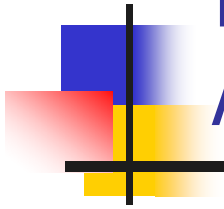


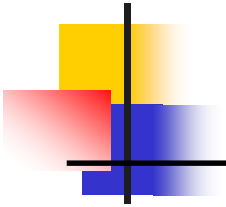
Model Driven Architecture

A New Paradigm in Software Development

Hermod Opstvedt

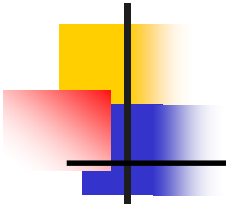
Chief Architect

DnB NOR ITU, Norway



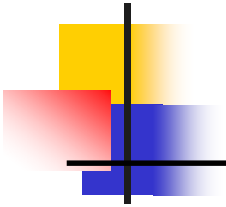
Model Driven Architecture

- Model Driven Architecture (MDA) is a specification by the Object Management Group (OMG).
- MDA established as the base architecture for OMG's standards, in September 2001.
- MDA Guide 1.0.1 released in June 2003
- Final version expected late this year



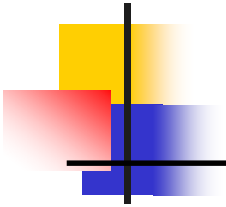
Model Driven Architecture

- OMG's MDA Vision:
  - "Support interoperability with specifications that address integration through the entire systems life cycle: from business modeling to system design, to component construction, to assembly, integration, deployment, management, and evolution."



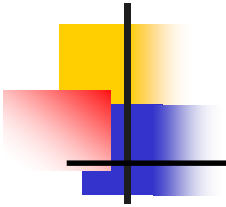
Model Driven Architecture

- Why do we need MDA ?
  - We will never all agree on platform specific issues like :
    - Hardware
    - OS
    - Programming language
    - *etc*.



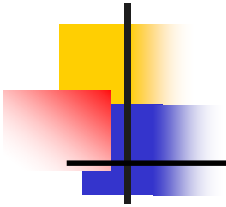
Model Driven Architecture

- Need to preserve investments as the computing environment changes.
  - New technologies emerge – need for Integration.
    - ✓ What do you do when super techonology "BubbA" comes along and your business people just "have-to-have-it".
      - ❖ Start a migration project ?
      - ❖ Struggle with integration ?
  - New versions – backward incompatibility.
    - ✓ Some versions are backward incompatible.
    - ✓ New features are added.



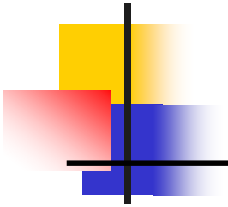
Model Driven Architecture

- Would it not be nice if you could :
  - Install a new add-on from your vendor and just hit the button and have it generate the new stuff?
  - Or
  - Just change to a different vendor and import your PIM and have it do the generation of this new stuff.



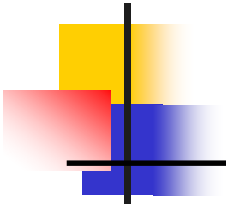
Model Driven Architecture

- Software development today
  - Traditional project
    - Start with analysis & design.
    - Often paper based diagrams (UML models *etc*.).
    - Sometimes modeling tool is able to generate skeleton code stubs.
    - Move on to coding.



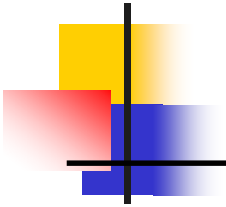
Model Driven Architecture

- More coding – don't have time to update docs now.
- Design documentation gradually becomes out of sync. Even wrong.
- Design documentation is rarely updated in after hand.



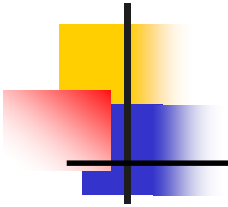
Model Driven Architecture

- XP Approach
  - Coding & Test cases only.
  - No documentation – except in code (maybe).
  - Project ends and the system moves to the maintenance phase. Original coders leave.
  - Maintenance people now have the challenge of trying to understand what the system really does.
  - They have no clue as to what was the intention behind it from start.



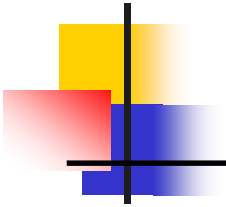
Model Driven Architecture

- Documentation
  - Often seen as a burden by developers.
  - Can be generated from code in some languages (JavaDoc, *etc*.).
  - Is a requirement for maintenance.
  - Describes design decisions that can not be expressed in code.



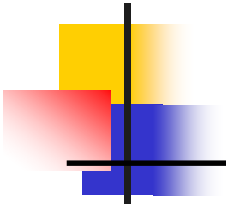
Model Driven Architecture

- How can MDA help us ?
- Supports full lifecycle.
  - Analysis.
  - Design.
  - Implementation.
  - Integration



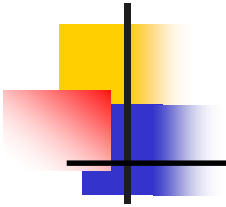
Model Driven Architecture

- MDA is based on other standards
  - Unified Modeling language (UML).
  - Object Constraint Language (OCL).
  - XML.
  - XML Metadata Interchange (XMI).
  - Meta Object Facility (MOF).
  - Common Warehouse Metadata.
  - *etc*.



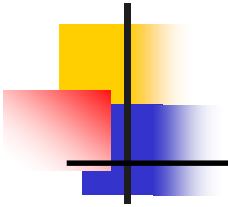
Model Driven Architecture

- Several layers
  - Platform Independent Model (PIM).
  - Platform Specific Model(s) (PSM).
  - Code.



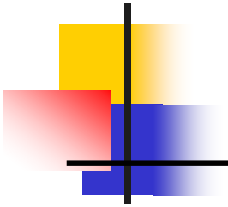
Model Driven Architecture

- Describing a model (PIM)
  - Use some form of language that is suitable for transformation – meaning it can be understood by a computer. Must be well defined.
    - UML
      - ✓ Very well suited for the static parts of the model – *i.e.* the classdiagrams, *etc*.
    - OCL
      - ✓ Very well suited for the dynamic parts of the model – *i.e.* the action/sequence diagrams



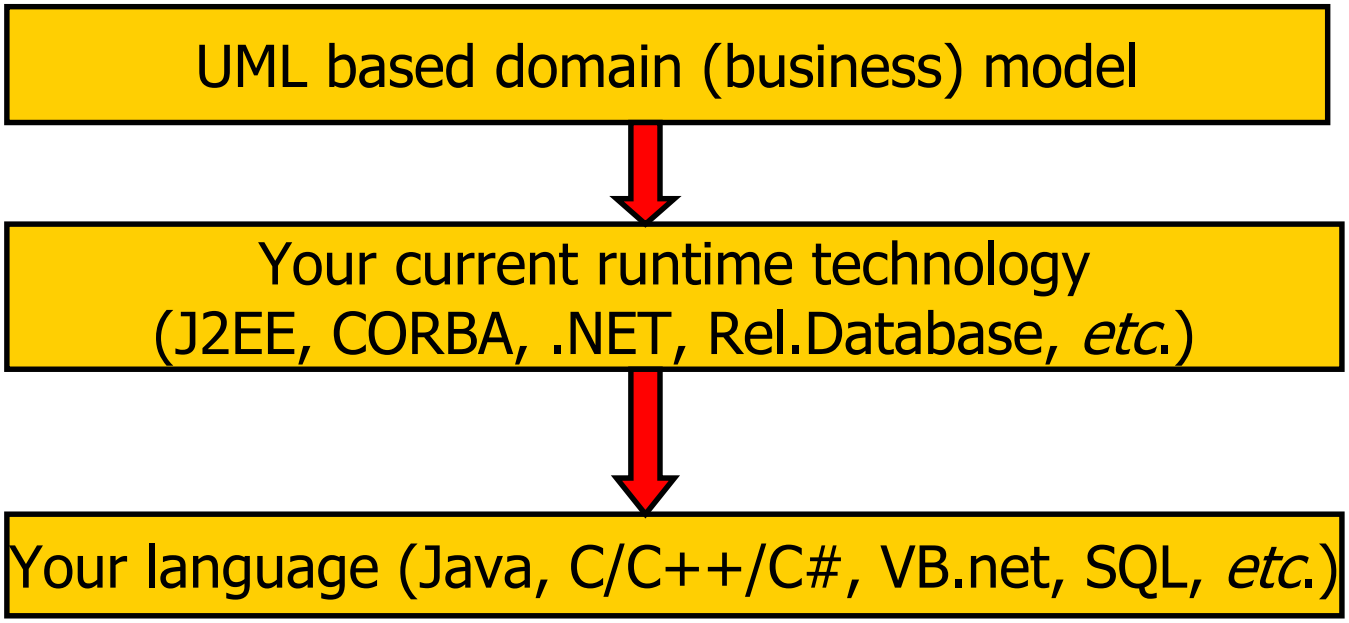
Model Driven Architecture

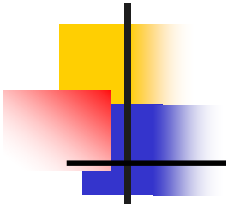
- Describing a model (PIM)
  - The model must describe the business – not the developers' thoughts of how it should be implemented. (common pitfall)



Model Driven Architecture

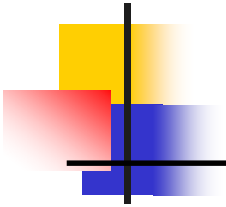
Conceptual View





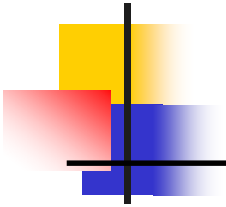
Model Driven Architecture

- Platform Independent Model (PIM)
  - Describes the business functionality.
  - Closely matches the user requirements.
  - Not tied to any platform.
  - Can describe pre & post conditions (OCL).



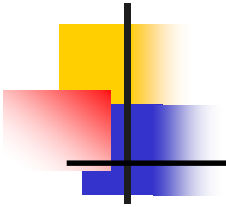
Model Driven Architecture

- Can be mapped into your current environment using a transformation process.
  - A PIM can and normally will be transformed into more than one Platform Specific Model (PSM).
    - ✓ J2EE
    - ✓ SQL (for database)
    - ✓ *etc*.



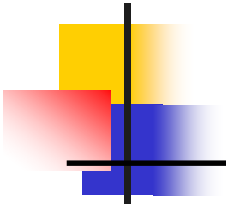
Model Driven Architecture

- Use tags or other metadata to annotate the PIM such that the different PSMs can be generated.
- Uses languages derived from the UML language
  - The are based on the Meta Object Facility (MOF)
- Often based on profiles.
  - JSR 26: UML/EJB Mapping Specification



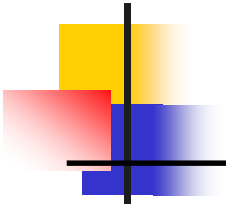
Model Drive Architecture

- PIM/PSM Transformation
  - Is the process of taking the PIM into the PSM(s).
  - Can be very complex.
  - Normally done by experts who understand the PSM very well.
  - OMG is working on a standard language
    - Query, Views and Transformation (QVT).



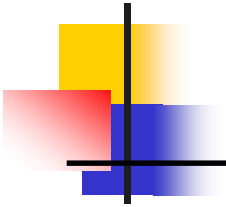
Model Driven Architecture

- Platform Specific Model (PSM)
  - Is the specific representation of the PIM for your target environment.
    - J2EE (WEB + EJB)
    - SQL
    - .NET
  - Is the basis for the next step – Code generation.



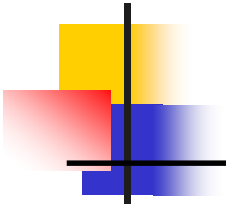
Model Drive Architecture

- Platform Specific Model (PSM)
  - Can also be modified in tooling.
    - Dependent of the tool implementation.
  - Can also be reversed into the PIM.
    - Dependent of the tool implementation.



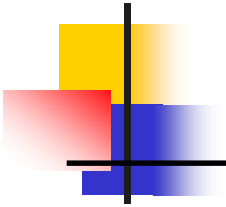
Model Driven Architecture

- Code generation (PSM to Code Transformation)
  - Is the process of taking the PSM into the final destination (code, ddl, *etc*.)
  - This is the least complex part of the process.



Model Driven Architecture

- Code generation (PSM to Code Transformation)
  - Can be developed by anyone that has a good understanding of XMI and the destination code.
  - Can be, and often is, template based.

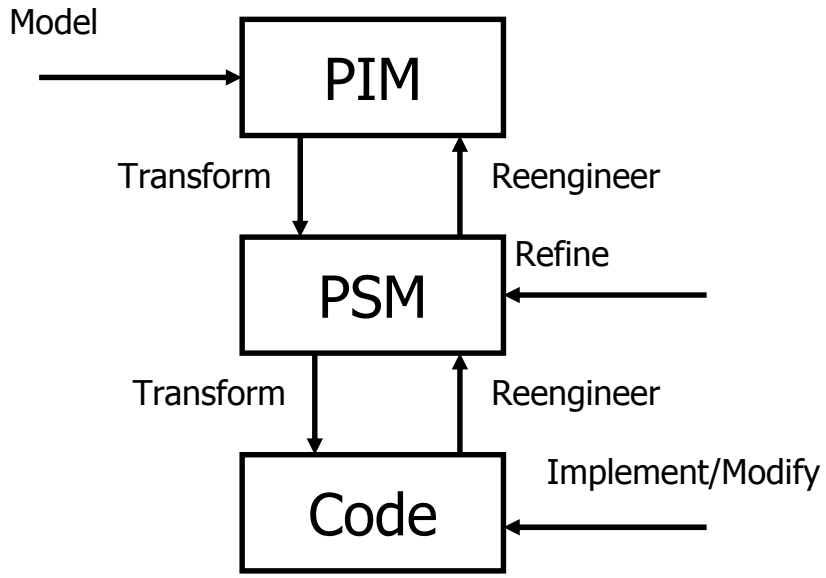


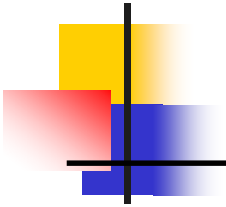
Model Driven Architecture

- Shortcutting it.
  - Transforming the PIM directly to code
    - Ex. AndroMDA
    - No refining in the PSM stage can be done

Model Driven Architecture

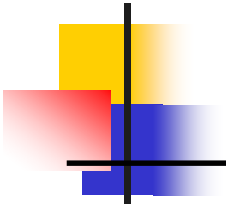
Overview of the complete process.





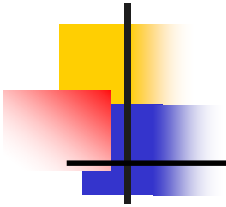
Model Driven Architecture

- A sample run using opensource software
  - Poseidon for UML – For modeling PIM.
  - AndroMDA – For transforming PIM to code.



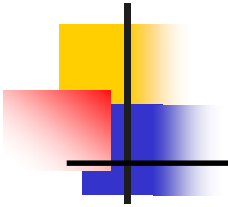
Model Driven Architecture

- UML model to code using OpenSource
- A look at the AndroMDA sample
  - The sample model
  - The PIM to code transformation



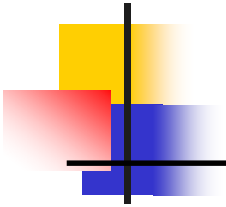
Model Driven Architecture

- Notes about UML modeling.
  - Because we are using the AndroMDA for generation, there are some requirements we must meet.
    - Use the correct Stereotype.
    - Use correct types when declaring attributes.
    - Primary keys of Entity Beans must be Strings.



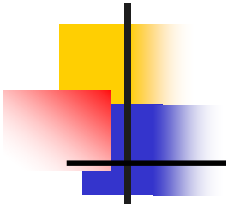
Model Driven Architecture

- If EJB's are the target then Session Bean names have to end in the word 'Service'.
- Model one exception class per component.
- See AndroMDA documentation for others.



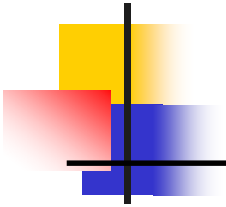
Model Driven Architecture

- First steps.
  - Run the AndroMDA genapp goal
    - Creates an initial project structure (Eclipse).
    - Creates the necessary Maven artifacts.
  - Model you application (ex. Poseidon for UML).
    - Note the AndroMDA requirements



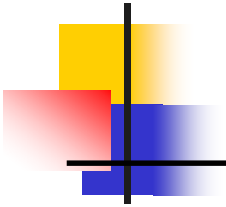
Model Driven Architecture

- Transforming PIM to code
  - Export the UML model to XMI.
  - Run maven on the generated pom.



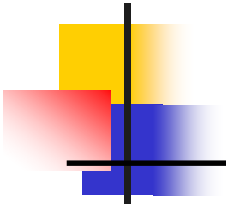
Model Driven Architecture

- Is it a paradigm shift?
  - 2-3 years before it is fully mature and adopted (Cutter Consortium).
  - Vendor adoption is increasing (IBM, Compuware, *etc*.)
  - Immature tooling.



Model Driven Architecture

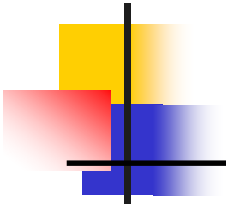
- Prediction is that it will have 50% market share by 2007 in the OO tools market (Cutter Consortium).
- Some vendors have documented 30% decrease in time spent on project.



Model Driven Architecture

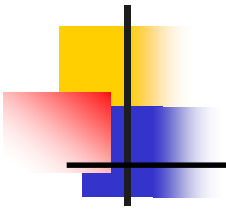
- Conclusion:

- MODEL – Don't CODE !!



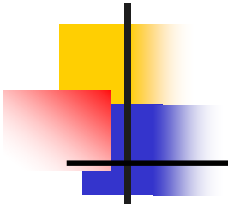
Model Driven Architecture

- Some tools available:
  - Opensource
    - AndroMDA: http://www.andromda.org/
    - Jamda: http://jamda.sourceforge.net
    - Eclipse – EMF: http://www.eclipse.org/emf/
    - Eclipse – GMT: http://www.eclipse.org/gmt/



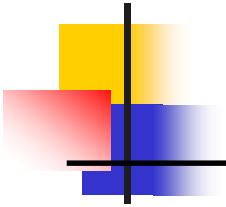
Mpodel Driven Architecture

- Commercial
  - Compuware: OptimalJ (Netbeans based)
  - IBM: Rational XDE (Eclipse based)
  - innoQ: iQgen
  - Io-Software: ArcStyler



Model Driven Architecture

- Resources:
  - http://www.omg.org/mda



Model Driven Architecture

- Questions