CASE STUDY

Updating the Royal Navy's Submarine Communications System

CHALLENGE

The BAE Systems project team undertook migration of the Royal Navy's legacy Command and Control system to an entirely new platform. The modernisation effort required detailed visual models of both the architecture and database schema of the legacy system, which consisted of over 250,000 lines of code.

WHY ENTERPRISE ARCHITECT

Enterprise Architect equipped the project with advanced UML 2.1 modelling support in addition to built-in C# round-trip code engineering, database schema visualisation and team collaboration capabilities.

BENEFIT

The project team engaged Sparx Systems partner and Enterprise Architect experts ObjektDev to implement a Component-driven Brownfield approach for the successful migration of the Command and Control system. Leveraging Enterprise Architect's powerful API, ObjektDev was able to automate object-relational mapping tasks, improving the team's productivity and helping the project remain ahead of schedule.

Background

In 2007, BAE Systems Christchurch won a unique managed service contract awarded by the UK Ministry of Defence that would see the management and support of a Royal Naval Command and Control system for the next 15 years. The system, known as "air traffic control for submarines", offers Royal Naval submarine operations staff a fully integrated, secure and high availability communications management facility. The legacy system, based upon the security-enhanced version of DEC's VAX/VMS and OpenIngres database, is hosted on a resilient VAX cluster. It took 25 man-years to design and develop over 250,000 lines of Ada83 and SQL code using Yourdon's Structured Analysis and Structured Design (SASD) technique with Cadre Teamwork.

The challenge facing the project team was how *not to throw the baby out with the bathwater*, i.e. how to migrate the system without losing many years of intellectual investment in the legacy system? BAE Systems teamed with ObjektDev, a specialist UML and Enterprise Architect consultancy, to assist in overcoming this challenge.

Goals

The main goal was to successfully migrate the existing Command and Control system to a modern platform. Within the context of the BAE Systems Capability Transition and for reasons of technology, tools and skills obsolescence, the system is being refreshed with new technology, including Microsoft's .NET Framework, Oracle RDBMS, with enhanced security afforded by BAE Systems' WinST product.

To model, develop and maintain the system, a UML modelling tool, Enterprise Architect from Sparx Systems, was selected for its UML 2.1 compliance, C# code engineering, database modelling and collaborative working capabilities.

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Model Development

The legacy architecture was modelled in Enterprise Architect at the component level with the legacy functionality and requirements being expressed through use cases, activity / sequence diagrams and statecharts. Each component was considered by the design team and through a combination of analysing the legacy software, the use cases (and supporting artefacts) a design was developed in Enterprise Architect. The legacy database schema was also automatically recovered and enhanced using Enterprise Architect.

With the selection of Enterprise Architect for UML modelling and code engineering, short-term and medium-term gains have been achieved. Immediate cost savings were made when purchasing Enterprise Architect licences for the top-of-the range Corporate Floating edition. Although Enterprise Architect is fully UML 2.1 compliant, supports forward and reverse engineering for C# and integrates with CVS and Telelogic DOORS, the capital expenditure of equipping the whole team with Enterprise Architect was less than the maintenance cost of competing toolsets.

Deployment

In addition to its UML credentials, ObjektDev is security cleared and has SADT/ Ada83 skills. Initially, ObjektDev undertook an investigation into the system's software development lifecycle to understand which project artefacts (requirements, security enforcing functions, design elements, code units, etc) could be recovered and used as an input to the migration process. As a result, several concepts ranging from a completely manual process to a fully automated process were investigated.

After detailed analysis, a 'Component-Driven Brownfield' approach was selected by BAE Systems' technical and project management team for many reasons but primarily because it ensures a true object oriented (OO) development process while allowing developers with legacy system skills to understand the new system architecture. Furthermore, legacy component acceptance tests can be leveraged resulting in cost savings during component and acceptance test phases.

Achievements

Medium-term gains were made when developers' productivity soared, as the BAE Systems project Chief Software Engineer explains "we've developed a sophisticated object relational mapping (ORM) mechanism in C# to persist business objects in the database but there is a lot of boilerplate code to write for each of the business objects. As we'd already modelled our business object classes and database schema in Enterprise Architect we saw the opportunity for automatic code generation from Enterprise Architect to do the tedious and potentially error-prone work for us." He adds "ObjektDev developed an Enterprise Architect plug-in for us that automatically generates the C# and SQL files to suit our ORM that can be included in the project and built without any manual intervention, saving us a lot of time."

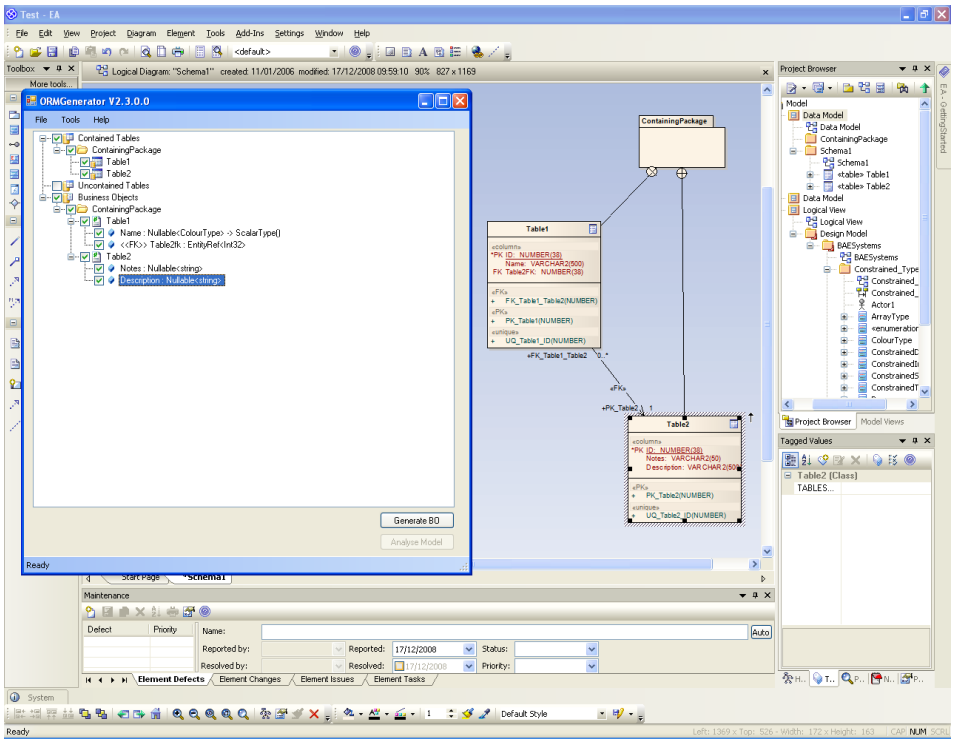

Figure 1: ORM Generator - Enterprise Architect plug-in developed by ObjektDev

Conclusion

The adoption of the 'Component-driven Brownfield' approach has proved highly successful for the project, culminating in the recent presentation of the prestigious BAE Systems Chairman's Bronze Award for Innovation to the Christchurch and ObjektDev team. Key benefits for BAE Systems recognised by the award are a reduction in cost through high efficiency and improved productivity, a reduction in risk and a change-driven approach.

The project is progressing well with recent milestones being achieved and some areas are in advance of the schedule as the BAE Systems project programme manager comments "the project is on schedule and even some 'stretch' milestones have been met. This is testament to the efforts of our motivated team, choice of toolset and use of targeted external consultancy."

About BAE Systems

BAE Systems is the premier global defense and aerospace company delivering a full range of products and services for air, land and naval forces, as well as advanced electronics, information technology solutions and customer support services. With approximately 100,000 employees worldwide, BAE Systems' sales exceeded $31.4 billion in 2007.

About ObjektDev

ObjektDev is an independent provider of professional services and tools that maximise an organisation's Application Lifecycle Management. Through ObjektDev's unique IP and strategic partnerships, it is able to deliver training, consulting, .NET development services and a suite of integrated software tools that are feature-rich, yet sensibly priced. ObjektDev supplies organisations developing mission and business-critical software systems for the defence, security and financial sectors.

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About Sparx Systems

Sparx Systems (www.sparxsystems.com) specializes in high performance and scalable visual modeling tools for planning, designing and constructing software intensive systems.

With customers in industries ranging from aerospace and automotive engineering to finance, defense, government, entertainment and telecommunications, Sparx Systems is a leading vendor of innovative solutions based on the Unified Modeling Language (UML) and its related specifications. A Contributing Member of the Object Management Group (OMG), Sparx Systems is committed to realizing the potential of model-driven development based on open standards.

The company's flagship product, Enterprise Architect, has received numerous accolades since its commercial release in August, 2000. Now at version 7.1, Enterprise Architect is the design tool of choice for over 150,000 registered users in more than 60 countries world wide.