Introduction to MDA

Applied MDA

From Business Objectives to Deployed SOA Solutions

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Tutorial: MDA, UML, and applicability to SOA

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Tutorial Agenda

- Introduction to MDA
  - The problem and opportunity
  - What is MDA and how it helps

- Introduction to UML2
  - Overview of new capabilities
  - Emphasis on concepts for services modeling

- Business Driven Development for SOA
  - Capturing and validating business goals and objectives
  - Architecting SOA solutions in UML2
  - Using MDA to generate a Web Services Solution
Part 1: Introduction to MDA

- **Business Imperatives Driving Change**
  - Innovation
  - Integration

- **Emerging Business Integration & Modeling Architectures**
  - Business Innovation & Optimization: Business Acceleration
  - Model Driven Architecture (MDA): Business & IT Modeling
  - Service Oriented Architecture (SOA): Integration Infrastructure

- **MDA Maps Requirements to Solutions**
  - MDA concepts, process, components and standards
  - MDA benefits and challenges

- **Accelerating Business Integration using Open Standards**
The Business and IT have to address similar concerns

Innovating the business to capture new value.

- Complexity Management
- Respond to dynamic change
- Modularity
- Encapsulation
- Separation of concerns
- Deferred commitment
- Composition
- Adaptability
- Reuse

Improving the productivity of resources deployed.
Business Innovation & Optimization (aka Business Performance Management) is an emerging market.

Business Innovation & Optimization solutions enable businesses to respond timely to customers’ needs, competitors’ actions, and regulatory changes; to take action based on contextual insight; and to achieve a shared set of business goals.
Unlock The Power Of SOA

Business Modelling & Integration are integral to Business Innovation & Optimization

- Set strategic goals (Business Motivation)
- Introduce Key Business Measurements
- Implement feedback and traceability
- Example: IBM Component Business Model, OMG Business Motivation Model

Corporate Modeling

Shared Artifacts

Business Modeling

IT and SOA Modeling

- Define business processes and rules to meet goals
  Validate through simulation
- Generate run-time code or execute processes directly
- Example: Business Process & Rule Model...

- Define architecture to realize processes and IT constraints
- Define the IT Artifacts – data and services
- Accelerate the IT development cycle
- Example: Service models, Object & Data models, …
Good old days: Businesses used to be simpler and internally focused

- Business get more complex as they do more to compete
- They used to control their critical processes
- Commoditization and globalization have reduced central control
- Now businesses have to focus on core competences
- And leverage competences of others for competitive advantage

**Case Study: Retail Store → Multi Channel Retail**

**Division**

Service (an independent business task)

Service Invocation (of next task)
Now businesses are Complex & Globally Distributed

Case Study: Multi Channel Retail

Change: Process Optimization
Three Key Concepts
To Adapt for Business Driven Development

**Business Innovation and Optimization**
--- Focus on Responsiveness and Optimization

- A design, monitoring and management approach that leverages integrated resources to achieve aligned, accountable, and action-oriented business operations

**Model Driven Architecture**
--- Focus on Efficiency and Quality

- A style of enterprise application development and integration based on using automated tools to build system independent models and transform them into efficient implementations.

**Service Oriented Architecture**
--- Focus on Flexibility and Reuse

- An approach for designing and implementing distributed systems that allows a tight correlation between the business model and the IT implementation
BDD enables business integration, optimization and verification

- Discover
- Construct & Test
- Compose

- Gather requirements
- Model & Simulate
- Design

- Integrate people
- Integrate processes
- Manage and integrate information

- Financial transparency
- Business/IT alignment
- Process control

- Manage applications & services
- Manage identity & compliance
- Monitor business metrics
Model-Driven Development Mission

Increase the productivity, quality and predictability of software by providing a modeling environment for integration, generation, discovery and visualization of software artifacts across the software development lifecycle.
MDA: Open standards for Modeling & Development
OMG™ Model Driven Architecture (MDA)™

- An integration of best practices in Modeling, Middleware, Metadata, and Software Architecture

- Model Driven (Models at the core - UML, MOF, CWM, BPDM, SBVR, RAS…)
  - Computation Independent Models (CIM) – Typically Conceptual and Business Models
  - Platform Independent Models (PIM) – Technology or Domain Models – can have logic/computation
  - Platform Specific Models (PSM) - J2EE, .Net, SQL
  - Mappings: PIM<->PIM, PSM<->PSM, PIM<->PSM
  - Applies across the business software life cycle

- Key Benefits
  - Improved Productivity for Architects, Designers, Developers and Administrators
  - Lower cost of Application Development and Management
  - Enhanced Portability and Interoperability
  - Business Models and Technologies evolve at their own pace on platform(s) of choice

MDA is a Standards Framework & a Open Modeling & Metadata Standards
What is the Model Driven Architecture™?

- A New Way to Specify and Build Systems based on open standards from the OMG™ & W3C™
  - Focus on Business Needs First
  - Based on Modeling & Metadata
    - Business & IT Modeling
  - Supports full lifecycle: Design, implementation, deployment, maintenance, and evolution
  - Builds in Interoperability and Portability
  - Integration with standards from W3C, OASIS, HL7...
  - Lowers initial cost and maximizes ROI
  - Applies directly to the mix of hardware and software that you face:
    - Programming language
    - Operating system
    - Network
    - Middleware
Model-Driven Architecture (MDA)

- An OMG initiative to support model-driven development through a series of open standards

**MDA™**

- Modeling languages
- Interchange standards
- Model transformations
- Software processes
- etc.
Model-Driven Style of Development (MDD)

- An approach to software development in which the focus and primary artifacts of development are models (as opposed to programs)
- Based on two time-proven methods

(1) ABSTRACTION

```cpp
SC_MODULE(producer)
{sc_inslave<int> in1;
int sum; //
void accumulate (){sum += in1;
cout << "Sum = " << sum << endl;}
```

(2) AUTOMATION

```cpp
SC_MODULE(producer)
{sc_inslave<int> in1;
int sum; //
void accumulate (){sum += in1;
cout << "Sum = " << sum << endl;}
```
The MDA enables automation of abstraction/refinement

OMG MDA focus on platform independence

abstraction

- Actual problem domain
- Scoped problem domain
- Requirements specification
- Platform-independent solution specification

refinement

- Platform-specific solution specification
- Source code
- Executable
- Actual solution

define scope & boundary of IT system

The Business/IT Gap

OMG’s Model-Driven Architecture
MDA Mappings

- Computation Independent Business Model
  - CIM → PIM Mapping
  - PIM → PSM Mapping
  - PSM → PSM Mapping
  - PSM → Code Mapping

- Platform Independent Analysis Model

- Platform Specific Design Model

- Code
A new Paradigm for Model Driven Architecture

MDD is really about separating and bridging concerns

MDA

- Architecture based Transformation
  - How the concerns are addressed
  - The parts involved
  - Rules for how they relate
- Contract Based Development
  - Formal contract specification
  - Realization formalism

Start with a specification of a set of concerns

Recursively iterate
- Different domains
- Different levels of abstraction

Realize those concerns while introducing new ones

A Realization becomes the specification for incorporating new concerns
Business Driven Development in a nutshell

What are the business organizational and operational requirements necessary to realize these objectives?

How do we ensure we are addressing the right requirements within operational constraints?

How should we realize those operational requirements while addressing IT and business integration concerns?

How do we create solutions based on the chosen architectures?

How can we deliver solutions that respond to rapidly changing business opportunities?

How do we collect data and monitor the results for solution validation and continuous improvement?
MDA Process in a Nutshell

1. Define the Platforms → «datastore» Platform Model → Choose a Mapping
2. Customize the Process
3. Define the Problem → Business Process Model
4. Define a Solution
5. Create a Solution → Generate Code
6. Test
7. Choose an Architecture
8. «datastore» IT Services Model
9. Implementation Model
10. «datastore» Code
OMG : Home of Business & IT Modeling standards

Enable Business Flexibility
(OMG BPMN*, BPDM*, SBVR, BMM*, OSM..)

Enable IT Flexibility
(OMG UML, MOF, XMI, RAS, CWM…)

Enable Interoperability
(W3C XML, HTTP, WSDL, OASIS BPEL..)

Modeling & Metadata Standards
Integrate with W3C, OASIS, HL7…

*Draft
Unlock The Power Of SOA

Business Modeling Standards Landscape

- **Simulation**
  - simulator "overlays" statistical distributions

- **Governance**
  - strategic goals, policies, capabilities

- **Observation**
  - events, metrics, KPIs, business situations

- **Rules**
  - Business rules

- **Authorization**
  - permissions and prohibitions

- **User Interaction**
  - user interfaces, dashboards

- **Process**
  - business tasks

- **Resource**
  - resources and roles

- **Information**
  - business artifacts

- **Organization**
  - hierarchical structures, organizations, locations

- **Services**
  - service providers and service interfaces

- **Business Motivation (BMM)**

- **Organizational Structure (OSM)**

- **Business Process Definition Metamodel (BPDM)**

- **Web Services Business Process Execution Language (WSBPEL)**

- **Business Process Modeling Notation (BPMN)**

- **Business Rules (BSBR/SBVR, PRR)**

- **Governance**

- **Simulation**

- **Entity**

- **Business Modeling Standards Landscape**

- **User Interaction**

- **Process**

- **Resource**

- **Information**

- **Organization**

- **Services**

- **Simulation**

- **Governance**

- **Observation**

- **Rules**

- **Authorization**

- **User Interaction**

- **Process**

- **Resource**

- **Information**

- **Organization**

- **Services**

- **Simulation**

- **Governance**

- **Observation**

- **Rules**

- **Authorization**

- **User Interaction**

- **Process**

- **Resource**

- **Information**

- **Organization**

- **Services**

- **Simulation**

- **Governance**

- **Observation**

- **Rules**

- **Authorization**

- **User Interaction**

- **Process**

- **Resource**

- **Information**

- **Organization**

- **Services**

- **Simulation**

- **Governance**

- **Observation**

- **Rules**

- **Authorization**

- **User Interaction**

- **Process**

- **Resource**

- **Information**

- **Organization**

- **Services**

- **Simulation**

- **Governance**

- **Observation**

- **Rules**

- **Authorization**

- **User Interaction**

- **Process**

- **Resource**

- **Information**

- **Organization**

- **Services**

- **Simulation**

- **Governance**

- **Observation**

- **Rules**

- **Authorization**

- **User Interaction**

- **Process**

- **Resource**

- **Information**

- **Organization**

- **Services**
Business Modeling MDA Standards
Business Modeling & Integration Task Force

- Semantics & Business Vocabulary for Rules– Final Voting
  - Business Rule and Business Vocabulary modeling
- Business Process Definition Metamodel (BPDM - Draft)
  - Business Process modeling – semantics, notation and integration
  - Integration with XML Schema, WSDL & BPEL4WS
  - Integration with UML & BPMN
- Business Process Modeling Notation (Draft)
  - Fast track standardization of Process Modeling Notation
  - Result of OMG & BPMI.org merger of activities
- Business Motivation Model (Draft)
  - Fast track standardization of Business Goals & Strategy model
- Organization Structure Metamodel (Draft)
  - Modeling organizational structures and resources
- Production Rule Representation (Draft)
  - XML Interchange for Business Rules Engines & Tools
Business Semantics of Business Rules (BSBR/SBVR) – Breakout Session at the forum

- Declarative expression of intent
- Provides for levels of enforcement
- Model represents concepts independent of business vocabulary
- Alternative vocabularies support different communities (e.g., English, German)
- Rules expressed as structured natural language
- Actions depend on context of application

**Rule: It is obligatory that each driver of a rental is a qualified driver.**

Standard influenced by Business Rules Group, Unisys, Neumont University et al
Open Modeling Standards: MDA Foundation: Analysis & Design Platform Task Force

- Unified Modeling Language (UML)
  - For describing the problem domain and the solution architecture

- Meta Object Facility (MOF)
  - For describing and manipulating models and metadata, general purpose modeling languages or domain specific modeling languages (metamodels)

- XML Model Interchange (XMI)
  - For exchanging model & metadata information in XML format and generating XSD

- Common Warehouse Model (CWM)
  - For describing data mappings and database schemas

- Reusable Asset Specification (RAS)
  - Packaging, distributing and reusing software asset metadata

Many Eclipse.org members are driving the core MDA standards Pragmatic integration of MDA, W3C and Java standards using Eclipse
Modeling for SOA and Web Services using standards

- **UML can be used to model Web Services**
  - Web Service Operations (WSDL Operations) are UML Operations
  - Groups of Web Service structures Requests (WSDL PortTypes) as UML Interfaces or Classes
  - XML Schemas using UML Class Diagrams
  - Web Services data structures using UML Class Diagrams
  - Web Services flow (E.g.:BPEL4WS) using UML Activity Diagrams
  - UML 2.0 Structured classes can be used to model services and service dependencies more directly

- **BPMN can be used to model business processes**
  - The semantics of process needs to nailed down – WSBPEL has executable process semantics

- **SBVR, PRR and BMM can be used to model, design and implement business rules within a motivating business context**

- **The OMG Business Process Definition Metamodel (BPDM) work is an example that integrates notation, semantics and technology mappings**

- **UML Profile for Software Services now on Developerworks**
  - Modeling and design for SOA
MDA – Two Benefit Areas

- **The Business Advantages:**
  - Architectural Viewpoint brings out how your applications work with each other, and with those on the outside
  - Model changing business requirements and shifting enterprise boundaries
  - Define the Business Functionality and Behavior of each application as a technology-independent model
  - Focus your IT investment in your core business

- **The Technological Advantages:**
  - Codifies architecture enabling less-skilled developers
  - Interoperability and Portability are built into the MDA
  - MDA speeds development as it concentrates investment on the business side
  - Move easily to the “next best thing”, or interoperate with it, quickly and easily
MDD Risks

- Difficulty in specifying the requirements, domain and application models in the first place
- Balancing abstraction for business modeling vs. details necessary for model execution and translation
- Too much variability in the metamodel limiting reuse of PIM to PSM translators and increasing development cost
- Availability of PMs and corresponding PIM to PSM translators
- Applicability of visual vs. text modeling to detailed processing instructions
- Infecting the business model with Platform Model (PM) information
- Reversible mappings and reconciling modifications of generated artifacts
- Transforming the culture to leverage MDA
- Too many metamodels, complexity of metamodels and UML2
Key Messages

- Business Innovation & Optimization takes a holistic view of Business & IT
- The ‘Flat Earth’ effect influences Business and IT at the core
- Individual businesses, tools & technologies become less interesting – Need to look at the supply chain that delivers business value
- Modeling is foundational to Model Driven Architecture (MDA) & Service Oriented Architecture (SOA)
- Business Process & Business Rules are key enabling technologies to assist Business Flexibility
- Business Modeling Standards are finally arriving on the scene after years of hard work
- SOA Infrastructure standards are getting widely supported
- Governance across the SOA life cycle will be a critical success factor
Thank You

Dankeschön

多謝

Danke

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Questions