

In the driving seat

FEEDBACK: CBRED@COMPUTERWIRE.CO.UK



Tom Welsh asks whether model driven architecture (MDA) is ready for production use, and if so who is likely to dominate this emerging market segment.

Deutsche Bank's b-online and Austrian Railways' LDZ projects went live this year, after two years and 18 months of development respectively. Both are important business applications, involving web servers, multiple Java 2 Enterprise Edition (J2EE) application servers, Oracle databases, and – in the case of b-online – CICS, DB2 and COBOL on an IBM mainframe. But both have something else in common: they were designed using Interactive Objects' ArcStyler in conjunction with Rational Rose; and they cost 35% to 40% less than would have been expected using conventional development methods.

Rational Software's Rose is well known as the market leader among graphical modelling tools for use with the unified modelling language (UML). In contrast, ArcStyler and Interactive Objects are unfamiliar

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names to many, even within the software development community. Claims of amazing productivity gains are often bandied about, but when two of Europe's biggest companies stand behind such a claim it is time to take a closer look.

Interactive Objects Software was founded in 1990, and soon specialised in the application of distributed object technology which, at the time, meant common object request broker architecture (CORBA). This brought it into close collaboration with several large corporations, including Credit Suisse. Still privately held, it now has about 70 employees and is based in Freiburg, Germany, with laboratories in Berlin and offices in San Francisco and Cambridge, England.

Richard Hubert, Interactive Objects' co-founder and CEO, sees IT architecture as his company's core compe-

Tom Welsh is an independent consultant specialising in software engineering, component technology and middleware. A senior consultant with Cutter Consortium, he is the editor of 'Web Services Strategies' and author of in-depth reports on CORBA, Model Driven Architecture and Web Services.

tency. "It is a solid business to be in," he urges. "We are saying 'stop patching the symptoms'. EAI [enterprise application integration] is fixing the symptoms of ad hoc architecture. We solve the problem at source, so you don't have to patch around with EAI. When you design a new building, you don't expect to go around after it is finished and link up all the plumbing."

It is an article of faith with Hubert that business solutions and IT architecture are independent and separate. "Companies are expecting too much of their employees," he warns. "Understanding business solutions is one job; IT architecture is another." If only there were a practical way of letting developers focus on writing business logic, then load that logic into a robust permanent architecture, much as a program is loaded into a computer.

That is exactly what model driven architecture (MDA) does and, according to Hubert, Interactive Objects' ArcStyler is the best MDA product that money can buy. That is why it was adopted by Deutsche Bank and Austrian Railways which have made impressive starts in demonstrating that MDA really can deliver worthwhile productivity benefits.

Vendor-neutral standard

MDA is a vendor-neutral standard controlled by the Object Management Group (OMG), better known as the home of CORBA and UML. Towards the end of 2000, OMG came to the realisation that UML was logically more important than CORBA. Indeed, it made sense to start with UML and derive from it applications that could be expressed in terms of CORBA. But if CORBA, why not J2EE, Microsoft.Net or any other kind of middleware or component model?

"Several companies were working in a solid engineering direction," Hubert recalls. "They got together with Richard Soley [OMG's CEO] to consolidate progress." As could be expected when a number of vendors set out to merge the architectures behind their existing products, there were disagreements about all sorts of issues. MDA itself is not a single specification: like CORBA and J2EE, it depends on a network of specifications. Some of these are complete, while a few others are still works in progress.

"OMG is standardising MDA at a pace that needs to be slow," says Hubert. "Standards bodies are there to

standardise things that have been proven, not to do research."

Nevertheless, MDA has received significant recognition. Borland, IBM, Rational and Unisys have acknowledged its importance, and it is supported by the open source Eclipse and NetBeans integrated development environments (IDEs). Rational recently acquired NeuVis Technology of Shelton, Connecticut, specifically for its MDA technology. Moreover, PricewaterhouseCoopers named it as a key software industry trend in its report, *Technology Forecast: 2002-2004, Volume 1: Navigating the Future of Software*.

Even though MDA is not fully baked yet, Hubert believes that Interactive Objects is out ahead of the field. "I think I can say without exaggeration that we are leading the MDA engineering effort. Whatever form the standard takes, we will be there with an implementation. There are going to be 200 MDA products, just like EJB [Enterprise JavaBeans]. The specification is loose at first – which encourages vendors to get involved – then it tightens up and the market shakes out."

Meanwhile, Hubert reasons, CIOs should be interested in the practical benefits, if not the technology. "The argument is not to use MDA, it is to save huge quantities of money and get better quality."

That is not to say that everyone is in complete agreement – far from it. The OMG's website lists 20 vendors, every one of which claims that they have an MDA-compliant product. Some, like Interactive Objects, can justify that claim on the basis of practical results as well as participation in the OMG design process. Others, according to Hubert, are not quite there yet. His criteria are quite exacting: "MDA requires generation for multiple platforms from well-defined UML models. Most vendors either don't have well-defined models, or support only one platform. Only OptimalJ and ArcStyler do both today."

OptimalJ is Compuware's Java development environment, which generates source code for J2EE only. How does that sit with 'multiple platforms'? Hubert's explanation is that J2EE is such a loose set of specifications, and so immature as yet, that there are big divergences between different implementations. Porting from IBM's WebSphere to BEA Software's WebLogic (or vice versa) means



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changing as much as 30% of the logic. "You know, you have to write applications that work," he explains. "Standard Java code won't even deploy to those products. Then you need to tune for performance." MDA, the implication is, can iron out those differences and simplify porting.

Tommi White of Compuware has a different perspective on development and maintenance issues. As COO of a billion-dollar corporation (albeit one that lost \$245 million last year), she has to take care of a lot of customers – some of them very large companies – who are looking for across-the-board software quality solutions. The main problem that she confronts is a lack of developers with the right skills and experience to work effectively with J2EE. Drawing a historical parallel, she points out that, just as in the days of assembly language, the top 10% of programmers are outstanding. Unfortunately, the rest are not.

Programming simplification

This is where MDA comes in. According to White, OptimalJ is to J2EE as COBOL was to assembler – a language that clears away most of the confusing details and turns programming into a relatively simple task. While a small number of Java experts produce the required components, designers can work with business analysts to create UML models that embody business logic and data. Once the design is done, the application is almost finished.

OptimalJ implements MDA as a top-down process says Mike Lucas,

Compuware technical manager – from UML to code. “Developers deal in business objects, at a high level of abstraction rather like JAD or RAD. That puts OptimalJ a step ahead of other IDEs. When code pops out, it is all highlighted and protected because you do not have to change it. It just works. Of course you can read it if you want to understand how it works.”

Ambitious projects

A lot of the cleverest parts of OptimalJ are invisible to the ordinary developer, such as the patterns used to generate code automatically for different environments. “Everyone who has used it says that the pattern generation approach is excellent,” reports Lucas.

“We have very ambitious plans for where we are going with this technology,” he declares. “But there is a reluctance to jump to that level. The developers who are attuned to the MDA message are the more goal-oriented ones, rather than those who are fastidious about their approach to coding.”

Compuware and Interactive Objects are aiming their MDA products directly at the Java market – where there is certainly plenty of demand – but there are other, equally valid, interpretations of the standard.

Kennedy Carter, a privately-held UK company, is also at the forefront of MDA design and deployment, but its success stories come from a very different area of industry. BAE Systems used Kennedy Carter’s iUML and iCCG products to deliver a mid-life software update for the Stingray torpedo; TRW Automotive produced a vehicle stability system; Siemens Metering created an ‘intelligent’ gas meter; and Thales wrote a training and simulation package for the Royal Air Force’s Nimrod aircraft. These are embedded real-time applications, written in Ada 95, C and C++.

Lockheed Martin is currently using Kennedy Carter’s tools to create the software for the Modular Mission Computer (MMC) which is to be installed in over 1,000 F-16 jet fighters. The MMC, which handles fire control, the head-up display and stores management, will substantially increase the F16’s capability.

Allan Kennedy, CEO of Kennedy Carter, is working on an MDA reference model expressed in UML – an important contribution to the OMG’s MDA initiative. He is a leading mem-

ber of the ‘translational’ school of thought, which believes that platform independent models (PIMs) should be translated into platform specific models automatically.

The alternative, ‘elaborative’ point of view – endorsed by Rational and many other conventional UML tool vendors – prefers to start with an analysis model and gradually add to it until it becomes a detailed design model. The risk here is that it will not be possible to recover the original analysis

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model – and one of the greatest benefits of MDA promises to be the ability to maintain and enhance applications at the PIM level.

This is how Kennedy explains the practical importance of this potential schism, which might seem academic at first sight.

“Richard Soley likes to talk about a ‘20-year architecture’. In other words, genuine platform independence allows a precise UML model to be a long-life asset able to survive the churn in platform technology by being compatible with all present and future platforms – provided that one can specify a mapping to the platforms. If this can be achieved, then the major obstacle to adoption of the latest faster, better, cheaper platforms (lack of application portability) is removed.

“Now, if PIMs are long-life assets, wouldn’t it be good to know that they are ‘correct’? Perhaps we will have to test them. How can we ‘test’ them if we can’t ‘run’ them against an acceptance test? How can we run them if they are not executable? Thus, MDA is driving the UML towards greater precision and ‘executability’. The standard that makes the UML executable is the Precise Action Semantics which is now part of UML 1.4 and has been incorporated in the two leading UML 2.0 submissions.”

Kennedy Carter is closely aligned in this respect with Project Technology of Tucson, Arizona, another privately-held company that specialises in modelling and code generation for embedded and real-time applications.

Its BridgePoint Development System uses what the company calls “Executable and Translatable UML” to create detailed models – a technique similar to that used by Kennedy Carter’s iUML. Like Kennedy Carter, Project Technology says that it can generate 100% complete source code directly from UML models.

While BridgePoint was originally aimed at embedded and real-time applications, Project Technology says that it can be used for any application domain. Some customers have generated over 2 million lines of C++ from PIMs, using the customisable model compilers supplied. AT&T, EDS, General Electric, IBM, Lockheed Martin, Motorola and Westinghouse are among Project Technology’s customers.

Translational school

Today Mellor is the leading proponent of the translational school of thought, which believes that analysis models can be made complete, executable and verifiable. This point of view has been summed up by the slogan, ‘Models are the new source code.’ If feasible, this would signal an extremely important advance in software engineering, relegating relatively complex and difficult programming languages like C++ and Java to a minor role.

Far from being an academic theory plucked out of thin air, MDA is the distillation of over ten years’ practical experience in modelling and code generation. As Hubert confirms, a number of vendors approached OMG and the idea gradually took shape in the course of months of discussions. Today, with the Action Semantics for UML specification adopted, and UML 2.0 taking shape, it is fair to speak of MDA as a real, vendor-neutral standard.

CBR OPINION

When fully baked, MDA promises to revolutionise software development. It could bring greater productivity, quality and flexibility – all at the same time. First, however, the industry has to undergo the usual teething pains. Of the two dozen or so products for which MDA compliance is claimed, hardly two are similar enough to make them interchangeable from a user’s point of view. And theoretical disagreements like the ‘elaboration versus translation’ controversy remain to be ironed out. Given the sort of practical results that companies like Compuware, Interactive Objects, Kennedy Carter and Project Technology are beginning to demonstrate, demand for MDA tools is likely to rise. Then we can expect the heat and pressure of competition to winnow out the impractical ideas and forge some kind of consensus.