Model Driven Architecture: An Introduction

OMG’s Vision

The Global Information Appliance
Heterogeneity is Permanent

- Programming languages
  - ~3 million COBOL programmers
  - ~1.6 million VB programmers
  - ~1.1 million C/C++ programmers
- Operating systems
  - Unix, MVS, VMS, MacOS, Windows (all 8!), PalmOS…
  - Windows 3.1: it’s still out there!
  - Embedded devices (mobile, set-top, etc.)
- Networks
  - Ethernet, ATM, IP, SS7, Firewire, USB
  - Bluetooth, 802.11b, HomeRF

Where Can We Agree?

- There will not be consensus on hardware platforms
- There will not be consensus on operating systems
- There will not be consensus on network protocols
- There will not be consensus on programming languages

- There must be consensus on interfaces and interoperability!
OMG’s Mission Since 1989

- Develop an architecture, using object technology, for distributed application integration, guaranteeing:
  - reusability of components
  - interoperability & portability
  - basis in commercially available software
- Specifications freely available
- Implementations exist
- Member-controlled not-for-profit

Who Are OMG?

<table>
<thead>
<tr>
<th>AT&amp;T</th>
<th>Glaxo SmithKline</th>
<th>LION Biosciences</th>
<th>Rational</th>
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<tbody>
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<td>Metanology</td>
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<td>Microsoft</td>
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<td>Hyperion</td>
<td>MITRE</td>
<td>Siemens</td>
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<td>John Deere</td>
<td>Oracle</td>
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OMG’s Major Successes

- Common Object Request Broker Architecture
  - CORBA® remains the only language- and platform-neutral interoperability standard
- Unified Modeling Language
  - UML™ remains the world’s only standardized modeling language
- Common Warehouse Metamodel
  - CWM™, the integration of the last two data warehousing initiatives
- Meta-Object Facility
  - MOF™, the repository standard
- XML Metadata Interchange
  - XMI™, the XML-UML standard

But Nothing Stands Still!

- Middleware itself has proliferated:
  - CORBA®: Vendor, OS & language independent middleware
  - COM/DCOM/MTS
  - Java/EJB
  - XML/SOAP
  - C#/.Net
  - What will be Next Best Thing?
- You must preserve your software investment as the infrastructure landscape changes around it
How Can We Protect Software Investment?

- The problem remains
  - Tracking the *next best thing*
  - Protecting your investment in existing software base
  - Retaining qualified staff
  - Maintaining existing code base

- Integrating what you’ve built
  - *With what you will build!*

The Model Driven Architecture

- OMG’s Model Driven Architecture (MDA™) initiative is aimed precisely at this problem
- You have an opportunity to increase your bottom line by integrating your assets
- Industry standards support that goal by future-proofing your application design
- The MDA will help you integrate the mix you have today, and give you an architecture to support the unexpected
- Focus on integrating legacy applications
- Ensure smooth integration of COTS applications
- Models are testable and simulatable
- The aim: a 20-year software architecture
What is Model Driven Architecture?

- A New Way to Specify and Build Systems
  - *Based on modeling with UML*
  - Supports full lifecycle: analysis, design, implementation, deployment, maintenance, evolution & integration with later systems
  - Builds in Interoperability and Portability
  - Lowers initial cost and maximizes ROI

- Applies directly to the mix you face:
  - Programming language
  - Operating system
  - Network
  - Middleware

Model Driven Architecture
**Leveraging UML is Critical**

- The Unified Modeling Language is the successor to the dozens of OO A&D notations of the early ’90s.
- Result of an OMG adoption begun in ’96 and completed in ’97.
- Complemented with repository (MOF) and XML Metadata specs (XMI).
- Standardization primed the market
  - Over 100 books
  - Dozens of commercial tools
  - Widely available training
- Supported by an open process
  - UML 2.0 process under way now

**The Dream: Web Services**

(Clipped from ebXML Technical Architecture)
The Reality: Integration

Clients

Middle Tier

Services

CORBA, EJB, DCOM, ODBC, JDBC, etc.

To Business Partners:
EDI, Web Services, .Net, SOAP, ebXML, etc.

Building an MDA Application

A Detailed Model, stating Pre- and Post-Conditions in OCL, and Semantics in Action Language

Start with a Platform-Independent Model (PIM) representing business functionality and behavior, undistorted by technology details.
Generating Platform-Specific Model

MDA tool applies a standard mapping to generate Platform-Specific Model (PSM) from the PIM. Code is partially automatic, partially hand-written.

Mapping to Multiple Deployment Technologies

MDA tool applies an standard mapping to generate Platform-Specific Model (PSM) from the PIM. Code is partially automatic, partially hand-written.
Generating Implementations

- **Platform-Independent Model**
  - CORBA Model
  - Java/EJB Model
  - XML/SOAP Model
  - Other Model

  Map PSM to application interfaces, code, GUI descriptors, SQL queries, etc.

  MDA Tool generates all or most of the implementation code for deployment technology selected by the developer.

Integrating Legacy & COTS

- **Platform-Independent Model**
  - Legacy App
  - COTS App
  - Other Model

  Reverse-engineer existing application into a model and redeploy.

  MDA Tools for reverse engineering automate discovery of models for re-integration on new platforms.
Automating Bridges

Bridge generation is simplified by common application models, simplifying creation of integrated applications both within and across enterprises.

MDA in Industry Standards

- The MDA promotes standards that are valuable across deployment technologies
  - Applicable to large & small deployments, new applications, legacy and COTS
  - Applicable to CORBA, DCOM, .Net, etc.
  - Allows knowledge leverage for the long-term, standards that persist
- MDA has been quickly adopted by OMG’s standardization groups
  - Both PIM and PSM(s) adopted by process
  - Standard model lasts decades
MDA in Practice

• Several excellent proofs-of-concept:
  – Wells Fargo (an architecture that has already been resilient through a decade of change)
  – Lockheed Martin Aeronautics
  – GCPR in US government
• These are “MDA-like”
  – Standards make it portable

OMG MDA Adoption Status

• Major direction agreed March ’01; overall architecture adopted September ’01.
• UML 1.4 complete; 2.0 in process.
• Large suite of standards already done:
  – Core: UML, MOF, CWM
  – Enterprise Models: EDOC, EAI
  – Platforms: CORBA, J2EE
  – Platforms soon: SOAP/XML, .NET
OMG MDA Adoption Status

- More importantly, vertical market groups are thriving on MDA approach:
  - Electronic Commerce
  - Financial Services
  - Healthcare
  - Life Sciences Research
  - Manufacturing
  - Space & Ground Systems
  - Telecommunications

Rapid MDA Timeline

- March 2001: OMG membership endorses MDA Initiative; Wells Fargo case study
- April 2001: First MDA vendor commitments (Borland, Codagen, io, KC, etc.)
- September 2001: OMG membership shifts architecture to MDA.
  - October 2001: US MDA Seminar Series
- November 2001: Vendor commitments (IBM, IONA)
- December 2001: Rational commitment
- January 2002: Borland Enterprise Studio
  - January 2002: First MDA-based vertical spec
- February 2002: European MDA Seminar Series
  - April 2002: US MDA Seminar II Series
MDA Benefits

- Full support for your “20 year architecture” across the application lifecycle
- Smooth integration across intra- and inter-business boundaries (across deployment technologies)
- Reduced costs from beginning to end
- Reuse of applications, code, training and people
- Technology-independent representation of the business
- Scalability, robustness & security via generated code
- Stable model-based approach maximizes ROI
- Rapid inclusion of the next best thing

The CIO Problem Solver

An Analyst’s View

Paul Harmon, Cutter Consortium:
“Model Driven Architecture is an Idea Whose Time Has Come”

- Likely market size?
Paul Harmon

- Senior Consultant, Cutter Consortium
- Distributed Architecture & E-Business Service
- Editor of Component Development Strategies newsletter (1990-2000)
- Editor of CASE Strategies (1989-1991)
- Co-Author: Developing E-Business Systems & Architectures (Morgan-Kaufmann, 2001)
- paul-harmon@earthlink.net
  www.cutter.com/consortium

MDA

- A major shift for the OMG
- A natural outgrowth of UML and MOF
- A solution for the EAI and multiple middleware problem
- The best chance we have to develop a systematic way of handling large, complex application development in reasonably short time frames
The Demand for MDA

- Companies will use it to improve their EAI and application development practices
- Vendors will promote it as a standards-based way to developing and fielding applications
- It has the potential to play a major role in collaborative development

Companies Are Interested

- Fall 2001, Cutter Survey on New Trends
- 170 Companies, Worldwide
- 10% OMG members
- Asked if they had heard of MDA
- 38% Yes, 62% No
- If yes, are you considering use?
Of the Companies That Know About MDA...

- Considered Using MDA: 40%
- Not Considering: 60%

The Unisys Commitment

- February 2002 Unisys Analyst Meeting
- Fred Dillman, VP Tech. & Architecture
- Announced Global Industries Technology Roadmap
- Creates (UML) blueprints for key legacy and new applications
- **Will use MDA to generate applications**
- More rapid development & change
- Facilitates Business Process Outsourcing
- Major commitment involving *all Unisys software developers*
Early Vendor Response

- Adaptive: Adaptive Framework
- Codagen Tech.: Gen-it Architect
- Codigo Solutions: CodigoXpress
- Headway Software: Headway ReView
- io Software: ArcStyler
- Kabira: ObjectSwitch
- Kennedy Carter: iUML; iCCG
- Firestar Software: ObjectSpark
- Metanology: Meta Development Environment
- Project Tech.: BridgePoint, DesignPoint
- Secant Technologies: ModelMethods

Major Vendor Responses

- IBM
- Rational
- Borland
- IONA
- Hewlett-Packard
- Microsoft
How Quickly Can MDA Grow?

- UML conversion of OO modeling tools was 85% complete in 3 years
- CASE grew faster in mid-late Eighties
- OO modeling tools are already in place
- The OMG is promoting MDA

The Market for MDA Tools

- IDC 1999 numbers for Component Construction, CASE and OO Visual Modeling Tool markets was:
  - $1,000 Million ($1 US Billion)
  - Only a little growth in 2000 or 2001
  - Projected to reach $3,000 Million in 2004
  - Let’s be modest and say $2,000 Million in 2005
- Assume that MDA will capture 33% of the Component, CASE and OO Modeling Tools markets by 2005 … $700+ Million
Summary

- This is the most exciting enterprise software initiative I've seen since UML
- It has the power to make a major shift in how IT organizations think about middleware, software engineering and application development
- It could take off very fast once the current economic slowdown is over

Recommendations

- Learn more about MDA now
- Move toward incorporating UML, MOF, and CWM into corporate architectures
- Explore MDA with an MDA tool and an experienced consultant
- Join the OMG to participate in the evolution of MDA profiles and standards
To Get More Information

- MDA Information Page
  - http://www.omg.org/mda/
- OMG General Information
  - http://www.omg.org/

Interactive Objects Software

- Model Driven Architecture™ with ArcStyler

  The ArcStyler assists an IT Organization along the entire critical development path in line with the Rational Unified Process (RUP) and with the concepts of MDA. Along this path, platform-independent business models are created and subsequently transformed, automatically or semi automatically, into more detailed platform-specific models while preserving the relationship to original business viewpoints along the way.

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Kennedy Carter

- Kennedy Carter specialises in MDA development tools that allow you to create precise, executable, platform independent UML models which can be executed in a host-based test and integration environment to verify their correctness before being transformed into efficient implementations with tailored translation engines.

- Kennedy Carter’s iUML and iCCG tools enable you to formalize all your intellectual property – the application, supporting services, platform, design patterns and coding standards – as verifiable platform independent specifications expressed in executable UML.

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Codagen Technologies Corp.

- Codagen develops and markets the industry’s first code generators that enable the re-use of common architecture specifications and implementation in the development of enterprise applications. Now architects can dictate what code is needed and how it should be generated, using Codagen’s XML-based Generation Templates®. Codagen enforces architecture from the UML model to the source code, and integrates seamlessly with leading UML tools to provide an open, model-driven approach for code generation.

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Metanology Corporation

- The Meta Development Environment (MDE) is a software development tool consistent with MDA. Through MetaPrograms, MDE’s unique code generation technology, MDE users maintain control of their:
  - application architectures, including the smooth migration onto ever changing platforms and multi-platform support;
  - PIM techniques, giving complete control of the application modeling process.

- With a complete set of PIM techniques and MetaPrograms for J2EE and .Net, MDE allows organizations to immediately realize the benefits of MDA.

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See Some Proof of Concept!