

# Legacy Systems Integration with MDA<sup>®</sup>

## An MDA Success Story

When online educator UNext<sup>SM</sup> was faced with standing up and integrating several enterprise systems, including Oracle Financials, Oracle CRM, Documentum<sup>®</sup> and BroadVision<sup>®</sup>, they turned to an architectural solution in the form of OMG's Model Driven Architecture.

### Introduction

UNext is an education company dedicated to providing high-quality integrated e-learning solutions (software, educational content and services). The company collaborates with some of the world's leading universities to deliver high quality online education anytime, anywhere. UNext's first learning community, Cardean University, provides accredited MBA degrees for individuals and corporations. UNext systems are used in the corporate eMBA programs of General Motors, Thomson and others.

The business and educational systems assembled by UNext work together to create a fully online university experience. The UNext systems are developed and maintained using a Model-Driven Architecture approach.

### The Problem

In mid 1999, the UNext architecture team was faced with constructing a completely online university from scratch. The university's enterprise systems were to be centered around a commercial CRM (Oracle's) for managing student relations and were to include an ERP for billing and general finance (Oracle Financials), a learning management system for student scheduling and course management (custom), a content management system for managing the course and media content (Documentum and Chuckwalla) and a high capacity web front end for delivering a personalized web experience to the students, faculty, various business functions and administrators (a custom BroadVision application).

At issue was how to describe the functionality of the enterprise as a whole, and how to map the required functionality into appropriate "customizations" of the major off-the-shelf systems. Each of the systems required specialized expertise for customization, development and deployment and none of this expertise was available in-house. A primary concern was how to ensure that the individual systems collaborated and allowed ongoing development of the systems as the business processes evolved over time.

### Solution

The team adopted an approach based on OMG's Model Driven Architecture. The MDA standard provides an architectural separation of business functionality from technology implementation. This separation allowed UNext to use business rules defined in a UML model to drive four distinct implementation projects independently of one another.

The project started by having a core team of architects and analysts create a pair of platform independent models (PIMs) in UML. The first model was a generic education domain model, used to build a common understanding and vocabulary among UNext's domain experts. The domain model was then mapped into a second platform independent model representing UNext's business. Each of the PIMs included a detailed set of UML Class Diagrams, Use Cases and associated Activity Diagrams describing the system. In creating the business model, the architects and analysts created one or more subsystems to represent the logical functions of each of the enterprise COTS systems. This business model contains both the details of the business logic, as well as the mapping of the logic into the major subsystems. The business model forms the basis for managing all change to the current systems.

UNext used consulting experts to build each of the enterprise systems. For example, Oracle Consulting provided architects and analysts to build, configure and customize Oracle Financials. These subsystem experts worked with the core team to detail the function of the business domain subsystems corresponding to their enterprise system. As the business model neared completion, the subsystem experts began creation

of Platform Specific Models (PSMs) for each of the enterprise systems. These models were each derived from one or more subsystems in the business model. The relationship between representative PIMs and PSMs is shown in Figure 1.

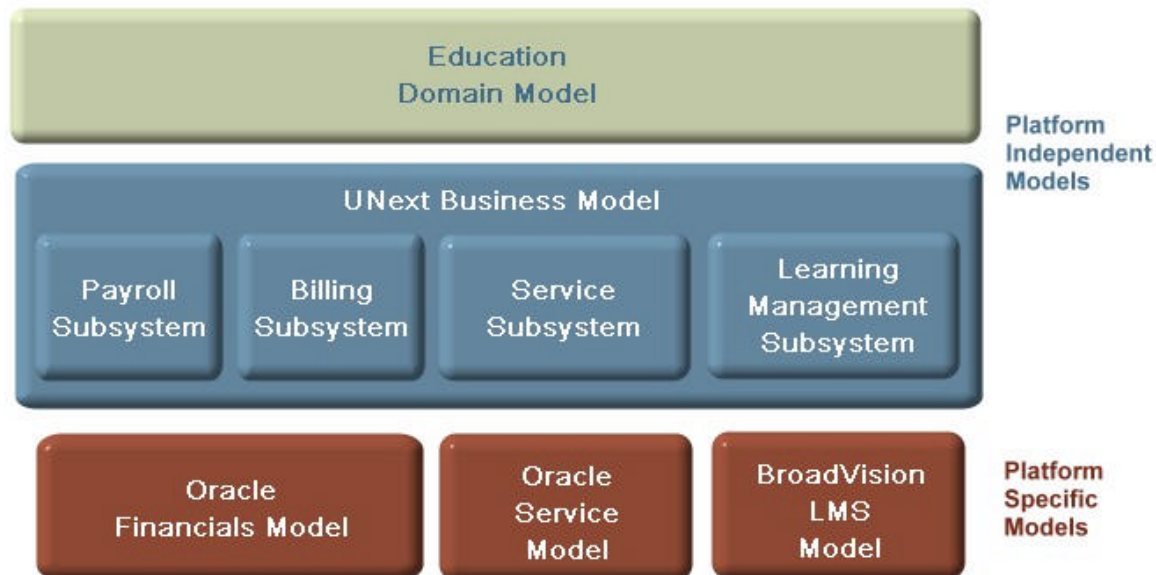


Figure 1: Models

System construction consisted of customizing each of the enterprise systems, and creating the business logic. Business logic that spanned systems was constructed as CORBA components and deployed in the BroadVision application server.

## Updates

As happens in any enterprise, the UNext systems have encountered unforeseen requirements changes since “completion” of the business analysis phase. Two of these are noteworthy in the context of MDA.

First, the team was presented with dramatically enhanced reporting needs as they neared completion of the first implementation wave. The decision was made to implement a data warehouse to provide cross-system reporting. Again, a team of specialists was brought in to build the systems and processes. The team extended the business model PIM to include the new use cases and activities and brought in a team of experts to construct the data warehouse. Existence of a complete business model PIM allowed the Oracle Data Warehouse subsystem experts to rapidly complete a PSM, and the data warehouse went live three months after the team began work.

After a year of operation, a fundamentally new type of course was created by the university. This new course was to be self-taught, and would no longer require an instructor. The change required modification to several systems, as the notion of “instruction” was pervasive. Existence of the PIM allowed UNext to explore the impact of the new courses on core business processes such as scheduling and instructor assignment, and to identify the subsystems that would be affected by the change. The new courses were ultimately brought online in 2 months.

## Observations

The UNext systems were developed over a 13-month period, and brought online using a phased approach over 4 months. An internal staff of 12 led 20 consulting analysts, and as many as 70 developers in building and deploying the systems. The MDA allowed UNext to heavily leverage the external experts while still providing overarching control.

### Benefits

UNext derives a number of specific benefits from its application of MDA.

- PIMs provide a clear mechanism for defining and maintaining cross-system behavior
- Work is easily and clearly partitioned across domain experts and system specialists: a team is created for each PIM and for each PSM
- PIM serves as basis for assessment and implementation of changes to business rules; such changes are readily mapped into corresponding PSMs
- PIMs contain more detail regarding business rules than code would have, and are more accessible than 3-ring binders of documentation
- Data warehouse PSM and system implementation was accomplished in 3 months

### Notes

UNext elected not to use tools in mapping across models, as the tools were immature during early development of the systems. Tools now available would allow automation of the mapping process from PIM subsystems into the appropriate PSMs. Further, generative tools could be used to build facades for each of the platform implementations. This approach is being actively investigated. Adoption of tools at this state will require that source PIMs be made more complete.

Construction of the UNext systems would have benefited from the existence of an industry standard Education Domain model. OMG task forces are working on domain models (PIMs) for a number of industries. Some of these are adaptable for use at UNext. These will be evaluated for use in future projects.

Several UML tools now support UML profiles. Profiles may be used to extend UML to incorporate the semantics of PSMs such as J2EE, .NET and CORBA. UNext's PSMs are being adapted to use OMG's UML Profile for Enterprise Distributed Object Computing.

## **Tools**

Analysis and Design Tools: Rational Analyst Studio, including Rose and SoDA  
Integrated Systems: Oracle Financials, Oracle CRM, Oracle Data Warehouse, BroadVision Application Server, Documentum, Chuckwalla

## **Contact**

Comments and questions are welcome. Please contact:

Bill Hazard  
Chief Technology Officer  
UNext  
500 Lake Cook Road  
Deerfield, IL 60030

hazard@unext.com