	665	Call	QA TR
Administering & Supporting FrontPage	To suit	2	595	London	PYGM
Mastering Internet Development with ActiveX Technologies	To suit	5	1195	London	PYGM
Introduction to Internet/Intranet for Business	To suit	4	1425	London	LTREE
Developing a Web Site	To suit	4	1425	London	LTREE
Designing an Intranet	To suit	4	1425	London	LTREE
Java for Multimedia Applications Development	To suit	4	1425	London	LTREE
Administering Site Server 3.0 Enterprise Edition	23/03/97	5	1195	London	PYGM
Essentials of Visual Basic Scripting Edition 3.0	06/02/97	1	330	London	PYGM
Essentials of Visual Basic Scripting Edition 3.0	06/03/97	1	330	London	PYGM
Microsoft Internet Information Server	13/1/98	4	1425	London	LTREE
Internet & System Security	20/1/98	4	1425	London	LTREE
Deploying Internet & Intranet Firewalls	17/2/98	4	1425	London	LTREE
Administering Site Server 3.0 Enterprise Edition	23/02/98	5	1195	London	PYGM
Mastering Web-site Fundamentals	23/02/98	5	1195	London	PYGM
Creating & Configuring a Web Server Using IIS 4	23/02/98	3	995	London	PYGM
Mastering Web-Site Development Using Visual InterDev	23/02/98	5	1195	London	PYGM
Secure Web Access Using Microsoft Proxy Server 2.0	26/02/98	2	695	London	PYGM
Mastering Web-site Fundamentals	23/03/98	5	1195	London	PYGM
Creating & Configuring a Web Server Using IIS 4	23/03/98	3	995	London	PYGM
Secure Web Access Using Microsoft Proxy Server 2.0	26/03/98	2	695	London	PYGM
Mastering Web-Site Development Using Visual InterDev	30/03/98	5	1195	London	PYGM
Mastering Web-Site Development Using Visual InterDev	05/01/98	5	1195	London	PYGM
Internet Information Server 4/Proxy Server 2.0 Training	05/02/98	1	330	London	PYGM
Internet Information Server 4/Proxy Server 2.0 Training	05/03/98	1	330	London	PYGM
Implementing Microsoft IE 4	10/02/98	2	595	London	PYGM
Implementing Microsoft IE 4	10/03/98	2	595	London	PYGM
Applying Internet Information Server 4.0 Technologies	12/02/98	1	330	London	PYGM
Applying Internet Information Server 4.0 Technologies	12/02/98	1	330	London	PYGM

LANGUAGES

Course	Date	Days	Cost	Place	Company
Advanced C	Regularly	4	1275	Call	QA TR
Advanced C++ Development Techniques	Regularly	4	1275	Call	QA TR
C++ for non-C Programmers	Regularly	5	1345	Call	QA TR
C++ for C Programmers	Regularly	4	1195	Call	QA TR
C++ Primer	Regularly	2	630	Call	QA TR
C Primer	Regularly	2	595	Call	QA TR
C Programming	Regularly	4	1230	Call	QA TR
Advanced Java Development	Regularly	5	1495	Call	QA TR
Developing JavaBeans	Regularly	5	1495	Call	QA TR
Java for non-C Programmers	Regularly	5	1295	Call	QA TR
Java Primer	Regularly	2	630	Call	QA TR
Java for C/C++ Programmers	Regularly	4	1245	Call	QA TR

MANAGEMENT

Course	Date	Days	Cost	Place	Company
Management Skills for IT Professionals	To suit	4	1425	London	LTREE
Influence Skills	To suit	4	1425	London	LTREE
Teambuilding Skills	To suit	3	1125	London	LTREE
Business Process Re-engineeering	To suit	4	1425	London	LTREE
Effective Communication Skills	26/1/98	3	1425	London	LTREE
Finance for Non-Financial Managers	17/2/98	4	1425	London	LTREE

NETWARE

Course	Date	Days	Cost	Place	Company
NetWare 3 Support & Administration	Regularly	4	1345	Call	QA TR
IntranetWare Support & Administration using Win NT	Regularly	5	1475	Call	QA TR
IntranetWare: NetWare 4.x Administration	Regularly	5	1595	Call	QA TR
IntranetWare: NetWare 4.x Advanced Administration	Regularly	3	1095	Call	QA TR
NetWare Service & Support	20/1/98	4	1425	London	LTREE
NetWare 4.x Administration	26/1/98	5	1675	London	LTREE

NETWORKING

Course	Date	Days	Cost	Place	Company
Hands-on LAN Troubleshooting	To suit	4	1425	London	LTREE
Cisco Routers	To suit	4	1425	London	LTREE
Hands-On Introduction to TCP/IP	To suit	4	1425	London	LTREE
Introduction to Internetworking	20/1/98	4	1425	London	LTREE
IP Routing with OSPF & BGP	31/3/98	4	1425	London	LTREE
Fast LAN Technologies	14/4/98	4	1425	Edinburgh	LTREE
Fast LAN Technologies	10/2/98	4	1425	London	LTREE

NETWORKS

Course	Date	Days	Cost	Place	Company
Introduction to Datacomm & Networks	Bi-weekly	4	1425	London	LTREE
Understanding ATM	Regularly	2	730	Call	QA TR
Introduction to Data Communications	Regularly	2	730	Call	QA TR
Enterprise-wide Communications & Networking	Regularly	4	1345	Call	QA TR
Local Area Network Implementation & Management	Regularly	4	1345	Call	QA TR
Network Primer	Regularly	1	295	Call	QA TR
Installing & Configuring SMS 1.2	To suit	1	330	London	PYGM
Planning a SMS 1.2 Site	To suit	2	595	London	PYGM
Local Area Networks	To suit	4	1425	London	LTREE
Hand-on PC Networking	To suit	4	1425	London	LTREE
Supporting SMS 1.2	19/01/98	5	1450	London	PYGM
SNMP: From Workgroup to Enterprise Network	20/1/98	4	1425	London	LTREE
Computer Network Architectures & Protocols	27/1/98	4	1425	London	LTREE
Internetworking TCP/IP on Windows NT 4.0	16/02/98	5	1450	London	PYGM
Supporting SMS 1.2	23/02/98	5	1450	London	PYGM
Internetworking TCP/IP on Windows NT 4.0	16/03/98	5	1450	London	PYGM
Hands-On PC Networking	21/4/98	4	1425	Edinburgh	LTREE
Internetworking TCP/IP on Windows NT 4.0	05/01/98	5	1450	London	PYGM
Data Network Design & Optimisation	10/2/98	4	1425	London	LTREE

OBJECT ORIENTED TECHNOLOGY

Course	Date	Days	Cost	Place	Company
Object-Oriented Analysis & Design using the Booch Method	Regularly	4	1245	Call	QA TR
Object-Oriented Analysis & Design using Rumbaugh's OMT	Regularly	5	1475	Call	QA TR
Developing CORBA Applications	Regularly	3	Call	QA TR	
Object-Oriented Design for C++ Development	Regularly	5	1475	Call	QA TR
Overview of Distributed Objects	Regularly	1	295	Call	QA TR
Object-Oriented Primer	Regularly	1	295	Call	QA TR
Object-Oriented Software Development	Regularly	3	995	Call	QA TR
Object-Oriented Analysis & Design using the Unified Modelling Language	Regularly	5	1475	Call	QA TR
Object Technology Introduction	To suit	4	1425	London	LTREE
Object-Oriented Analysis & Design	2/2/98	5	1675	Birminghm	LTREE
Object Technology Introduction	16/2/98	4	1425	Birminghm	LTREE
Object-Oriented Analysis & Design	26/3/98	5	1675	London	LTREE

PC SUPPORT

Course	Date	Days	Cost	Place	Company
PC Configuration & Troubleshooting	Bi-weekly	4	1425	London	LTREE
Advanced PC Support	Regularly	4	1245	Call	QA TR
PC Fundamentals	Regularly	3	845	Call	QA TR
PC Support	Regularly	4	1175	Call	QA TR

Course	Date	Days	Cost	Place	Company
Supporting Word 6.0	To suit	3	795	London	PYGM
Supporting Excel 5.0	To suit	3	795	London	PYGM
PC Configuration & Troubleshooting	To suit	4	1425	Edinburgh	LTREE
Troubleshooting & Data Recovery	To suit	4	1425	London	LTREE
PC Configuration & Troubleshooting	17/3/98	4	1425	Birminghm	LTREE

PROGRAMMING

Hands-on Visual Basic 5	Bi-weekly	4	1425	London	LTREE
Developing Windows NT Server Applications	Regularly	5	1595	Call	QA TR
Mastering Web Site Development using Visual InterDev	Regularly	5	1445	Call	QA TR
Win32 Programming Essentials	Regularly	5	1495	Call	QA TR
Developing ActiveX Controls & Components	Regularly	5	1495	Call	QA TR
Windows Programming in C	Regularly	5	1495	Call	QA TR
Windows Programming with Visual C++ & the MFC Library	Regularly	5	1475	Call	QA TR
Building Applications with Microsoft Transaction Server	Regularly	5	1595	Call	QA TR
Fasttrack Windows NT 5 for Developers	Regularly	2	650	Call	QA TR
Windows OLE Programming with the MFC Library	Regularly	5	Call	QA TR	
Developing OLE/ActiveX Controls with the MFC Library	Regularly	5	1495	Call	QA TR
Windows OLE System Programming	Regularly	5	1595	Call	QA TR
Application Development with Excel 95 using VBA	To suit	5	1195	London	PYGM
Visual Basic 5.0 Advanced Techniques Workshop	To suit	5	1195	London	PYGM
Mastering Visual J++ Fundamentals	To suit	5	1195	London	PYGM
Mastering Visual J++ Development	To suit	5	1195	London	PYGM
Microsoft Access Programming	To suit	4	1425	London	LTREE
Programming ActiveX with MCF	To suit	4	1425	London	LTREE
Java Programming: Hands-On	To suit	4	1425	London	LTREE
Visual J++	To suit	4	1425	London	LTREE
Introduction to Programming: Hands-on Workshop	To suit	4	1425	London	LTREE
C Programming	To suit	4	1425	London	LTREE
Introduction to C++ for Non-C Programmers	To suit	4	1425	London	LTREE
Introduction to C++ & Object Orientated Programming	26/01/97	5	1395	London	PYGM
Introduction to C++ & Object Orientated Programming	26/01/97	5	1395	London	PYGM
Java for Enterprise Systems	13/1/98	4	1425	London	LTREE
Mastering Visual Basic 5.0	19/01/98	5	1195	London	PYGM
Mastering MFC Fundamentals Using Visual C++	19/01/98	5	1395	London	PYGM
Delphi	19/01/98	5	1295	Painswick	DPR
Visual Basic v5	19/01/98	5	1295	Painswick	DPR
Mastering MFC Development Using Visual C++	26/01/98	5	1395	London	PYGM
Delphi 3	26/01/98	5	1295	Painswick	DPR
Visual Basic	26/01/98	2	615	Painswick	DPR
Visual C++: Windows Programming with MFC	26/1/98	5	1675	London	LTREE
Visual Basic	28/01/98	3	825	Painswick	DPR
Programming in Access 95	02/02/98	5	1195	London	PYGM
Mastering Microsoft Access 97 Programming	02/02/98	5	1195	London	PYGM
Mastering Visual Basic 5.0 Fundamentals	02/02/98	5	1195	London	PYGM
Delphi	02/02/98	5	1295	Painswick	DPR
Access	02/02/98	5	1295	Painswick	DPR
Delphi	02/03/98	5	1295	Painswick	DPR
Introduction to C++ & Object Orientated Programming	2/3/98	5	1395	London	PYGM
Mastering MFC Fundamentals Using Visual C++	16/02/98	5	1395	London	PYGM
Delphi	16/02/98	5	1295	Painswick	DPR
Visual Basic v5	16/02/98	5	1295	Painswick	DPR
Mastering MFC Development Using Visual C++	23/02/98	5	1395	London	PYGM
Implementing OLE 2.0 in MFC Applications	23/02/98	5	1395	London	PYGM
Visual Fox Pro	23/02/98	5	1295	Painswick	DPR
Visual Basic	23/02/98	3	825	Painswick	DPR
Mastering Visual Basic 5.0 Fundamentals	16/03/98	5	1195	London	PYGM
Delphi 3	16/03/98	5	1295	Painswick	DPR
Visual Basic v5	16/03/98	5	1295	Painswick	DPR
Windows Architecture	23/03/98	5	1395	London	PYGM
Mastering MFC Development Using Visual C++	23/03/98				
Visual Basic	25/03/98	3	825	Painswick	DPR
Programming in Access 95	30/03/98	5	1195	London	PYGM
Mastering Microsoft Access 97 Programming	30/03/98	5	1195	London	PYGM
Mastering Visual Basic 5.0	30/03/98	5	1195	London	PYGM
Mastering COM Development Using Visual C++	30/03/98	5	1395	London	PYGM
Delphi	30/03/98	5	1295	Painswick	DPR
Access	30/03/98	5	1295	Painswick	DPR
Introduction to C++ & Object Orientated Programming	30/3/98	5	1395	London	PYGM
Win32 Systems & Network Programming	14/4/98	4	1425	London	LTREE
Visual Basic	15/04/98	3	825	Painswick	DPR
Delphi	20/04/98	5	1295	Painswick	DPR
Visual Basic v5	20/04/98	5	1295	Painswick	DPR
Delphi 3	27/04/98	5	1295	Painswick	DPR
Visual Basic	27/04/98	5	1295	Painswick	DPR
Programming in Access 95	05/01/98	5	1195	London	PYGM
Mastering Microsoft Access 97 Programming	05/01/98	5	1195	London	PYGM
CA-Clipper	05/01/98	5	1295	Painswick	DPR
Mastering Visual Basic 5.0	09/02/98	5	1195	London	PYGM
Windows Architecture	09/02/98	5	1395	London	PYGM
Delphi	09/02/98	5	1295	Painswick	DPR
Visual Basic	09/02/98	5	1295	Painswick	DPR
Mastering MFC Fundamentals Using Visual C++	09/03/98	5	1395	London	PYGM
Kornshell Programming	10/2/98	4	1425	London	LTREE
Mastering Visual Basic 5.0 Fundamentals	12/01/98	5	1195	London	PYGM
Windows Architecture	12/01/98	5	1395	London	PYGM
Delphi	12/01/98	5	1295	Painswick	DPR
Visual Basic	12/01/98	2 days	615.00	Painswick	DPR

PROJECT MANAGEMENT

DSDM Aware	Regularly	1	295	Call	QA TR
Managing Modern Software Development Projects	Regularly	3	1045	Call	QA TR
Microsoft Solutions Development Discipline: Deployment	Regularly	3	945	Call	QA TR
Microsoft Solutions Development Discipline: Development	Regularly	3	945	Call	QA TR
DSDM Practitioner	Regularly	3	945	Call	QA TR
Object-Oriented Project Management	Regularly	2	695	Call	QA TR
Project Management Skills	Regularly	4	1245	Call	QA TR
Project Management: Skills for Success	To suit	4	1425	London	LTREE
Software Project Planning & Management	20/1/98	4	1425	London	LTREE

SYSTEMS ANALYSIS

Software Systems Analysis & Design	To suit	4	1425	London	LTREE
Software Quality Assurance	17/2/98	4	1425	London	LTREE
Hands-on Microsoft Exchange 5	To suit	4	1425	London	LTREE

SYSTEMS MANAGEMENT

Building Office 97 Intranet Applications	To suit	4	1425	London	LTREE
Windows Open Systems Architecture	10/2/98	4	1425	London	LTREE
UNIX Fundamentals	Regularly	4	1195	Call	QA TR

UNIX

UNIX Programming	Regularly	5	1375	Call	QA TR
UNIX Systems Administration	Regularly	4	1195	Call	QA TR
Mastering UNIX Shell Scripts	Regularly	4	1195	Call	QA TR
Solaris Systems Administration	Regularly	4	Call	QA TR	
UNIX Introduction	To suit	4	1425	London	LTREE
Perl Programming	To suit	4	1425	London	LTREE
UNIX Tools & Utilities	20/1/98	4	1425	London	LTREE
X Window System Programming	20/1/98	4	1425	London	LTREE
UNIX Workstation Administration	17/2/98	4	1425	London	LTREE
UNIX Programming	17/2/98	4	1425	London	LTREE
Perl Programming	17/3/98	4	1425	Edinburgh	LTREE
UNIX Server Administration	24/3/98	4	1425	Edinburgh	LTREE

WINDOWS

Course	Date	Days	Cost	Place	Company
Windows 95 Support & Networking	To suit	5	1675	London	LTREE
Hands-On TCP/IP Internetworking on Windows NT	To suit	4	1425	London	LTREE
Windows NT 5	To suit	5	1675	London	LTREE
Upgrading to Windows 98	30/01/98	2	595	London	PYGM
Integrating Microsoft Office 97	3/2/98	4	1425	London	LTREE
Supporting Windows 95	30/3/98	5	995	London	PYGM
Supporting Windows 95	09/02/98	5	995	London	PYGM
Supporting Windows 95	09/02/98	5	995	London	PYGM
Supporting Windows 95	9/3/98	5	995	London	PYGM
Supporting Windows 95	12/01/98	5	995	London	PYGM
Supporting Windows 95	12/01/98	5	995	London	PYGM
Administering Microsoft Windows NT 4.x	Regularly	3	1035	Call	QA TR

WINDOWS NT SERVER

Supporting Windows NT Server 4.x - Enterprise Technologies	Regularly	5	1475	Call	QA TR
Supporting Windows NT 4.x - Core Technologies	Regularly	5	1475	Call	QA TR
Supporting Microsoft Systems Management Server	Regularly	5	1475	Call	QA TR
Supporting Microsoft SNA Server V4	Regularly	5	1475	Call	QA TR
Windows NT 4.x Essentials	Regularly	4	1395	Call	QA TR
Windows NT 5 Essentials	Regularly	5	1595	Call	QA TR
Supporting Windows NT 4.x Servers	Regularly	4	1395	Call	QA TR
Implementing Windows NT 5 Active Directory	Regularly	3	1045	Call	QA TR
Windows NT 5.0 Technical Overview	To suit	1	330	London	PYGM
Upgrading to Windows NT 5.0	To suit	5	1195	London	PYGM
Supporting Windows NT 4.0 Core Technologies	26/01/98	5	995	London	PYGM
Supporting Windows NT 4.0 Core Technologies	26/01/98	5	995	London	PYGM
Supporting Windows NT 4.0 Enterprise Technologies	02/02/98	5	995	London	PYGM
Administering Windows NT 4.0	02/03/98	3	750	London	PYGM
Supporting Windows NT 4.0 Core Technologies	16/02/98	5	995	London	PYGM
Supporting Windows NT 4.0 Enterprise Technologies	23/03/98	5	995	London	PYGM
Installing & Configuring Microsoft BackOffice small Business Server	04/02/98	1	330	London	PYGM
Installing & Configuring Microsoft BackOffice small Business Server	04/03/98	1	330	London	PYGM
Administering Windows NT 4.0	05/01/98	3	750	London	PYGM
Supporting Windows NT 4.0 Core Technologies	05/01/98	5	995	London	PYGM
Supporting Windows NT 4.0 Core Technologies	05/01/98	5	995	London	PYGM
Administering Windows NT 4.0	09/02/98	3	750	London	PYGM
Supporting Windows NT 4.0 Enterprise Technologies	12/01/98	5	995	London	PYGM
Windows NT 4 Workstation & Server: Hands-on	Bi-weekly	5	1675	London	LTREE
Windows NT Optimisation & Troubleshooting	To suit	5	1675	London	LTREE
Windows NT 4 Workstation & Server: Hands-on	23/1/98	5	1675	Edinburgh	LTREE
Windows NT 4 Workstation & Server: Hands-on	2/3/98	5	1675	Birminghm	LTREE
Porting Applications from UNIX to Windows NT	17/2/98	4	1425	London	LTREE
UNIX & Windows NT Integration	24/2/98	4	1425	London	LTREE

WINDOWS SUPPORT

Implementing Windows NT Security: Hands-on	To suit	4	1425	London	LTREE
Microsoft Systems Management Server	To suit	4	1425	London	LTREE
Windows 95/NT/3.11 Multiplatform Networking	20/1/98	4	1425	London	LTREE
NetWare to Windows NT Integration & Migration	31/3/98	4	1425	London	LTREE

COMPANY DETAILS

DPR	Database Programmers Retreat
LTREE	Learning Tree International
PYGM	Pygmalion
QA-TR	QA Training Ltd

Database Programmers Retreat

Contact: Sue Darkin
The Old Fleece
Bisley Street
Painswick
Gloucestershire G16 6QQ
Tel: 01452 814303 Fax: 01452 813918
E-mail: 71760.632@Compuserve.com
Web: http://www.dp-retreat.com

DPR offers the finest technical training in the industry, by instructors who are all practicing programmers. You are guaranteed a high level of personal attention in classes which are based on practical exercises with sole use of a high-spec PC. Our training centre is located in the charming village of Painswick in the heart of the Cotswolds.

Learning Tree International Ltd.

Mole Business Park, Leatherhead, Surrey KT22 7AD
Contact: Jan Mott
Tel: 0800 282353 Fax: 01372 364611
email: uksales@learningtree.com
Web: http://www.learningtree.com/uk

Learning Tree International provides training for IT professionals. Established in 1974, the company presents an impartial view, focusing on practical application of knowledge.

Pygmalion Computer Group

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W1M 8NT
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Fax: +44 (0)171 436 2249
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email enquiries@pygmalion.co.uk

Pygmalion is a Microsoft Certified Solution Provider Partner and Authorised Technical Education Centre, a Borland Connections Premier Partner and a Lotus Business Partner. Internet, Systems & Network Training: IIS, Exchange, Windows NT, SQL Server, SMS. Developer Training: DNA-COM+, Visual InterDev, Visual C++, Visual J++, Visual Basic, Delphi Technical Consultancy: Design and specification for client/Server systems, networks and Intranets

QA Training Ltd

Cecily Hill Castle
Cirencester
Gloucestershire
GL7 2EF
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Fax: 01285 643748
Email: responsecentre@qatraining.com
Web: http://www.qatraining.com

QA Training is widely recognised as the premier IT training company in the UK and the largest provider of technical training to IT professionals. We offer over 150 programming and support courses and are major business partners and accredited trainers of Compaq, Hewlett-Packard, Lotus, Microsoft, Netscape, Novell, Oracle and Powersoft amongst others. More than that, we actually provide internal training to companies like Microsoft on their own products in advance of release. This makes us the first to understand and provide training and consultancy on the latest technologies to our customers.

See EXEOnline for the latest news in software development and for the searchable Software Training Guide.

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Fax: 01296 336037
Email: jobs@soltech.co.uk

SOFTWARE OPPORTUNITIES

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Aylesbury
Bucks HP20 1SQ

SEND A CV OR CALL FOR INFO:

Interactive TV C/C++ multimedia, to £35k+	*S. Coast, Surrey Camb*
Internet & e-mail protocols, to £40k	*Suffolk*
Image processing, interactive apps	*Cambridge*
Visual C++/C++/Win32, SDK, MFC	*Manchester*
Borland C++, GUI development	*Herts*
Videoconferencing	*Bristol*
1yr: Visual C++, MFC, SDK, 95/NT audio	*Cambridge*

VIDEO/AUDIO - TV

Cambridge £20 to £35k

International manufacturers of exciting TV Broadcast equipment - a young and dynamic engineering driven company and winner of 1997 Queens Award for Export. Their products are based on proprietary RISC hardware & software with applications for character generation, graphics creation 2D & 3D animation, non-linear video & audio editing. You will be developing the algorithms & applications level software for their range of innovative video & audio processing systems used for TV production around the world. You should have 2 years + experience in C in an embedded environment; any experience in graphics or audio software a plus.

GRAPHICS - TV

Hants £18 to £40k

Well known international consumer electronics company with an expanding UK design centre seeks engineers with drive and ability. In exchange for your skills & experience you can expect great career prospects, state-of-the-art work, and the prestige of working for this first class company. If you are well-educated with some experience under your belt and skills in some of the following: graphics device drivers, algorithmic development for 2D or 3D graphics libraries, real-time embedded systems, graphics display for TV, then please send a c.v. or call for further details.

REVOLUTIONARY!

Cambridge to £35 + bens

I'm sure you'll be impressed with the exciting leading-edge work this company is doing - and you'll want to be a part of it! Some of their current work includes: interactive TV, set-top boxes, multimedia handsets, Internet, MPEG video conferencing, graphics, high speed ATM, networking systems. You'll want to send your c.v. to be considered for this company - currently recruiting for 6 positions (call for more details if you're still not convinced!) Skills of interest: (SOME of): C, C++, Java, device drivers, compilers, filing systems, kernels, network system software (IP, ATM), audio, video codecs, imaging (colour), graphics (2D/3D), DSP, assemblers (especially ARM), RISC OS, pSOS, VRTX, VxWorks, Windows programmers.

TELECOMS/BROADCAST

Cambridge £20 to 35k

My client is involved in the design, manufacture & supply of test equipment for the telecoms & broadcast industry. They currently have requirements for Software Engineers to work on Windows software. Ideally you will have a good degree and around 3 years experience as well as C++/MFC, OOD, Windows NT/95 application development, and preferable some experience of scientific/industrial applications. OLE, MPEG/DVB/digital video and Windows NT device driver experience a plus.

C++/OO, COMMS

London, Berks, Wilts to £35k + bens

I have several top companies, all leaders in the telecoms & mobile comms industries, now seeking a number of degree (or HND) qualified software engineers with experience of C++ and OO techniques. Any experience in the comms industry would be an advantage but you can look forward to top salaries and excellent training in areas such as: GSM, Windows NT, UNIX, network planning, etc. These companies also offer excellent benefits packages and career development.

MULTIMEDIA

Berks to £30k

Major player in Object Technology, Advanced Web Applications, and Multimedia technologies have several vacancies for Software Engineers with at least 2 years experience in some of the following: Delphi (or C++ prepared to learn Delphi), Visual Basic, GUIs, Java, SQL Server, Active X, Windows 95/NT, Object Technology, Visual C++, MFC, OWL, Windows 95/NT at systems level, network management, TCP/IP, embedded systems (set-top boxes, drivers), Internet technologies.

TV BROADCAST GRAPHICS

Surrey £Excellent!

Private, profitable, and successful client who design & manufacture TV broadcast products. You will be joining a team of software engineers and working in pleasant surroundings - competitive salary, and excellent benefits await you, as well as the opportunity to join in on this expanding & interesting market sector. Ideally you will have a good degree (2:1 minimum) and have 1 to 3 years experience of Visual C++/MFC programming under Windows 95/NT. Fresh graduate level to 7 years + experience.

IMAGE PROCESSING

Surrey £15 to £30k

World leader in design of high speed graphics for visual simulation and imaging are looking for bright engineers to work on a variety of interesting imaging projects. You should have a good degree (2:1 or above) from a good university with some experience in image processing/compression, real-time imaging, C, and some assembler. Experience in embedded systems, DSP, CCTV video, storage systems, automated analysis, video streams, motion are also desirable. They are happy to consider fresh graduates with some project experience in image processing to engineers with 5 - 10 years experience.

Artificial Life

Junior Programmers

Probably a recent graduate with 2.1 or better in Computer Science. You will have developed skills in C++ or Visual C++ and a working knowledge/understanding of Object Oriented Programming.

Ref: MJ0104

Guru Programmers

Individuals who are top in their field with at least ten years software development experience. Must be capable of developing at all language levels (assembler to C++ and Script) and of working independently. Particular areas of interest Artificial Life, Neural Nets, Genetic Algorithms, Graphics, etc.)

Ref: MJ0105

Programmers

At least 12 months experience in an industrial software environment. Should have a working knowledge of C++, MFC and DirectX. Familiarity with Java would also be a plus.

Ref: MJ0106

Lead Programmers

Experienced programmer capable of taking on some management and design functions. Must be capable of leading a small team of up to five programmers. Should have at least five years general programming experience together with a particular area of expertise in a domain of interest to the company.

Ref: MJ0107

ERS Technical

ERS Technical is a member of the Executive Recruitment Services plc group of companies

Cambridge £Excellent

It really is that simple! The creation of independent beings complete with needs, desires and even goal oriented behaviour. The birth of intelligent personalities capable of evolving, self replicating, reasoning and learning from events and circumstances that surround them. In short, the creation of LIFE. It is simply the fusion of biology, computer science, artificial intelligence, neural networking and 3D modelling and texturing. In fact it is so simple that only the very best software practitioners will suffice.

We are a very bright, very exciting, very selective developer of artificial life environments. If you think you can work with the best in the industry and meet the criteria shown, I simply want to hear from you NOW!

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email: mike_jenkins@ers.co.uk

FUTURE OPTIONS?

We are currently retained by many of the City's top financial institutions to resource a number of high profile development projects. Following is a selection of our current City based contracts. To secure the right Option for your Future, call Abacus IT - NOW.

VISUAL C++, NT, MFC - DEVELOPER

To write front end GUI applications in the Fixed Income area of a major Investment Bank. This is a 3 tier server environment so relevant experience would be a distinct advantage.

C, C++, NT - DEVELOPMENT / SUPPORT

One year's post grad experience would secure this exciting role. Offering support to the development environment in FX Equities. You will need good user interfacing skills.

iT Contact Sue Cowie

COBOL, CICS - ANALYST PROGRAMMER X 4

Working for a top Investment Bank on their Year 2000 project.

SUNBUSINESS, VB4, SQL-SERVER, VC++ - DEVELOPER

Working for one of the City's major Exchanges, developing further functionality in Sun. General Microsoft development skills would be useful. This is a long term project with 1998's plans including work in COM, D/COM, Active-X and Java.

iT Contact Matthew Holt

C, UNIX, SYBASE +/-GLOSS - A/P

Top Investment Bank urgently require developers for the GLOSS team. You will have strong C, Unix and Sybase, with GLOSS experience being a real plus. These are long term assignments.

TANDEM, GUARDIAN - OPERATOR

A number of Tandem operators and support staff are required by this major Investment Bank to work on their remote site in Bucks.

iT Contact Julia Banks

VISUAL C++, MFC, NT - DEVELOPER

Strong MFC skills are required for this application enhancement project. Multi Threading experience would be preferred.

YEAR 2000 - ANALYST

Strong Systems/Business Analysis skills are urgently required for this very high profile Year2000 role. Working with one of the City's fastest growing Investment Banks.

iT Contact Steve Mallison-Jones

C++, UNIX, SYBASE - ANALYST PROGRAMMERS X 5

Top Investment Bank urgently require a number of C++ developers. Projects include Settlement and Derivative Risk, Risk Exposure, Derivative Trading, P&L and Derivative Pricing Re-Valuation. Three Tier Server environment with some spreadsheet work on the client end.

C++, OO, COM, D/COM - ANALYST PROGRAMMER

Working for one of the City's top Derivatives Houses, this role is developing the banks daily reconciliation system. In a 3 tier server environment you will be developing the server side of the total risk exposure system.

EXCEL, VBA, COM - DEVELOPER

You will need two years solid Excel VBA experience to secure this high profile role in one of the City's most respected Investment Banks. You will be developing trader spreads in the Equity Derivatives area.

iT Contact Derek Armson

VMS, C, INGRES - ANALYST PROGRAMMER

Working in the FX Swaps area, you will be responsible for enhancement, support and further development of existing systems.

VAXBASIC, DCL, UNIX, EXCEL, ACCESS - DEVELOPER

Development and Support of the Back Office Equities system. Solid technical skills required along with good user facing skills.

C++, NT, MFC, UNIX - DEVELOPERS

A number of developers required with any combination of the above skills. This role is working in the risk Development Team of a team of a major Investment Bank.

iT Contact Tim Bashall

iT
Abacus IT
CONTRACT ASSIGNMENTS

CATCH US ON THE NET

http://www.abacusit.co.uk

Abacus IT The Bunching Sheds 23 High Street Redbourn Herts. AL3 7LE

Tel 01582 794444 Fax 01582 792900

E-Mail: info@abacusit.co.uk

EXE RECRUITMENT

Call Ben Boswell on 0171 287 5000 email: benb@dotexe.demon.co.uk

VISUAL C++

VISUAL C++/FINANCE

Cambs – To £30k

Our client designs and develops financial software for the offshore markets. A vacancy currently exists within their team for a Visual C++ developer. All work is under NT and/or 95. Candidates must be from a strong academic background, preferably with a good University degree. Excellent opportunities to work for a dynamic and successful organisation. *Ref:CP/1*

VISUAL C++/MFC

Wales – £20k-£30k + Car

Leading developer of integrated telephone products requires software engineers with at least 1-2 years Visual C++ and 32bit development experience. This is a customer facing development role and you must enjoy working with people as well as being prepared to travel. You will be responsible for the full project life cycle of bespoke software solutions. An exciting opportunity to develop your skills. *Ref: KB/2*

VISUAL C++/BANKING

California – To £45k

Get away from the drab UK and work in the sun in California. You will be working on software for the financial markets, using Visual C++. There will be a heavy emphasis on OLE work and any experience of ODBC and/or relational databases with SQL would be advantageous. Successful candidates' responsibilities will also include product management and liaising with clients. Initial interviews will be held in the UK. *Ref: DE/3*

WINDOWS DEVELOPMENT

OLE/ACTIVE X/NT

West London – £25k-£40k

Exciting new product for the travel industry. We require programmers through to senior programmers with Visual C++/MFC experience. The successful candidates will be working on Windows NT and 95 platforms using OLE and Active X technologies. There will also be the opportunity to work with JAVA. *Ref: LC/5*

C/C++ DEVELOPERS

Berks – £20k-£30k

This rapidly expanding company manufacture anti fraud check systems. They are currently looking for a developer with at least one years experience of C and C++ under Windows 3.1. Excellent technical and career prospects are available, with this successful and friendly company. *Ref: KB/6*

VISUAL C++/VISUAL BASIC

Herts – To £27k

Our client is the leading independent provider of distributed IT systems and services. They are currently searching for a highly motivated developer with good skills in Visual C++ and/or Visual Basic and excellent client/server or relational database skills. Excellent remuneration packages available and you will have the opportunity to learn other technologies. *Ref: CP/7*

NETWORK MANAGEMENT

Herts – To £35k

Two vacancies with rapidly expanding company to work on the development of new products for global markets. Candidates should have strong Object Oriented Design experience including Visual C++ or Java. Experience of developing network management products and a team spirit are essential for these positions. *Ref: LC/8*

VISUAL BASIC/SYBASE/SQL

Berks – To £30k

This leading insurance company has a vacancy for an Application Developer. Candidates must have at least two years Visual Basic programming, preferably under NT. Sybase or SQL Server experience is also required. Good communication skills are essential as is the ability to learn. *Ref: CP/9*

C++/NT/SYBASE - FINANCE

City/Amsterdam – To £30k

Eight vacancies exist with this major City based European investment bank. Opportunities are at all levels from programmers to project managers. Development is carried out using Visual C++/MFC under Windows NT running with a Sybase back-end. No previous financial knowledge is necessary for candidates with the above technical skills. Excellent benefits package and opportunities to work in Holland. *Ref: FS/10*

VISUAL BASIC

VISUAL BASIC - FINANCE

CITY – To £35k

This Broking company requires two Visual Basic v4 developers to produce GUI's for financial products. Working in a client/server environment, you will require Windows NT and SQL Server experience, as well as a maths or banking background. Bonus skills would be any knowledge of VBA and Excel. Excellent benefits package and career progression. *Ref: RC/17*

VISUAL BASIC DEVELOPERS

City – £22k-£30k

Leading consultancy developing solutions for the asset management community require strong Visual Basic developers. Any SQL or financial markets knowledge an advantage, but not essential. Excellent opportunities to work for a dynamic and successful organisation. *Ref: PP/18*

VISUAL BASIC/ACCESS

City – £24k

This city bank is keen to employ an additional Visual Basic developer who has also used Clipper. New development will all be done using Visual Basic v4. There are a number of existing banking systems, written in Clipper, which will need to be supported. They are soon to implement Windows NT so these skills would be of particular interest. *Ref: RC/19*

Logistix Recruitment Limited, Lamb House,
Church Street, Chiswick Mall, London W4 2PD

Logistix

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Telephone: 0181 742 3060

SOFTWARE ENGINEERS
NEW YEAR NEW CHALLENGE

COMMERCIAL SYSTEMS DEVELOPMENT

South East Salaries to £35K – These companies at the forefront of Neural Computing are developing some of the most advanced Software Solutions for today's and tomorrow's Computing Applications. They seek exceptional candidates with both excellent Qualifications and Experience to originate, design and develop New and exciting Solutions for World Class Computing Products for both industry and Commercial environments. You will be degree qualified min 2.1 with 2yrs+ experience gained in C/C++ or Visual C++ & OOD plus any of the additional listed skills below.

C++, SQL, WINDOWS-NT, OOD, CLASS LIBRARIES, GUI'S, OLE, SYSTEM ARCHITECTURES, ACTIVEX, 32-BIT WINDOWS, MFC, UNIX, STATISTICAL METHODS, AI, EXPERT SYSTEMS, DATABASES.

Speak to Kaye Chambers or Michelle Maxwell for Commercial Positions

REAL TIME SOFTWARE DEVELOPMENT

South Coast Salaries to £30K – This World Leading Designer and Manufacturer of Process Control Instrumentation & Production Monitoring Systems is expanding its Windows Software Development Team. They seek Highly Qualified developers with at least 1 yrs experience of C++ and MFC gained in a 32 bit Windows environment. Any experience of COM and ActiveX would be an advantage.

South East Salaries to £25K – This small highly successful British Company with a large International client base is at the start of Major New Projects. They are looking for Software Engineers to join their development team working on the complete redesign of their Major Product. You will be working on a Highly Graphical and Scientific Application involved in all areas of the Project Lifecycle in a Commercial environment. You will need to be highly qualified ideally to PhD with at least 1yrs experience using C++ and OOD. This is an excellent opportunity to use Research skills in a Commercial environment.

Speak to James Hunt or Ron Cook for Real Time Positions

ASH Associates

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First Floor, 39 to 41 High Street
Ringwood, Hants, BH24 1AD
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Telephone
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Email:
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In and Around West Yorkshire

We have clients currently seeking the following:

Developers required for consultancy roles working on client sites in UK & Europe. Experience needed in either Visual BASIC with SQL or in 'C' under UNIX. .....£20,000+

PC Developer for financial systems, experienced in 'C' and Visual BASIC. £18,000

Visual Developer with Visual 'C++' or Visual BASIC or DELPHI or Visual FOXPRO experience to re-develop an existing DOS-based package into an NT environment £16,000 to £20,000

Visual FOXPRO or FOXPRO for DOS Developer.....£17,000

UNIFACE Developers for financial/leasing systems .....£very wide range

Web Page Developers with JAVA, JAVA Script, Internet Server SQL/database or similar experience.....£20,000+

Visual 'C++' Developer to work with MFC5 writing comms software for PCs running NT..... to £33,000 + excellent benefits

For your next career move around West Yorkshire telephone Vincent Atherton on Leeds (0113) 250 4560 or write to:

Airedale Recruitment

Realtex House, Micklefield Lane,

Rawdon, Leeds, LS19 6 AX

The first thing you'll develop is an international outlook.

Heathrow

By utilising object oriented software and drawing upon over 25 years of operational expertise, Speedwing has become a top supplier of business and IT solutions to airlines, ground handling agencies and airport authorities all over the world. We have also secured a strong presence in the travel and tourism sectors and include finance institutions, telecommunications companies and hotel chains amongst our clients.

Our Finance Systems group has recently won a number of prestigious contracts to implement the passenger revenue accounting system, JADE. This has created the need for experienced IT professionals looking to develop their careers in a fast-moving environment that promises exposure to an international client base.

Software Engineers

Our systems are currently based on UNIX and OS/2, although we will be moving from OS/2 to Windows NT over the next year. We are particularly interested in Engineers with at least 2 years' experience in C and C++ with SQL, ideally a UNIX platform. We also need a Team Leader who has core skills in UNIX, SQL, Oracle and C, as well as 2 years' team leading experience.

Technical Support

We also have a number of opportunities in the group providing technical support for JADE, ranging from Team Leader and Lead Designer to Technical Support Specialist and Systems Tester. Relevant skills include C++, OOA/OOD, UNIX, SQL and LAN's. The more senior roles require C++ programming and team leadership experience.

All positions are based at Heathrow and some may involve international travel. We offer competitive salaries, which vary according to experience, together with an attractive range of large company benefits.

So, if you'd like to give your career development an international flavour, please send a full CV, quoting reference Exe/1 and indicating the role you feel most qualified for, to Maxine Scaffardi, Speedwing, PO Box 35, Heathrow House (S534), Bath Road, Hounslow, Middlesex TW5 9RS.

PUT OUR EXPERIENCE TO WORK

SPEEDWING

Visual C++ and Music
Cambridge £25,000 - £35,000

An outstanding opportunity for software Developers with at least 2 years solid Visual C++/MFC experience. This prestigious company specialise in the design of digital audio recording and test equiptment for the Music Industry offering a dynamic work environment and excellent career progression. Whilst technical expertise is essential, a passion for music is highly advantageous. So, whatever your musical preference, call today for more details! *Ref: kc-1203/EX*

Visual C++ in Finance
Various Locations £20,000 - £40,000

A superb opportunity to work on major Client/Server Development Projects applying the latest in Object Oriented techniques. This is a challenging role working as part of a Finance Practice Team developing innovative solutions for Banking and Insurance. In exchange for a fantastic remuneration package, in addition to endless cross-training opportunities, you must demonstrate excellent C++ development skills with knowledge of any of the following: DCOM, ActiveX, Windows NT, SQL Server or Rational Rose. *Ref: kc-1201/EX*

VISUAL C++ MFC WITH COM CORBA JAVA & ASP
London (City) £32,000 to £45,000 + benefits

Are you fed up with the same old Visual C++/MFC GUI work? Do you want to work with an approved Microsoft Partner using the latest tools **(ActiveX, COM, DCOM, IIS, ASP)**? If you're mad you answer will be no! but all you sensible people out there will recognise this as an opportunity not to be missed. And **HEY!** you will even get to learn JAVA. What *more* could you ask for? Put the magazine down now and apply today, you don't need to look at any other advert. *Ref: DL-1204/EX*

BACK TO THE FUTURE...
Visual C++ • SDK • COM • ACTIVEX
Guildford to £40,000

Developing internal multimeida products to be installed in 'tomorrows vehicles' TODAY. If you relish participating in hi-tech, state-of-the-art technology, have vision and strong Windows development experience in either Visual C++, Visual Basic or Delphi then you could not wish for a better opportunity! *Ref: JS-1203/EX*

Visual C++ MFC 'C'
Software Engineer

The role will involve developing new client/server applications, data communications, application management systems, embedded system development, data access, full life cycle and beyond and GUI development. Must have two to four years commercial development of Visual C++ with some 'C' network experience. Also helpful would be, SQL, DAO, MFC, 32bit DLL, Java, GUI or networks. *Ref: NB-1203/EX*

SPOT THE HIDDEN MESSAGE!
Visual C++ under Windows (Junior & Senior Positions)
West London From £20,000

How can I describe this opportunity to you???

Challenging Work	CAN DO attitude
A Recognised technology leader	Hot development projects
Rapid Career Progression	A Fabulous opportunity
Established Blue Chip Clients	New Technologies
Exciting industry	Great Working Atmosphere
Revolutionary Software	Excellent Salaries

If you have solid experience in Visual C++, MFC and/or API, then I think you know what this opportunity will spell for you!!!! *Ref: ko-1210/EX*

ALL VISUAL C++ MFC PEOPLE - AT LAST AN OFFER TO END ALL OFFERS
London Up to £35,000

If you're a Visual C++ MFC person you may be fed up with being inundated with interviews and wondering which company to join. Well, I have the answer. There is nothing to compare with a job offer from this client for prestige, career prospects and training. One of the top city-based consultancies requires experienced (minimum eighteen months) Visual C++ MFC programmers to develop financial applications. Send us your CV as your first step to embarking on a brilliant career.

Ref: JA 1201/EX

VISUAL C++, MFC DEVELOPMENT WITHIN MOTOR RACING
Woking £21,000 to £33,000

We have a very prestigious client inviloved in the development of **real time Windows systems** for use within precision timing and racing car management environments. They are now seeking **Windows engineers** with skills in **VISUAL C++** and the **MFC** to work on their latest range of award winning software. You will have the opportunity to work within a very fast moving, dynamic environment, within an environment that everyone will envy. *Ref: JJ-1203/EX*

VISUAL C++ MFC - ENGINEERING
Kingston, Surrey to £30,000

Our client is a specialist organization, who develop systems for the engineering sector. Degree educated in Mathematics or Science related subject, you will have acquired at least two years Visual C++ development of a large engineering analysis system. In return, our client will offer you true career progression, along with an excellent salary and benfits package. *Ref: TS-1204*

VISION

VISION COMPUTER RECRUITMENT

These are a small selection of our current vacancies. Please call for more information or send/fax/email a CV and we will contact you as soon as possible.

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Telephone: 01908 319600 Fax: 01908 319638 Email: mail@visioncr.co.uk

THAMES VALLEY

PC/UNIX//WINDOWS DEVELOPMENT

SOFTWARE ENGINEER VISUAL BASIC & DELPHI

Fleet — **To £24,000+Benefits**

My client a market leader in the telecommunications industry are looking for pure developers. You will be working in the Billing System/ Customer Care department and will be involved in the development and coding of their windows NT database. 12 months experience in VISUAL BASIC 3/4 or DELPHI 1/2 is essential, plus an understanding of one of the following would be beneficial: UNIX, ORACLE, INGRES or INFORMIX. Minimal travel is expected plus the cross training opportunities are superb. **Ref: COM-NL10121**

SOFTWARE DEVELOPERS VISUAL BASIC & ACCESS

Surrey — **To £32,000+Benefits**

My client the largest independently owned firm in actuaries and consultants in the UK, are looking for developers to work in the Desktop team. Working in a IT department team of 35, you will have PC client/server experience and have at least 2 years experience in VISUAL BASIC 3/4 and ACCESS. Experience in any of the following would be beneficial: MS OFFICE PRODUCTS, ODBC, SQL Server and OLE. You can expect the opportunity to cross train into areas such as DELPHI and VIS C++. No travel is expected.
Ref: COM-NL10122

SOFTWARE ENGINEER VISUAL BASIC & ACCESS

Reading — **To £30,000 Package**

Established in 1992 this Direct Marketing House are looking for Software Engineers to join their data-base department. With 35 people in the company and 7 within IT, they are looking to increase to 10 by April 1998. Therefore it is an opportunity that can not be missed!!! You will be a pure ACCESS developer of 12-18 months, but will also have an understanding of BASIC. A degree would be beneficial but a good team player with excellent communication skills is essential. No travel is expected and a superb incentive scheme if offered. **Ref: COM-NL10123**

SOFTWARE ENGINEERS VISUAL C++, JAVA & WINDOWS 95

Woking & Surrey — **To £38,000+Bonus**

My client being a leader in the development of systems for the financial market across the whole of the world are looking for software engineers to join their dedicated development team. You will ideally have over 2 years experience in VISUAL C++ as well as experience with Java/HTML in a programming environment. You will be expected to get involved in all aspects of the project life cycle including testing, development, design and analysis With excellent training opportunities, these positions offer new technology and challenging projects. **Ref: COM-MK101204.**

SENIOR CONSULTANTS VISUAL C++, DELPHI, C, VISUAL BASIC

Surrey — **To £38,000+Benefits**

A highly successful software house and consultancy ugently requires a number of individuals to join their elite consultancy team. You will possess a good degree in the computing associated degree and have a sound understanding of at least two of the following: VISUALC++, DELPHI, VISUAL BASIC, C or ORACLE. Applicants should be prepared to travel across the country.
Ref: COM-MK101205.

ANALYST PROGRAMMERS (JUNIOR/SENIOR) X 2 C/C++(VISUAL), SQL, ODBC, RAD, 95/NT (FINANCIAL SYSTEMS)

Reading — **To £40,000+Benefits**

This well established and rapidly expanding software house specialising in high profile Financial systems is looking to employ at least two additional Analyst Programmers. You will work as part of a team responsible for the analysis, design and development of client specified systems using VISUAL C++/MFC, SQL, ODBC, SQL, NT/95, and RAD technologies. Suitable candidates (Junior/Senior) will have proven C/C++/WINDOWS (BORLAND/MICROSOFT) development experience. This is truly an unique opportunity to gain new skills within a company that is committed to leading edge technology. **Ref: COM-MK-C/C++(RG)**

SOFTWARE ENGINEER VISUAL BASIC & ACCESS, SQL

Reading — **To £25,000 Package**

My client a leading software house in hand held computer terminals are looking for candidates with knowledge of VISUAL BASIC 3/4, plus experience in either ACCESS or SQL. With 12 months experience in the development arena, you will be expected to analyse a client's needs and then develop, code and test the product, making sure that it meets the requirements and within the designated time. Training will be offered in weak areas, and an aspect of European travel can be expected. **Ref: COM-NL10124**

SOFTWARE ENGINEER (VISUAL BASIC 3/4 LEARN VB5)

Bracknell — **To £28,000+Car+Benefits**

My client a leading software house in the financial industry, are looking for candidates who are interested in learning VISUAL BASIC 5 and ACCESS 97. You will have at least 12 months experience in ACCESS, plus have a working experience in VISUAL BASIC 4. Joining a team of 4 that will double in the next 6 months, you will have an equal split of support and coding. Working a flexi-time system you will be office based, but can expect a degree of European travel. An excellent opportunity that can not be missed!!!
Ref: COM-NL10125

DEVELOPMENT TEAM LEADER (WINDOWS - VB4/5, DELPHI, C++)

Reading — **To £35,000+Benefits**

This leading computer services company who deal with all the major financial companies are looking for a development team leader. You will be responsible for heading the development of all bespoke work including interfaces, data conversion programs and screen/reports. Liasing with both internal staff and external contractors, meeting deadlines is crucial. Reporting to the Project Manager you will assist with project planning and therefore will be expected to have at least 2 years experience at a senior level as well as a proven track record in P.C. Development (VB, Delphi, or C++). With minimal travel involved and an excellent package offered, this is surely an excellent career move. **Ref: COM-NL10126**

SOFTWARE DEVELOPER VISUAL C++ & MFC

Reading — **To £40,000+Superb Benefits**

A challenging opportunity has arisen in my clients company developing leading edge technology with internet products. Being a market leader in the financial arena, this is an opportunity that can't be missed!!!. The ideal applicant will have 2 years VISUAL C++ experience, and 5 years commercial experience, with MFC & Object Orientation. Knowledge of JAVA would be beneficial but training will be given. You will work on ACCESS and SQL databases, getting involved in all aspects of the full project life cycle. **Ref: COM-MK101201.**

TECHNICAL CONSULTANT X 5 VISUAL C++ & WINDOWS 95

Bracknell — **To £40,000 +Car+Benefits**

My client an internationally renowned world-wide company is looking to employ a number of sales individuals. The position is extremely diverse requiring a TECHNICAL CONSULTANT with a very confident manner, social personality, with excellent communication skills and the ability to present to large blue-chip organisations. Travel into Europe and the Far East can also be expected. You will ideally have at least 3 years experience in VISUAL C++, so that you can successfully promote their financial computer packages.
Ref: COM-MK101202.

APPLICATION DEVELOPERS VISUAL C++, C & WINDOWS NT

Farnborough — **To £26,000+Benefits**

A world leader in the provision of high profile information systems to major companies are looking to employ a number of Application Developers to work on a variety of projects. You will have a minimum of 18 months programming experience using VISUAL C++ and possess applications design and development skills, with a knowledge of C, WINDOWS 95 and NT would also be beneficial. You will be mature in nature with the ability to deal with customers in a challenging environment. Training will be provided in areas such as ORACLE. **Ref: COM-MK101203.**

ANALYST PROGRAMMERS * 6 VISUAL C++ WINDOWS NT SEQUEL SERVER

Guilford — **To £40,000**

To survive in the fast moving world of trading you need to guarantee the systems and software you are using is effective, efficient and is one step ahead of your competition .That is why our client a major force in the stocks and shares market are in the process of developing some advanced client server systems utilising some of the latest microsoft tools. They require a number of experienced WINDOWS developers with proven C++ skills to join an established but growing team. The environment is fast moving ,the offices are superb and the rewards are continuous. **Ref: COM MK C++**

WEB SITE MANAGER (JAVA & HTML)

Reading — **To £28,000+Benefits**

Our client, a leading company in the communications industry, is looking for a WEB SITE MANAGER. Managing their dynamic Web Site development team of 3 - 6, you will be expected to liase with colleagues in marketing, development and support in order to maintain a high quality standards. At least 3 years experience in successfully implementing internet projects is required coupled with sound knowledge of JAVA and HTML. (A graphical sense would be advantageous. With a high technical content your skills will be kept at an enviable height. **Ref: COM-NL1012**

SOFTWARE ENGINEER (VISUAL BASIC & JAVA)

Bracknell — **To £45,000+Benefits**

My client a leading software house are at present looking for 2 software engineers to join their database department. This role will be a customer facing role and therefore you will be expected to have excellent communication skills as well as having an outgoing personality. With at least 2 years experience in VISUAL BASIC 3/4 and a clear understanding in either ACCESS or SQL. A knowledge of JAVA would be beneficial, but training will be given. Cross training into VIS C++ is also a distinct possibility. No travel is expected and the remuneration package is superb. **Ref: COM-NL10128**

SENIOR SOFTWARE DEVELOPER VISUAL BASIC - C/C++

Reading — **To £37,000+Bonus+Superb Pension**

Owned by a large financial services company, this leading systems house is currently enjoying a rapid but strategic growth programme. Their success is as a result of maintaining and developing their employees which in turn has produced effective and quality software for their client base. A number of additional staff are required. Only developers with 2 years VISUAL BASIC/C or C++ combined with dedication, commitment and enthusiasm need apply. There are many career advancements within the technical or management arena within this organisation so why wait till after Xmas. **Ref: COM-MK-VB-C-FIN**

ANALYST PROGRAMMERS VISUAL BASIC 5 SEQUEL SERVER WORKFLOW

Slough — **To £37,000+Relocation+Bonus**

Employing over 500+ people ,this UK based computer services company are seeking experienced VISUAL BASIC developers to join a new team being established within their WORKFLOW division. You will be working on the latest Object Oriented technology and you will involved in the full life cycle of development projects to include consultancy to continuous training programme is in place with regular appraisals and salary reviews that will ensure your loyalty and commitment to this highly successful organisation.
Ref: COM MK VB WORKFLOW

SOFTWARE ENGINEER (VISUAL BASIC, ACCESS & SQL)

Maidenhead — **To £20,000+Benefits**

This leading company in Aviation Technology are looking for a software engineer. Having been established for over 30 years and with a turnover of $100m, this market leader is poised to totally dominate the world in its field. You will be involved in database development, making sure that the refuelling system process from beginning to end runs smoothly. You will have 12 months experience in VISUAL BASIC 3/4 as well as an understanding of ACCESS or SQL. Working on a WINDOWS NT platform you can expect training in weak areas. No travel is expected and the promotion prospects are exceptional. **Ref: COM-NL10129**

MIDLANDS
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24 Martineau Square,
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for all offices.

Wonderful press releases

Ctrl-Break receives lots of press releases – a few are relevant, to the point, and you can often read about them in our news section. But what about all the others? Here's a small selection of what we've received in the past few months: some wonderful, some amazing, some tacky, and some completely fake. Here, for your enjoyment...

Subject: A NEW WEB SITE LISTS ALL COMPETITIONS WITH PRIZES.

http://www.intervid.co.uk/prize

Internet consultancy Intervid, has sponsored a useful service that will be a big hit over the Xmas period. Many Web sites have competitions, but finding them, and making sure there is still time to enter can be a laborious task!!

There are over 40 competitions on the site upon launch, including prizes of a car, a $100,000 holiday, a house, and many others.

"The competitions are designed as a way to attract people to visit a Web site, so what we are doing is both good for the Web site owners and good for the public," said Intervid MD Nick Rosen.

Rather tacky is it not?

Subject: Microsoft sues Bandai

Redmond WA, (AP).

Microsoft (MSFT) has announced a 54 million dollar lawsuit against Tomagotchi maker, Bandai. Microsoft is claiming that the Tomagotchi (the Japanese electronic pet that's all the rage with the kids) is an infringement of its intellectual property.

Microsoft spokesperson, Erik Loregard stated "Software that needs constant, even hourly attention, or else it dies? Sounds like Windows to me. This is clearly an infringement on our technology".

The Bandai company spokesman refused to comment on the suit.

OK, this one is completely fake. As we pointed out last month, we receive many fake ones targeting Microsoft. Many more than for any other company. Why is no one having some fun at the expense of the many other software companies out there?

Subject: UK Technology Helps Uncover Chinese Infiltration in the US

[...] Using publicly available information, Thomas Hampson testified that "the People's Republic of China uses China Resources as an agent of espionage – economical, military and political. They acquire companies in order to use them as surrogates". He illustrated the complex relationship of the different companies and individuals using enlarged versions of i2 charts. [...]

This is real – beware!

Subject: Press Information

[...] NOTE TO EDITORS: Colour photographs available of [...]

b) a Databasics veterinary user, a vet with a Burmese Mountain puppy /and if required adult Burmese Mountain dog too on an examination table looking at a databasics computer screen in the background. [...]

Why oh why would we publish such a photograph? Aren't there any more relevant screen captures?

Subject: ATTENTION: The World Wide Web Consortium announces W3C-LA (European Leveraging Action)

For immediate release

European Commission's Esprit Programme Champions W3C to Leverage the Web for European Industry

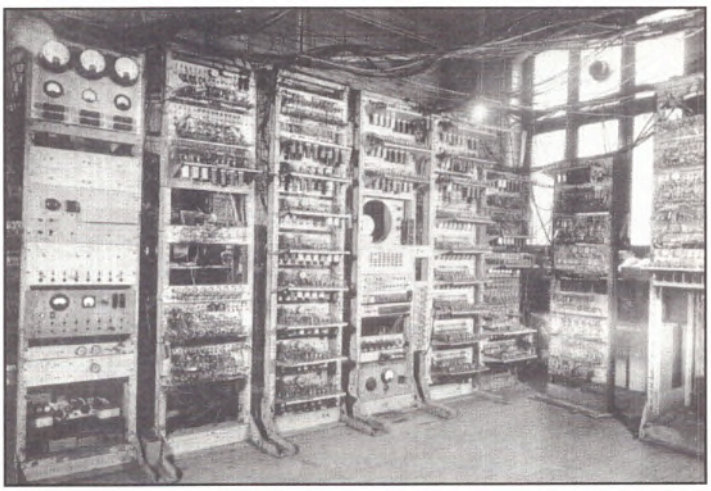
BRUSSELS — 24 November, 1997 — The World Wide Web Consortium (W3C) today announced the launch of W3C-LA, a new initiative to promote W3C developments to leverage the Web for European industry. W3C-LA (Leveraging Action) is one of the European Commission's "Leveraging Actions for Software Technologies", sponsored by the Esprit programme. [...]

Leveraging is becoming the most common word (after Java) appearing in press releases and also the one most hated by all UK journos. This is the first time we've seen it appearing in a product/initiative name.

Subject: World Wide Appeal for Programmers to Write Software for the World's First Computer

Computer experts and novices alike from around the world are being invited to enter a competition to write a software program for the world's first stored-program digital computer which is being re-built to celebrate the 50th anniversary of its birth on 21st June 1948 at the University of Manchester, England. [...]

Time-warp. Fantastic competition; your program should be less than 1024 bits (yes, you read correctly) long. There are a whopping seven instructions to play with. More info at http://www.cs.man.ac.uk/prog98/.



'Baby'; fifty years old in June.

The Browser

Verity Stob has taken another selection of popular verse and, in Tom Lehrer's choice phrase, kicked it while it is down.

Warning

When I am a senior analyst, I shall draw flow charts
With ER diagrams, which combination doesn't go, and doesn't make sense.

And I shall spend half the year's budget on a CASE tool
That doesn't work, then say we have no money for PC upgrades.
And I shall advise others on coding issues about which I know nothing.
And I shall refer to other people's time as 'programmer utilisation',
Strolling into the office saying 'We really have to get utilisation up'.
And I shall call emergency meetings, and then turn up late,
But some mornings get in really early,
Ostentatiously making notes on my Psion as my colleagues arrive.

You can answer your phone on hands free,
Make everyone adopt your personal taste in naming conventions
Then blame it on ISO 9000.
You can call directors by their first names to their faces
And move the training video TV onto your desk to watch The Simpsons.

But now I must work to 7.30pm on Fridays,
And fill in timesheets marked in 15 minute intervals,
And smile prettily when booking the holiday time which is mine,
And generally be a Good Girl.

Perhaps I should practise a little now
So people aren't too shocked and surprised
When suddenly I become a senior analyst, and draw flow charts.
What do you mean: *how will we tell when you're practising?*

Upgraded Spanish Postcard

It's ActiveX to bed and ActiveX to rise
Only the tourists outnumber the flies.

(I never thought I'd find myself saying it,
but this used to work better when it was 'OLE'.)

The Foreshortened Alphabet

Said A to B 'I don't like C
Its syntax does my head in.'
Said B to A 'That's quite okay.'
And the poet snuck a Z in.

The Browser

Once upon a Wednesday morning, I was stretching, I was yawning
One more surfing day was dawning, surfing to the Net's far shore.
Hung my coat up, got my beverage, went to check up on our homepage –
But the browser didn't show the corporate logo as before.
Gone was our fine corporate logo, 'File not found' was all I saw.
Gone, and to return no more.

Couldn't help but feel dejected – file does exist, not read protected
This is not what I expected from my browser version four.
Checked my bookmark, checked my spelling, found no cause nor reason telling
Why the program was rebelling instead of working as of yore.
But each time I clicked the Reload I got Error Four-Oh-Four
Wretched Error 404.

Tried to look up dear old EXE, some MS promo ActiveX-ey,
Tried a naughty site most sexy that La Whitehouse would abhor.
Tried for Yahoo, AltaVista, tried the home page of my sister,
Even tried to get on HotWired though their GIFs stick in my craw.
Could not even get on HotWired where I think the artwork's poor –
Quoth the browser '404'.

Time to end procrastination – must find out the explanation
Nail this useless application – time to grasp at every straw.
In a mood of techie fervour: verified domain name server,
Pinged to Demon, did a hop check, even crawled upon the floor.
Crawled about to check the cable, sweating freely from each pore.
Still 404 and nothing more.

'Cur!' I cried with sudden passion, 'gizmos may be all the fashion,
But I've really had my ration – this has got beyond a bore.
Take away your stupid Java, and your client-side script palaver,
Take away your push technology – stick them where they make you sore!
You're rotten to your stinking core!' I banged the keyboard with my paw.
No prize for guessing right the score.

Then crept upon me coldest terror: I will never clear this error,
That I'll always hit this error, error that I can't ignore.
So now you'll find me quietly moping, with Web-less life I'm poorly coping,
I've very nearly quit from hoping to reach the Net beyond my door.
Shall I ever see the Web-net instead of error 404?
Quoth the browser 'Nevermore.'

PS: Later: actually it was a proxy server problem, as it turned out. ■

Verity Stob apologises humbly to Jenny Joseph, Roger McGough, Spike Himself and Edgar Allan Poe.

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from Soffront Software, Inc.

Beat the Competition!

Track all of your development and technical support.

- Bug reports
- Code changes
- Test cycles
- Support calls
- New features
- Releases
- Documentation
- System configurations

There's nothing like TRACK & TRACKWeb. Save time, money and dramatically increase customer satisfaction.

Easy to submit, modify and query. Your entire team can start using TRACK without any training. Not possible? Just download the evaluation copy from www.soffront.com, install it on the LAN and let everyone try it!

SQL database support. The fast dBaseIV engine supports 100+ users and popular SQL databases such as Microsoft SQL, Oracle , Sybase.

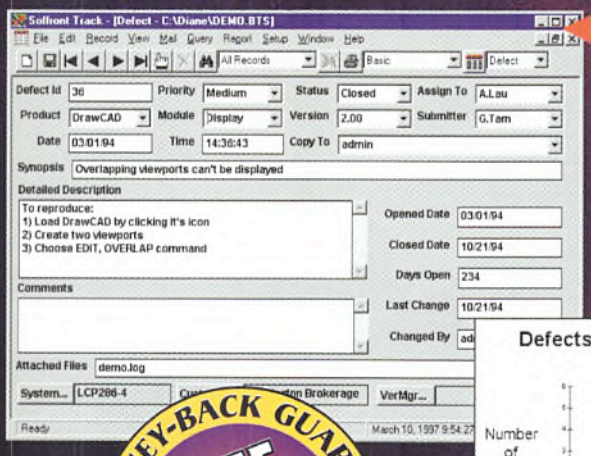
Global project management becomes reality. Get real-time interaction to geographically dispersed developers, QA and support personnel.

Links to customer database. TRACK integrates defect tracking and Help Desk.

Multiple security levels. Set up your desired level of security for commands, projects, tables, fields, data, and more!

Track code changes. TRACK integrates with popular version control systems.

Automatic notification using numerous mail systems. TRACK keeps everyone up-to-date when new bugs are entered or pending bugs are modified. You'll know when a bug was entered, who's working on it, and when it's likely to be fixed.



Customizing TRACK is a joy. Using a visual form editor, customize the database, tables, forms, fields, notifications, formulas, etc.

TRACK's reporting capabilities are *fast*, powerful and intuitive.

Here's what the users and press say about TRACK and TRACKWeb.

What Users Say:

"The ability to get users up and running with TRACK in a very short period of time is invaluable. Most people are able to use TRACK without ever reading the documentation."
— Greg Bryant, Principal Software Engineer, NEC Technologies, Inc.

"Using TRACK we're able to look at exactly what happened on a project and come up with accurate time estimates for future releases."
— Kirsten Thompson, Quality Assurance Analyist, Pepsi International

"After using TRACK for several months, we have found that it has streamlined our problem reporting and tracking efforts on a corporate basis."
— Rory Roybal, Director of Engineering, Phoenix Technologies, Ltd.

The Press Agrees:

"TRACK automates interactions with related tools."
— Peter Coffee, PC Week, March 4, 1996

"TRACK wins hands down in the flexibility, power and ease-of-use areas."
— Data Management Review, January 1996

30-DAY MONEY-BACK GUARANTEE

FREE EVAL!

SOFFRONT® TRACK

for Windows, NT, 95 and popular Web browsers.

www.soffront.com

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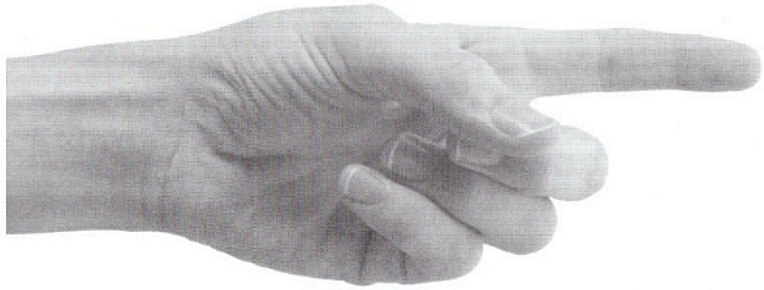
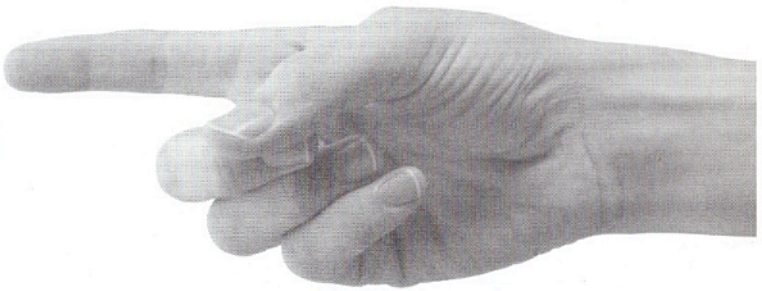


What are you really worth?



THE SOFTWARE DEVELOPERS' MAGAZINE

EXE

See the EXE Salary Survey between pages 48 & 49

THE SOFTWARE DEVELOPERS' MAGAZINE

EXE What are you really worth?

Is your salary right for the job you do? Software development is thought by some to be a goldmine where you can dictate whatever salary you want and come to work in scruffy jeans and a T-shirt. We want to know if this is really so. We're sure many of you think that you should be paid more. Here's your chance to find out how your salary compares with colleagues in similar jobs. For the first time, EXE Magazine will publish a comprehensive survey of the salaries in the software development industry. Help us to understand the current situation by telling us about your job, and we'll give you the real story.

The questionnaire is anonymous and all details will remain confidential. Just tick which job you do, fill in your rate of pay and tell us a bit about your track record, then send this form to us (postage paid). And please pass it on – photocopy this and get your colleagues to complete it, too. The more of you who respond, the more accurately we can tell you what the going rates for your skills and experience are.

Fold, secure and send completed questionnaires back to us or simply fax it to 0171 437 1350.

Your job

1. **Are you in full-time employment?** ☐ a Yes ☐ b No

   1.a. If yes, how many years have you been in full-time employment?
   ☐ a less than 1 ☐ c 2-4 ☐ e 6-10
   ☐ b 1-2 years ☐ d 4-6 ☐ f 10+

   1.b. If no, are you in part-time employment
   ☐ a Yes ☐ b No

   1.b.1 If yes, how many years have you been in part-time employment?
   ☐ a less than 1 ☐ c 2-4 ☐ e 6-10
   ☐ b 1-2 years ☐ d 4-6 ☐ f 10+

   1.c. If no, are you self-employed? ☐ a Yes ☐ b No

   1.c.1 If yes, how many years have you been self-employed?
   ☐ a less than 1 ☐ c 2-4 ☐ e 6-10
   ☐ b 1-2 ☐ d 4-6 ☐ f 10+

2. **Which of the following best describes your company's main activity?**
   ☐ a IT ☐ d Telecoms ☐ h Government
   ☐ b Finance ☐ e Services ☐ i Other
   ☐ c Industry ☐ f Education _____

3. **Which of the following best describes your current job title?**
   ☐ a Software developer ☐ k Database manager
   ☐ b Software engineer ☐ l Design engineer
   ☐ c Software architect ☐ m Information manager
   ☐ d Project engineer ☐ n Web developer
   ☐ e PC programmer ☐ o Multimedia developer
   ☐ f System analyst ☐ p Researcher
   ☐ g System designer ☐ q Contract programmer
   ☐ h Analyst/Programmer ☐ r Technical director
   ☐ i Consultant ☐ s Technical support
   ☐ j Database developer ☐ t Other _____

4. **Which department are you in?**
   _____

5. **Do you currently have a formal flexi-time arrangement?**
   ☐ a Yes ☐ b No

6. **Are you expected to dress formally (suit and tie), smartly (shirt and trousers), or casually (jeans and T-shirt)?**
   ☐ a Formal ☐ c Casual ☐ b Smart

7. **Which programming languages do you use in your job?**
   ☐ a Visual Basic ☐ g Cobol ☐ m JavaScript
   ☐ b Delphi ☐ h 4GL ☐ n VBScript
   ☐ c C ☐ i Lisp ☐ o Assembler
   ☐ d C++ ☐ j Smalltalk ☐ p HTML
   ☐ e Java ☐ k Perl ☐ q Others
   ☐ f Fortran ☐ l TCL _____

8. **What platforms do you develop for?**
   ☐ a Windows ☐ c Unix
   ☐ b MacOS ☐ d Others _____

9. **What platforms do you do development work on?**
   ☐ a Windows ☐ c Unix
   ☐ b MacOS ☐ d Others _____

10. **What type of development are you primarily involved with?**
    ☐ a System software ☐ c Embedded apps
    ☐ b Off-the-shelf apps ☐ d Other
    ☐ c Bespoke apps _____

11. **Are the users of your software primarily in-house?**
    ☐ a Yes ☐ b No

Money matters

12. **Which range does your current salary fall into?**
    ☐ a £10k ☐ f £23k-£26k ☐ k £38k-£41k
    ☐ b £10k-£15k ☐ g £26k-£29k ☐ l £41k-£50k
    ☐ c £15k-£17k ☐ h £29k-£32k ☐ m £50k+
    ☐ d £17k-£20k ☐ i £32k-£35k
    ☐ e £20k-£23k ☐ j £35k-£38k

13. **Do you feel your current salary is:**
    ☐ a Too high ☐ c About right ☐ e Very Low
    ☐ b Quite high ☐ d Slightly Low

14. **Do you feel your current salary accurately reflects your skills and abilities?** ☐ a Yes ☐ b No

15. **Do you receive an annual bonus?** ☐ a Yes ☐ b No

    15.a. If yes, what % of your salary does this bonus represent? _____

16. **What was your salary range 12 months ago?**
    ☐ a <£10k ☐ f £23k-£26k ☐ k £38k-£41k
    ☐ b £10k-£15k ☐ g £26k-£29k ☐ l £41k-£50k
    ☐ c £15k-£17k ☐ h £29k-£32k ☐ m £50k+
    ☐ d £17k-£20k ☐ i £32k-£35k
    ☐ e £20k-£23k ☐ j £35k-£38k

17. **Roughly what amount of salary increase do you expect to receive within the next 12 months?**
    ☐ a No increase ☐ d £2k-£3k ☐ g £5k+
    ☐ b £500-£1k ☐ e £3k-£4k
    ☐ c £1k-£2k ☐ f £4k-£5k

18. **If you changed job what increase in salary would you expect?**
    ☐ a No increase ☐ d £2k-£3k ☐ g £5k+
    ☐ b £500-£1k ☐ e £3k-£4k
    ☐ c £1k-£2k ☐ f £4k-£5k

19. **What range do you expect your salary to fall into in three years time?**
    ☐ a <£10k ☐ f £23k-£26k ☐ k £38k-£41k
    ☐ b £10k-£15k ☐ g £26k-£29k ☐ l £41k-£50k
    ☐ c £15k-£17k ☐ h £29k-£32k ☐ m £50k+
    ☐ d 17k-£20k ☐ i £32k-£35k
    ☐ e £20k-£23k ☐ j £35k-£38k

20. **Is earnings potential the main reason you work within the IT industry?** ☐ a Yes ☐ b No

Your track record

21. **How many employees are there in your company?**
    ☐ a <5 ☐ d 50-99 ☐ g Don't know
    ☐ b 5-9 ☐ e 100-499
    ☐ c 10-49 ☐ f 500+

22. **Where are you based?**
    ☐ a London ☐ f Midlands ☐ k Scotland
    ☐ b M4 corridor ☐ g Wales ☐ l Northern Ireland
    ☐ c South East ☐ h East Anglia ☐ m Other
    ☐ d Southern England ☐ i North West _____
    ☐ e South West ☐ j North East

23. **Which if any of the following qualifications do you possess?**
    ☐ a GCSE ☐ d Degree ☐ g MCP
    ☐ b A-Level ☐ e Masters ☐ h MCSE
    ☐ c HND ☐ f Doctorate ☐ i CNE
    ☐ k Other _____

24. **Are you a member of any professional body or association?**
    ☐ a BCS ☐ d ACCU ☐ g UK Unix UG
    ☐ b ACM ☐ e BUG ☐ h Institute of Analysts & Programmers
    ☐ c IEEE ☐ f VBUG
    ☐ i Others _____

25. **How many years have you been involved in software development?**
    ☐ a 0-1 ☐ c 2-4 ☐ e 6-10
    ☐ b 1-2 ☐ d 4-6 ☐ f 10+

26. **Were you in full-time employment 12 months ago?**
    ☐ a Yes ☐ b No

27. **How long ago did you last change job?**
    ☐ a Have not changed job ☐ e Between 2-3 years
    ☐ b Less than six months ☐ f Between 3-5 years
    ☐ c 6 months to a year ☐ g More than 5 years
    ☐ d Between 1-2 years

28. **Was salary the primary reason for changing?**
    ☐ a Yes ☐ b No

    28.a. If yes, how much did your salary increase?
    ☐ a No increase ☐ d £2k-£3k ☐ g £5k+
    ☐ b £500-£1k ☐ e £3k-£4k
    ☐ c £1k-£2k ☐ f £4k-£5k

    28.b. If no, what was the primary reason for changing?
    _____

29. **How many years have you worked for your current employer?**
    ☐ a less than 1 ☐ c 2-4 ☐ e 6-10
    ☐ b 1-2 years ☐ d 4-6 ☐ f 10+

30. **How many years have you held your current job title?**
    ☐ a less than 1 ☐ c 2-4 ☐ e 6-10
    ☐ b 1-2 ☐ d 4-6 ☐ f 10+

31. **Do you foresee a long-term career with your current employer?** ☐ a Yes ☐ b No

32. **How would you go about finding a new job?**
    ☐ a Recruitment consultant
    ☐ b Word of mouth
    ☐ c Newspaper or magazine advertisement
    ☐ d Direct application to a company

33. **Does your company provide any job-related training?**
    ☐ a Yes ☐ b No

    33.a. If yes, do you feel this training is worthwhile?
    ☐ a Yes ☐ b No

    33.b. How many days of training courses has your company provided within the year?
    ☐ a <3 ☐ c 5-10
    ☐ b 3-5 ☐ d 10+

    33.c. Is this training externally supplied? ☐ a Yes ☐ b No

34. **Have you paid privately for any IT-related training?**
    ☐ a Yes ☐ b No

    34.a If yes, how much did you pay for this training?
    _____

About you

35. **Which of the following age ranges do you currently fall into?**
    ☐ a <20 ☐ e 30-32 ☐ i 42-45
    ☐ b 21-23 ☐ f 33-35 ☐ j 46-50
    ☐ c 24-26 ☐ g 37-39 ☐ k 51+
    ☐ d 27-29 ☐ h 40-42

36. **Are you:** ☐ a Male ☐ b Female

37. **If you have any further comments which you would like us to include in our survey, please enter them below.**
    _____
    _____
    _____
    _____