

CSSE 490 Model-Based Software Engineering: MDSD and Case Study



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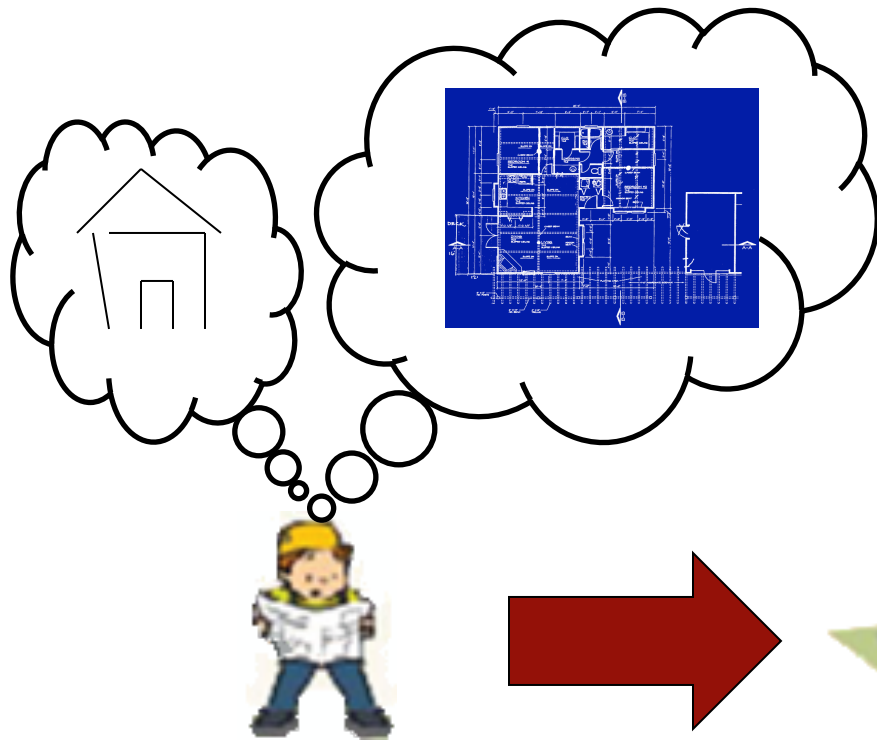
Learning Outcomes: MBE Discipline

Relate Model-Based Engineering as an engineering discipline.

- Outline major elements of MBSE
- Examine transition from traditional to model-based development
- Introduce the Milestone 1 assignment



Traditional Software Development



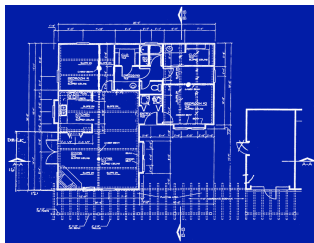
**Gather
Requirements
& Design it**



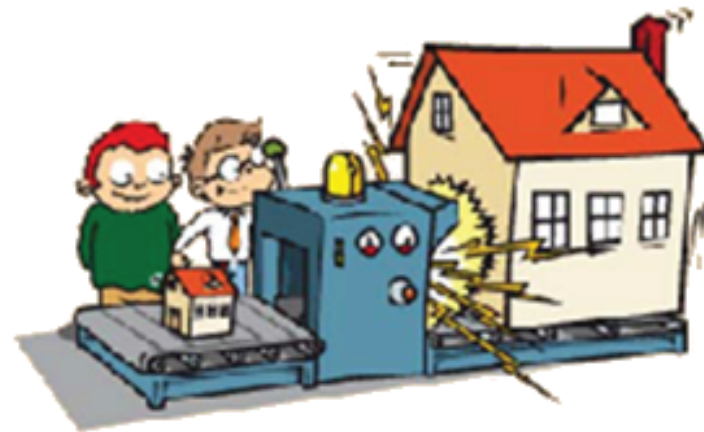
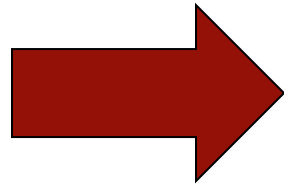
Build it...

Model-Based Software Engineering

- a.k.a. Model-Driven Software Development (MDSD), MDD, MDA, MDSE ...



Model it



Generate it

So, what would you do differently for a situation like the following?

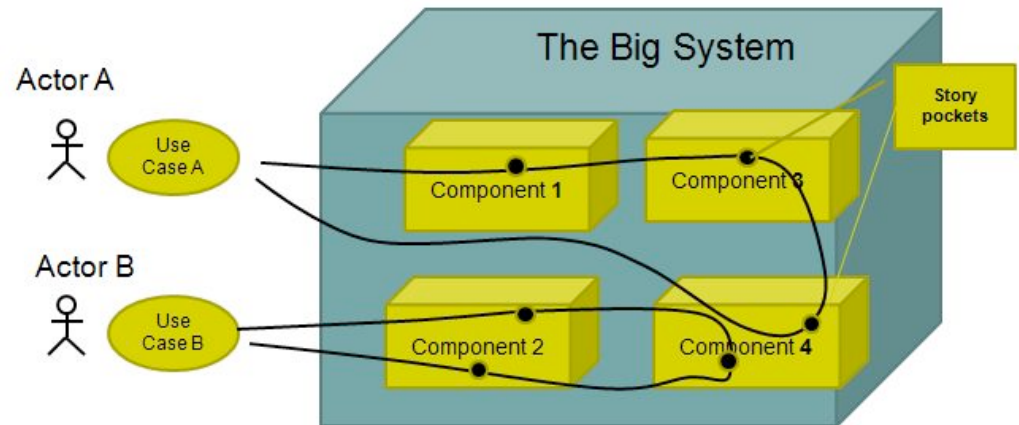
You are the software developer for your firm's (Acme, Corp.) web-based social network system (Acme Facebook 😊). You are working on AFBE for collaborative engineering projects. It was such a hit that they want you to do it for the marketing and human resources folks in the coming year. You have been told that next year you are to write your AFB application for some of your business partners in the 5 key product lines. The boss is already starting to talk like they would like to make AFB a product-line itself as it looks like it could be a revenue generator.

- Think for a minute...
- Turn to a neighbor and discuss it for a minute



Model-Based Engineering Essentials

- Everything is a Model
- Models used for Simulation
 - Software is a simulation in operation
- Start with understanding Application Domain
 - Domain Engineering
- Specify System
- Generate System
- Repeat
 - Populate Repository and Refine Knowledge



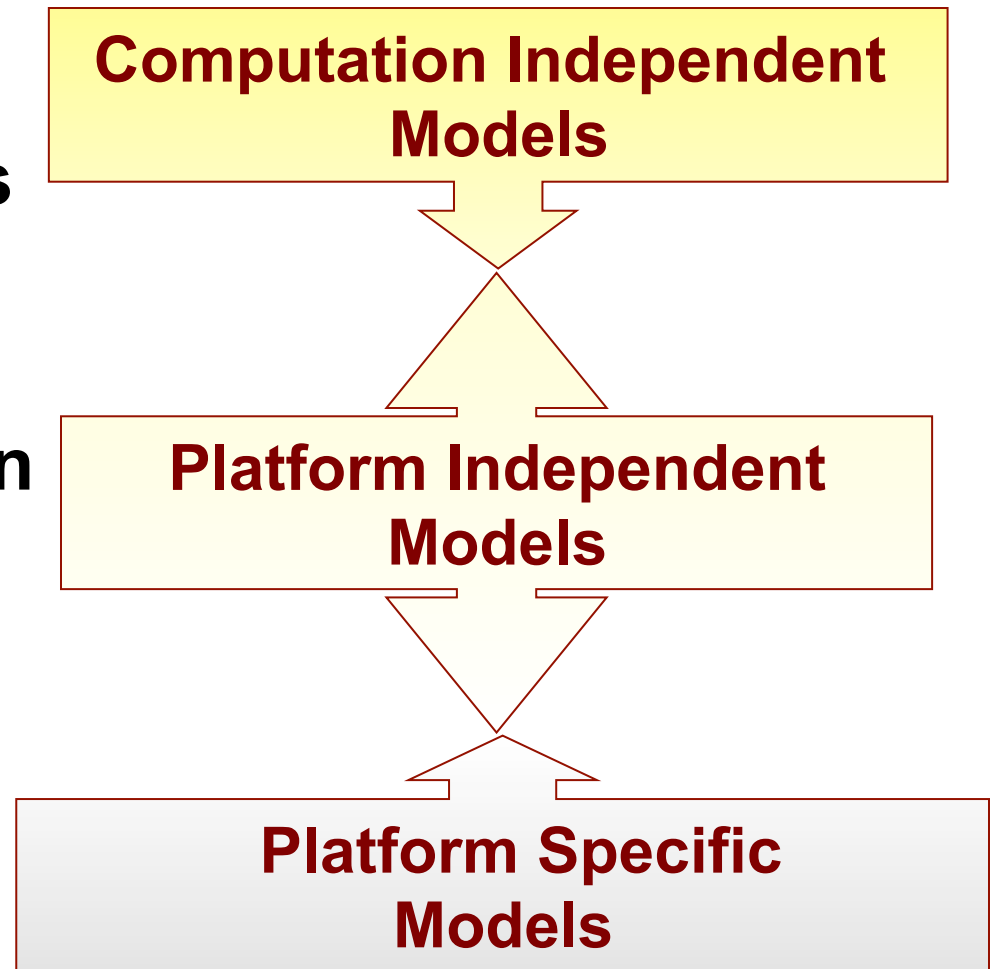
Leading w/ Limitation: Observations about Architecture Centric MBSE

- Software System *Families* as opposed to unique items
- Architecture Centric Design
- Forward engineering (no emphasis on Roundtrip)
- Model-to-Model transformation for modularization
- Source code generation without explicit use of target Metamodel
- Not 100% generation – 60-80% with HITL



Basic Model Layers

- One or model levels per layer
- Mappings and Transforms between models
 - Mappings
 - Transforms



Computational Independent Model (CIM)

Computation Independent Models

■ What is it?

- not well documented
- provides contexts and constraints to other layers
 - description of the environment
 - requirements
 - constraints of the system
 - domain models

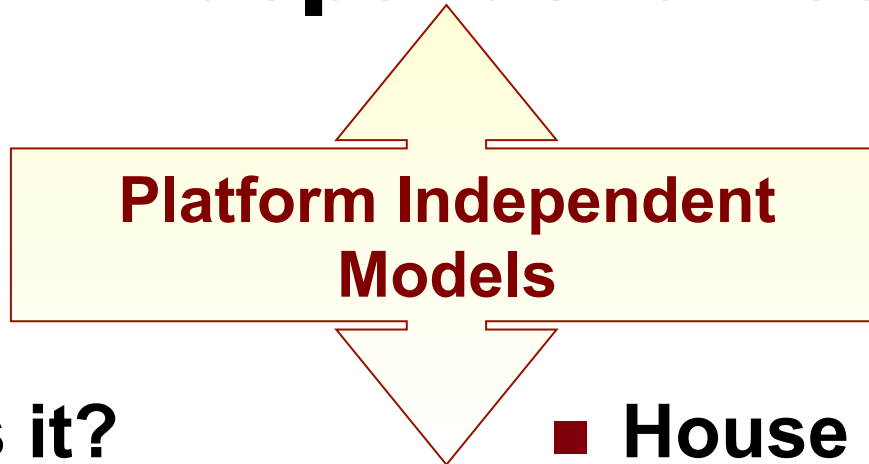
■ For a house

- county building code
- budgetary constraints
- available suppliers
- lot details

■ For software

- budget constraints
- best practices/style guides
- available resources

Platform Independent Model (PIM)



■ What is it?

- Description of what the system does, but not necessarily how it does it
- A complete specification of the system without platform details

■ House Example

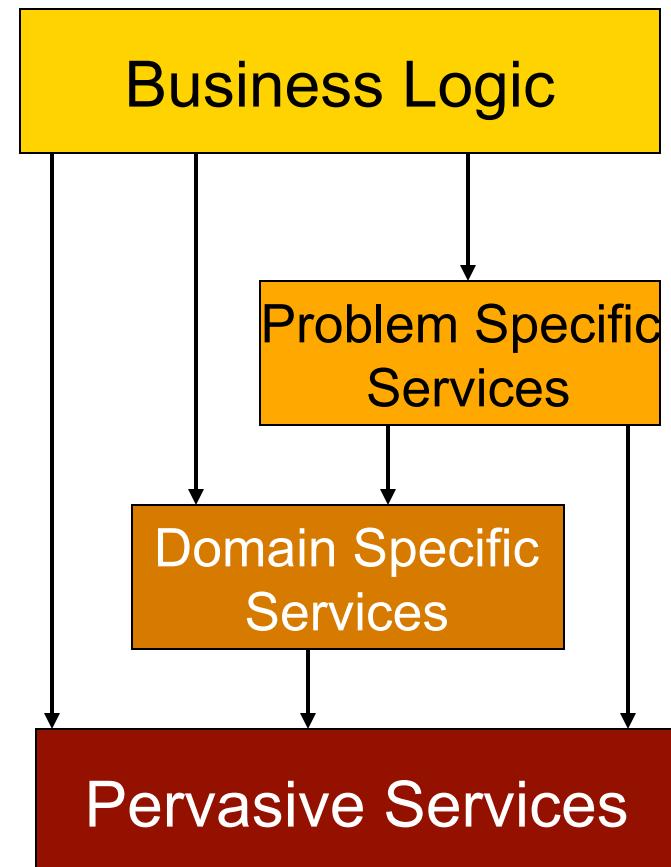
- blueprints
- artists renditions
- wiring diagrams

■ Software Example

- Class diagrams
- Interaction diagrams
- State diagrams

Platform Independent Model (continued)

- **Business Logic Models**
 - the core system
- **Problem Specific Services**
 - Defined by developers of the PIM
- **Domain Specific Services**
 - Lexicon Query Service,
- **Pervasive Services**
 - Naming, directory, transaction, security





Platform Specific Model (PSM)

■ What is it?

- Abstraction layer on top of the actual platform
- May provide skeletons for low level details to be filled in



**Platform Specific
Models**

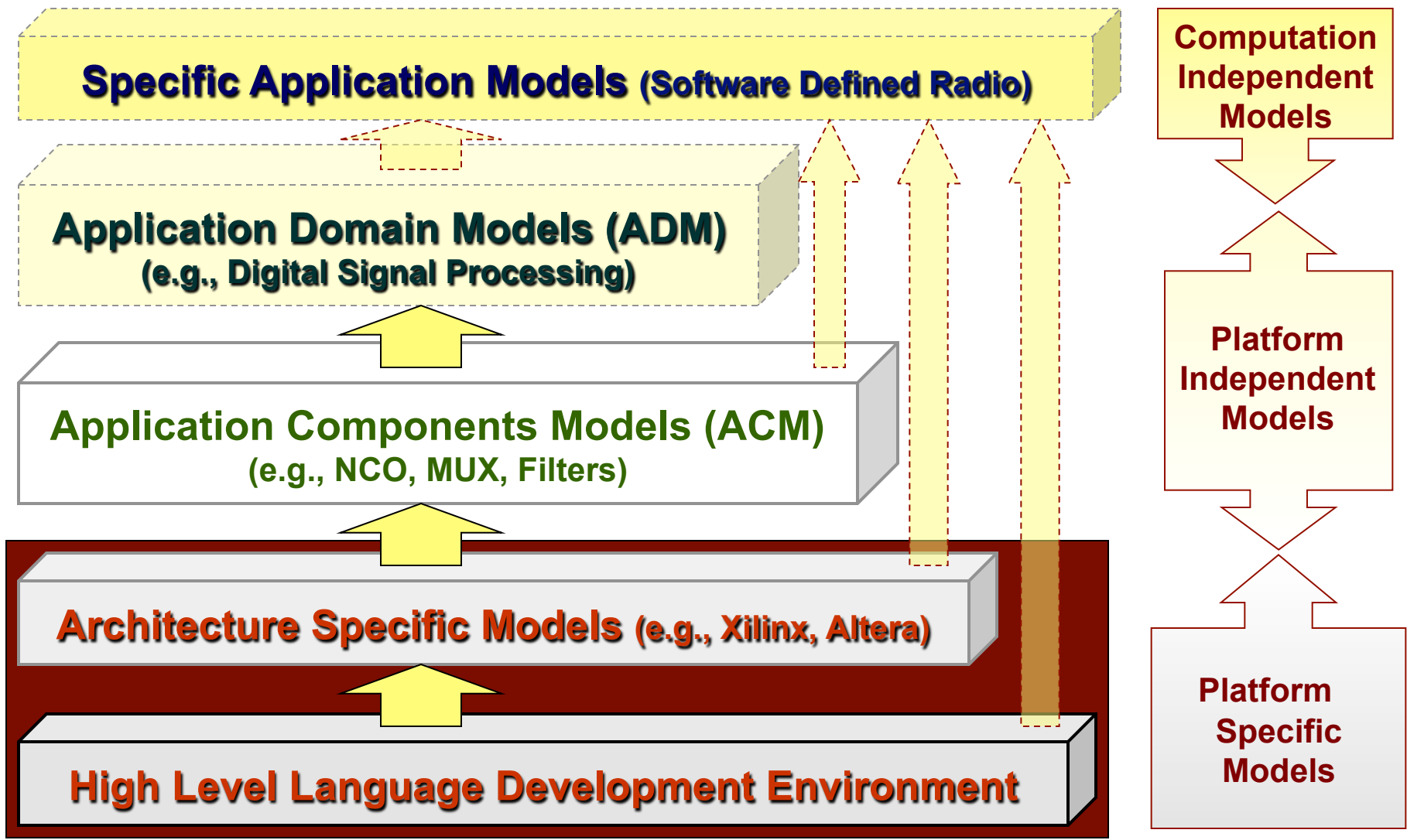
■ House Example

- chalk lines and markers
- noise penetration measures

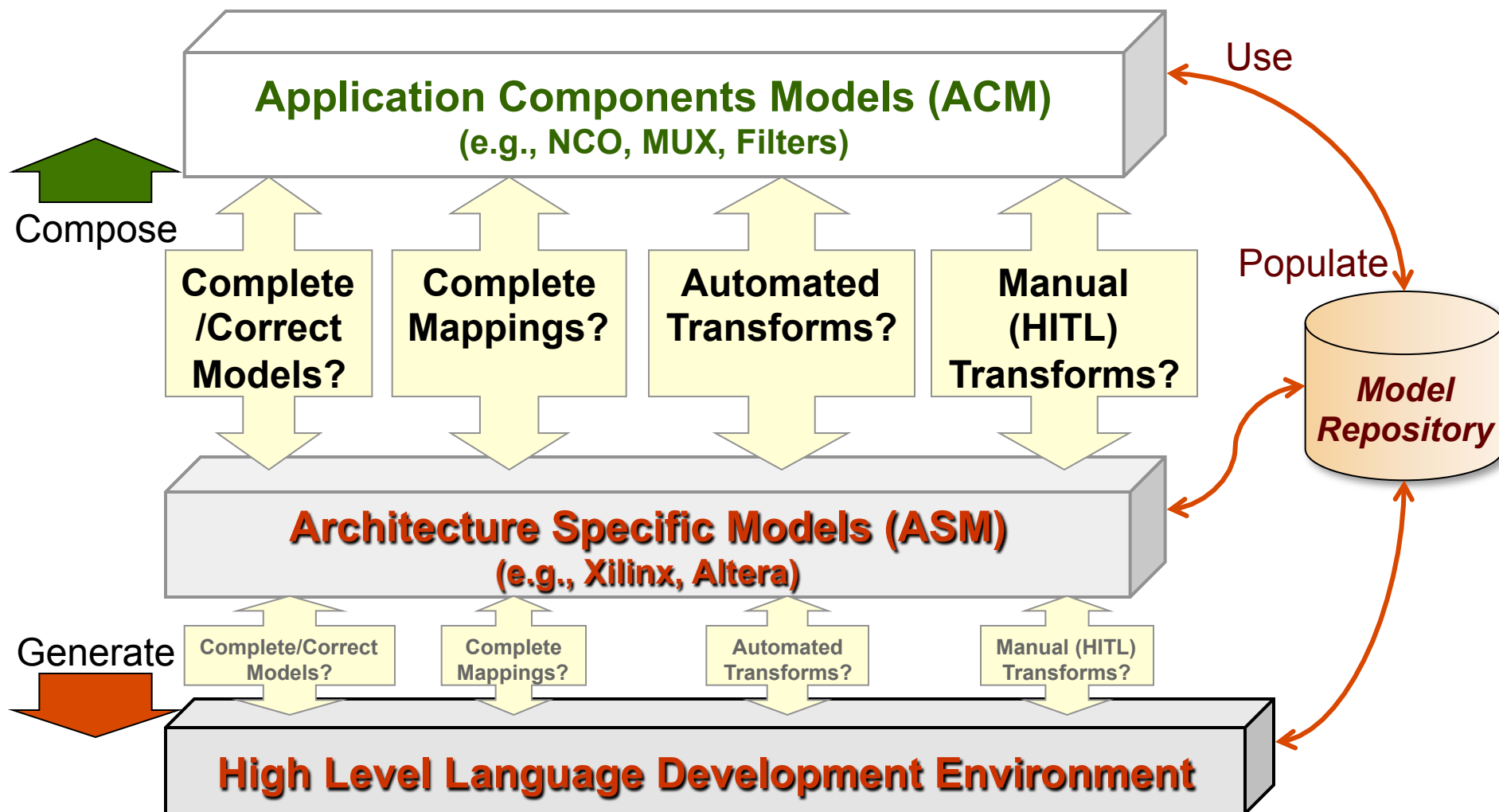
■ Software Examples

- middleware platforms
- code in high level languages
- templates and skeletons

Model-Base Engineering for High-Performance Reconfigurable Computing

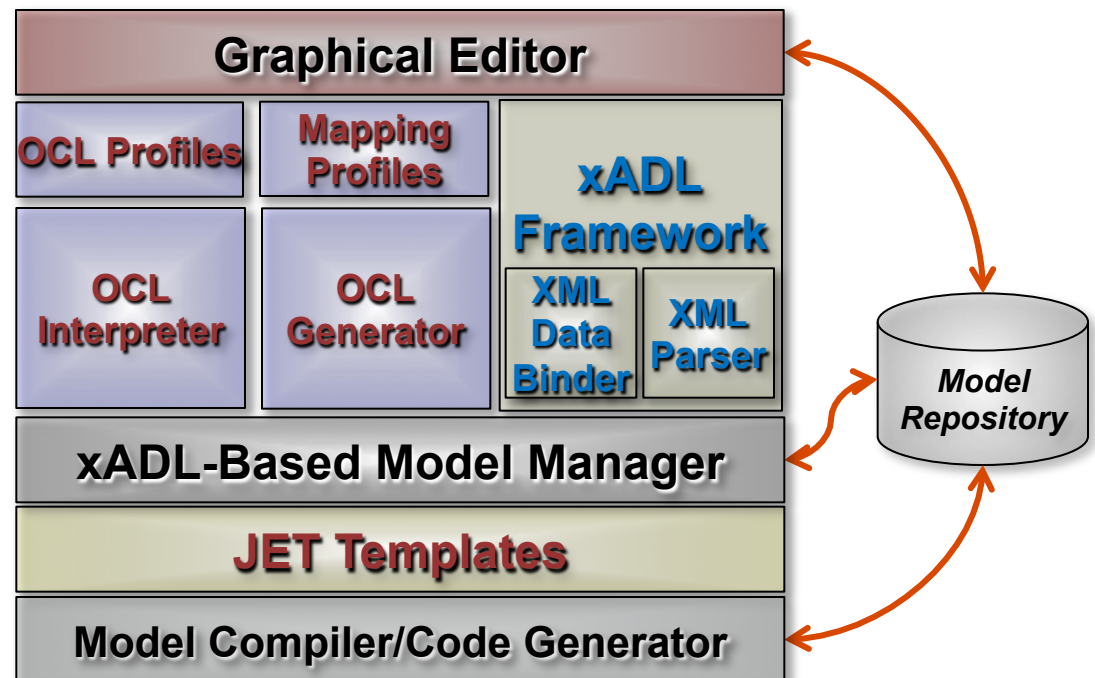


MBE-HPRC Strategy/Issues



An Example Architecture

- Interaction through a graphical editor
- Assembly and Transformations enabled through tools
- Use of OCL
- Parsers are key
- XML-based interchange
- JET for final transforms



Software Defined Radio Prototype

The screenshot displays the Eclipse SDK environment for the XC Model Editor. The main workspace shows a diagram with components NCO, Multiplier, and FIRFilter. A 'Platform Selection' dialog box is open, listing 'ML316' and 'Harris SIP1' as available platforms. The 'Model Definition' view on the right shows the 'Component Name FIRFilter' and its properties. The Package Explorer on the left shows the project structure, including the 'FIRFilter' component and its associated files.

Platform Selection Dialog:

Platforms
ML316
Harris SIP1

Model Definition View:

Component Name FIRFilter
Set the properties of the selected object

Name FIRFilter

Properties View:

Property	Value
ComponentType	FIRFilter
name	FIRFilter
Parameters	ParamPropDataLabelProvider



Homework Discussion

- **Assignment: Create an application that keeps tracks of the information in such a simple social network.**
- **The application allows for user profiles to be added to, deleted from, or looked-up in the social network**
- **For each profile, you will keep track of:**
 - **Person's name associated with that profile**
 - **An optional image that the person may wish to display with the profile**
 - **An optional "current status" for the profile (just a String indicating activity the owner is currently engaged in)**
 - **A list of friends for each profile**

Case Study Discussion:

- **What makes Car Sharing a reasonable application for MBSE?**
- **Do you think their approach was transform driven? Why?**
- **Using the Architecture Driven approach, what was the significance of the Metamodel/ Profile Implementation?**
- **What was the role of Template programming?**





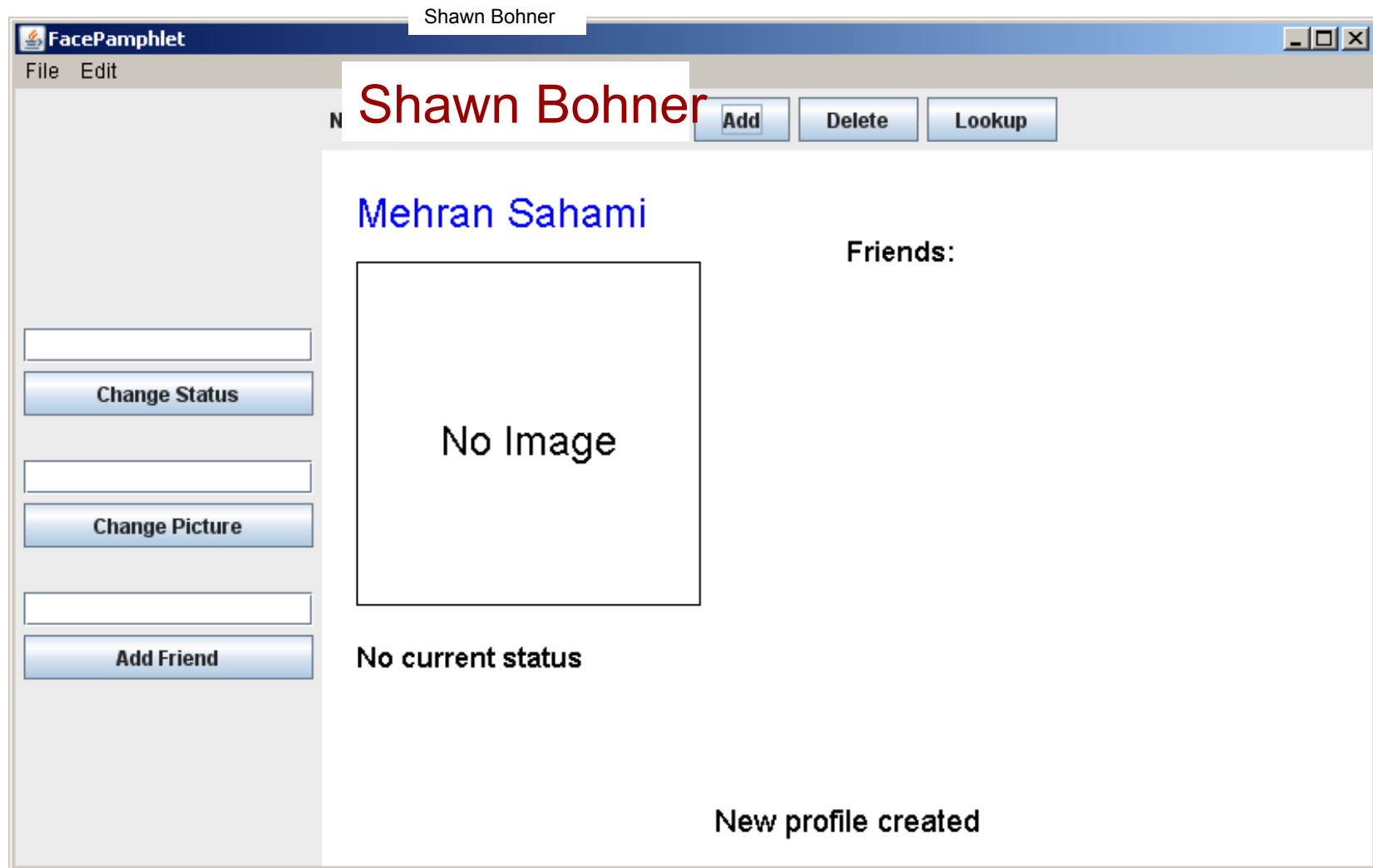
Basic FacePamphlet

FacePamphlet

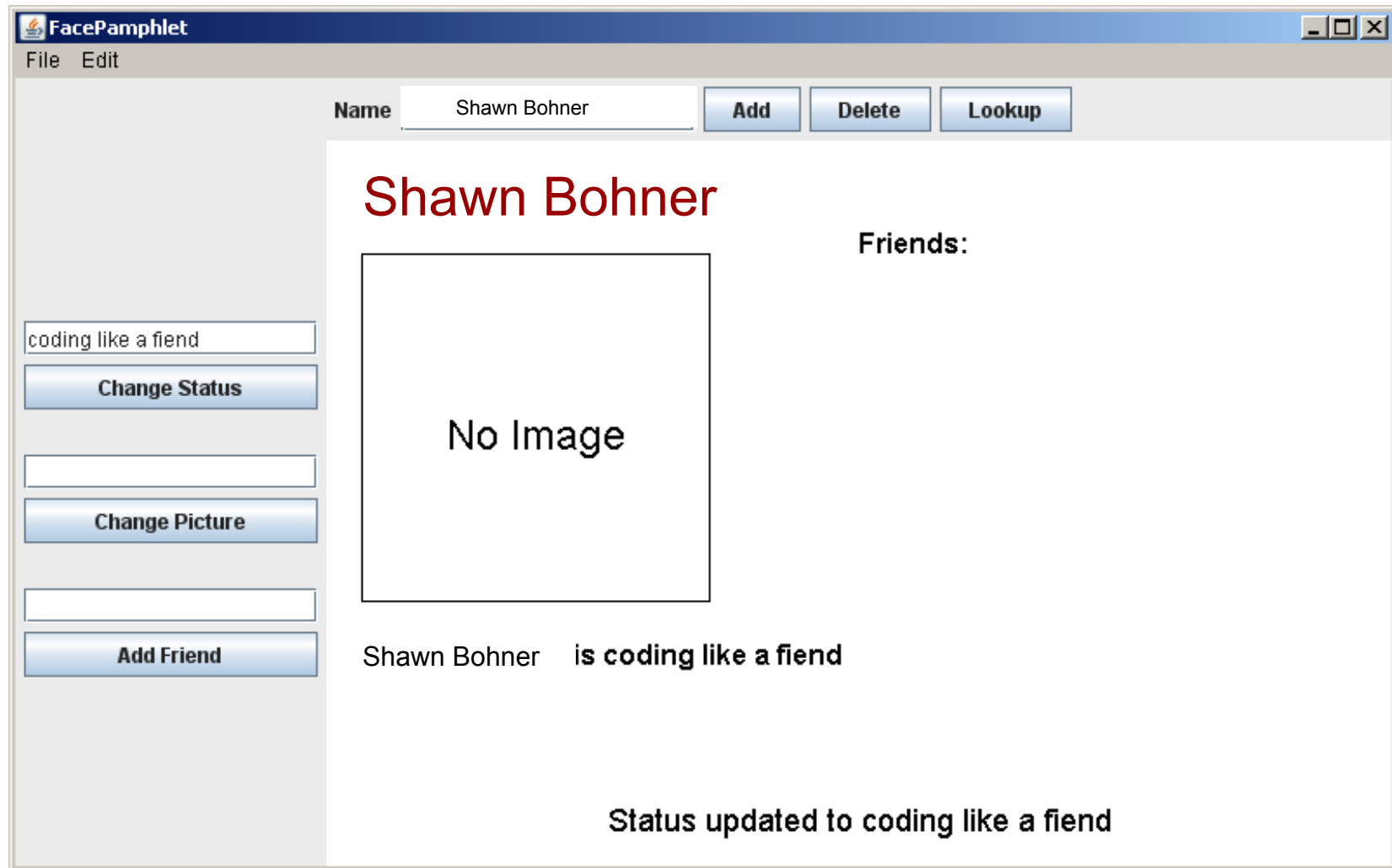
File Edit

Name

Adding a Person



Changing Status





Change/Add Picture

FacePamphlet

File Edit

Name

Shawn Bohner

coding like a fiend

MehranS.jpg

Friends:



Shawn Bohner is coding like a fiend

Picture updated



Other features...

- **Similarly you can:**
 - Add others to the system
 - Delete them
 - List them as your friends
 - Etc.

 - **I will put the DETAILED description and a demo app on Angel tonight or by tomorrow**
 - **This is an assignment given to first year CS students at Stanford to complete in about 2 weeks... with 5 team members, you should be able to finish in a week ...**
 - **Keep Model-Based Engineering in mind!**
-



Homework and Milestone Reminders

- **Read Chapter 4 of MBSD Text – Concept Formulation**
- **Let's talk tomorrow about the project this term**