

# INF5120 and INF9120

## ”Modelbased System development”

Lecture 5: 13.02.2016

Arne-Jørgen Berre

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# Course parts (16 lectures) - 2017

- January (1-3) (Introduction to Modeling, Business Architecture and the Smart Building project):
- 1-16/1: Introduction to INF5120
- 2-23/1: Modeling structure and behaviour (UML and UML 2.0 and metamodeling) - (establish Oblig groups)
- 3-30/1: WebRatio for Web Apps/Portals and Mobile Apps – and Entity/Class modeling – (Getting started with WebRatio)
  
- February (4-7) (Modeling of User Interfaces, Flows and Data model diagrams, Apps/Web Portals - IFML/Client-Side):
- 4-6/2: Business Model Canvas, Value Proposition, Lean Canvas and Essence
- 5-13/2: IFML – Interaction Flow Modeling Language, WebRatio advanced – for Web and Apps
- 6-20/2: BPMN process, UML Activ.Diagrams, Workflow and Orchestration modelling value networks
- 7-27/2: Modeling principles – Quality in Models
  
- March (8-11) (Modeling of IoT/CPS/Cloud, Services and Big Data – UML SM/SD/Collab, ThingML Server-Side):
- 8-6/3: DSL and ThingML, UML State Machines and Sequence Diagrams
- 6/3: Oblig 1: Smart Building – Business Architecture and App/Portal with IFML WebRatio UI for Smart Building
- 9-13/3: UML Composite structures, State Machines and Sequence Diagrams II
- 10-20/3: Architectural models, Role modeling and UML Collaboration diagrams
- 11-27/3: UML Service Modeling, ServiceML, SoaML, REST, UML 2.0 Composition, MagicDraw
- 27/3: Oblig 2: Smart Building – Internet of Things control with ThingML – Raspberry Pi, Wireless sensors (temperature, humidity), actuators (power control)
  
- April/May (12-14) (MDE – Creating Your own Domain Specific Language):
- 12-3/4: Model driven engineering – Metamodels, DSL, UML Profiles, EMF, Sirius Editors
- EASTER – 10/4 og 17/4
- 13-24/4: MDE transformations, Non Functional requirements
- 1. Mai – Official holiday
- 14-8/5: Enterprise Architecture, TOGAF, UPDM, SysML – DSLs etc.
- 8/5: Oblig 3 - Your own Domain Specific Language
  
- May (15-17): (Bringing it together)
- 15-15/5: Summary of the course – Final demonstrations
- 16-22/5: Previous exams – group collaborations (No lecture)
- 17-29/5: Conclusions, Preparations for the Exam by old exams
- June (Exam)
- 13/6: Exam (4 hours), (June 13<sup>th</sup>, 0900)-1300

# This lecture, February 13, 2017

## IFML and WebRatio

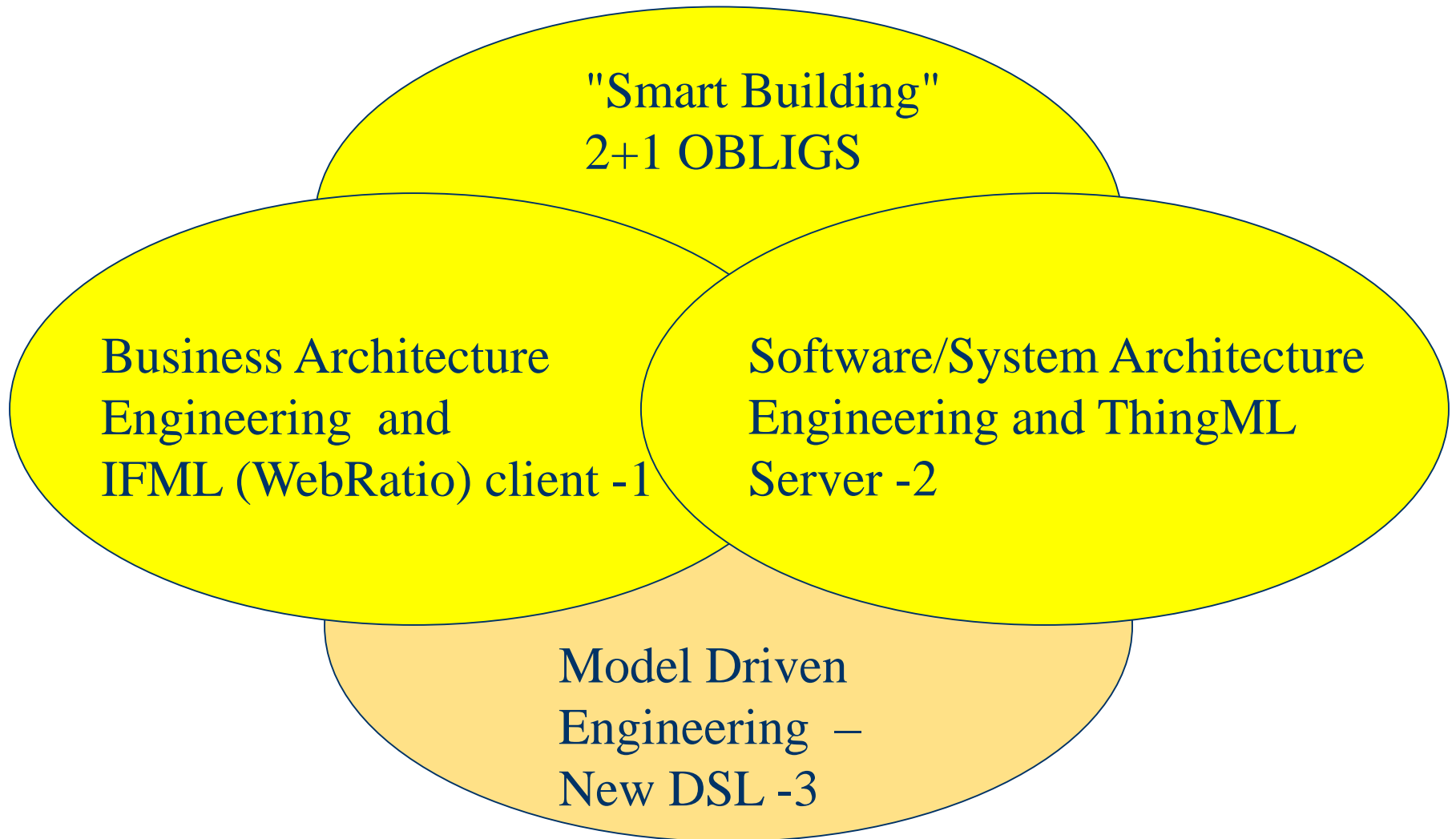
- IFML Example
- IFML Metamodel
- IFML Tooling – WebRatio
- IFML – Student guide - modules

# Next lecture, February 20, 2017

## BPMN and Process modeling

- BPMN process,
- UML Activ.Diagrams
- Workflow and Orchestration modelling
- Value networks
  
- More on IFML ...

# Course components



# IFML: The Interaction Flow Modeling Language

*The OMG standard for front-end design*



## The Interaction Flow Modeling Language

*The new OMG Standard for integrating the front-end design in your system and enterprise models*



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### IFML

The standard Interaction Flow Modeling Language (IFML) is designed for expressing the content, user interaction and control behaviour of the front-end of software applications.



<http://www.ifml.org/>





# IFML Objectives



Content

Navigation Path

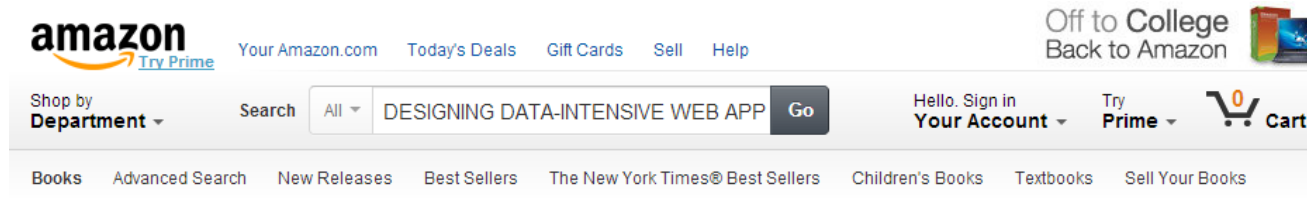
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Business Logic

Binding to  
Persistence Layer



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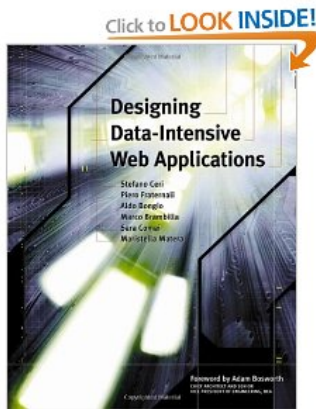
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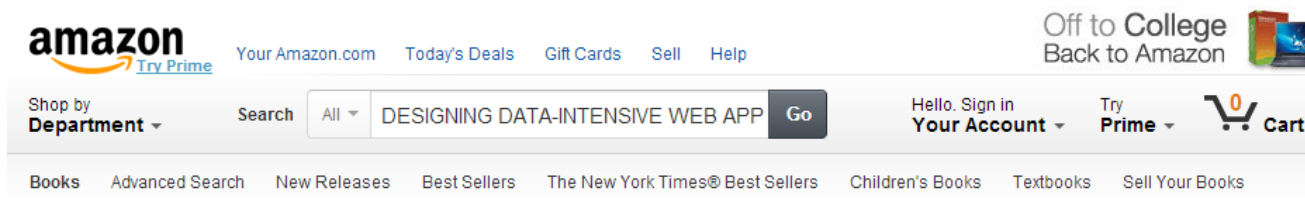
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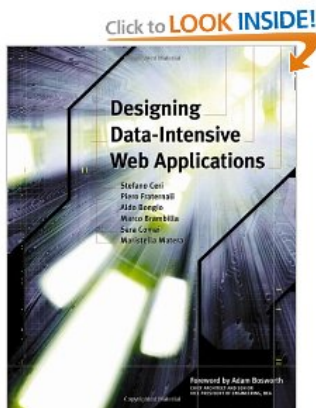




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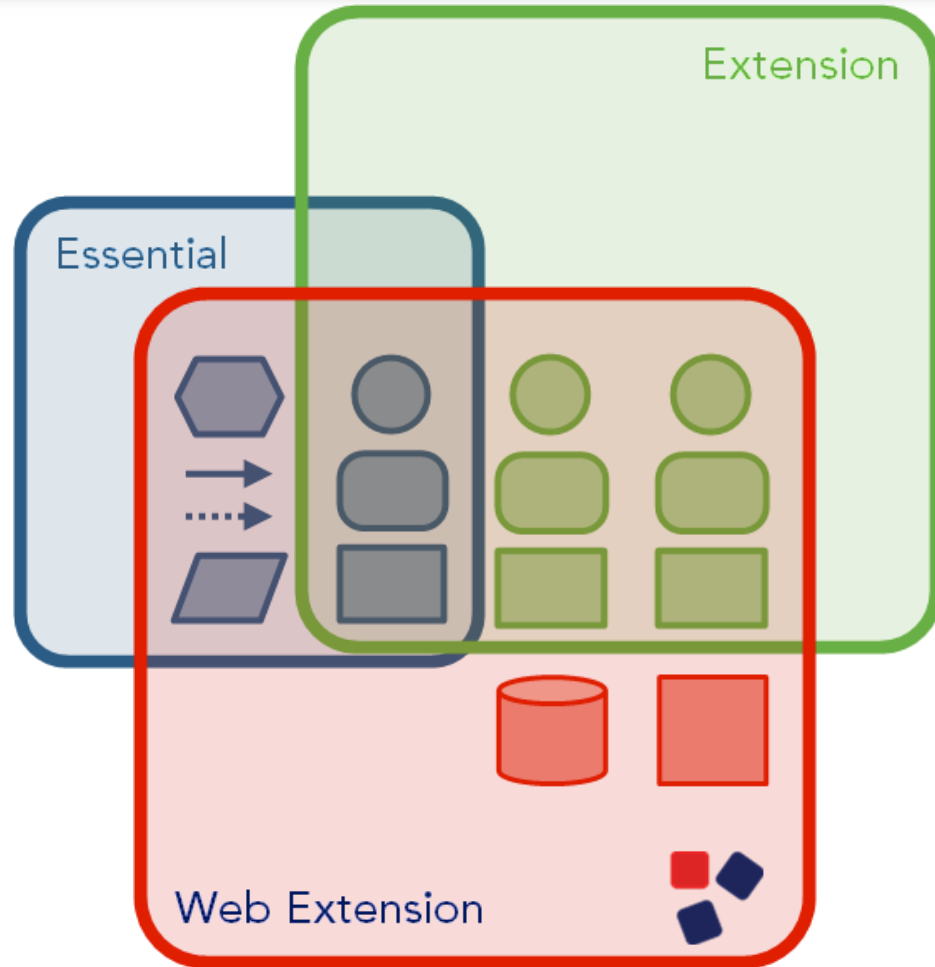
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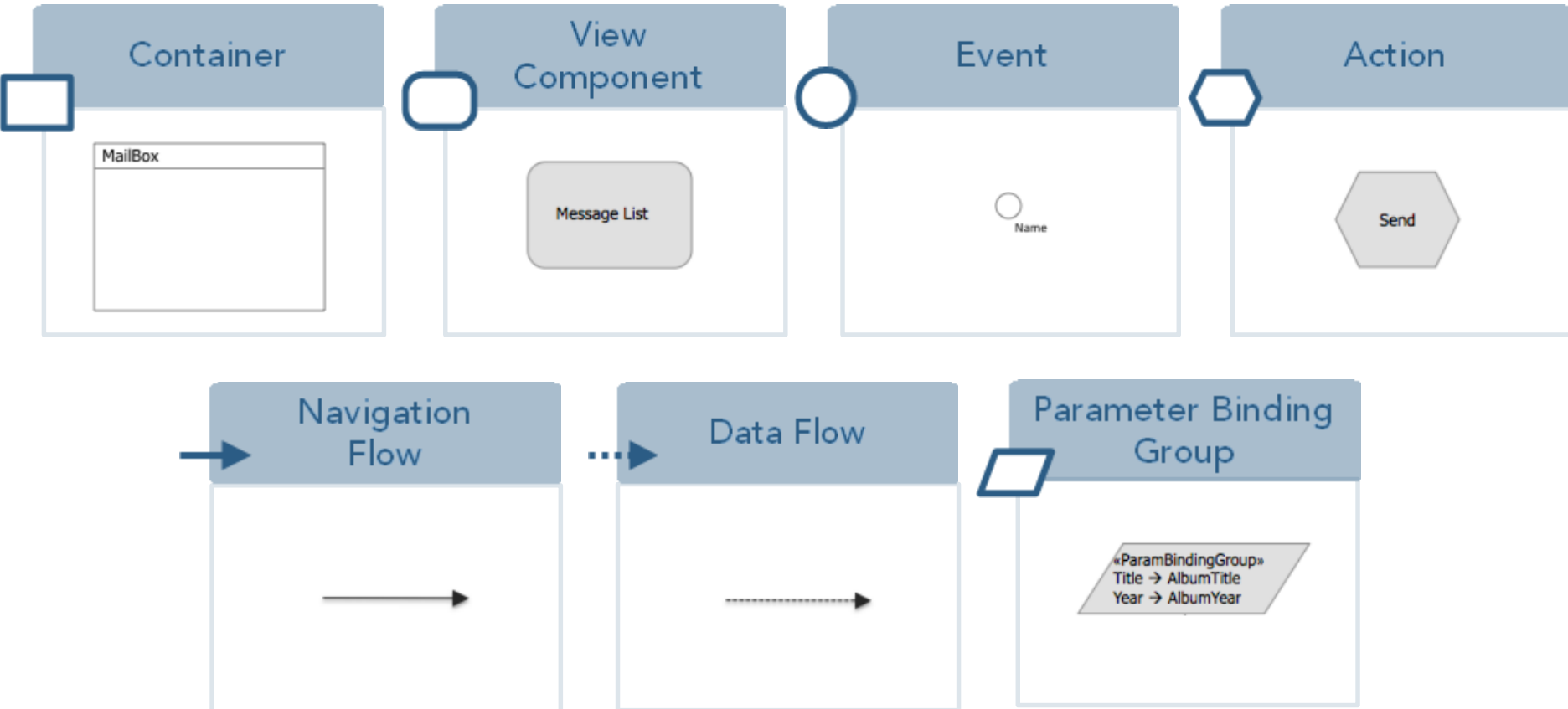
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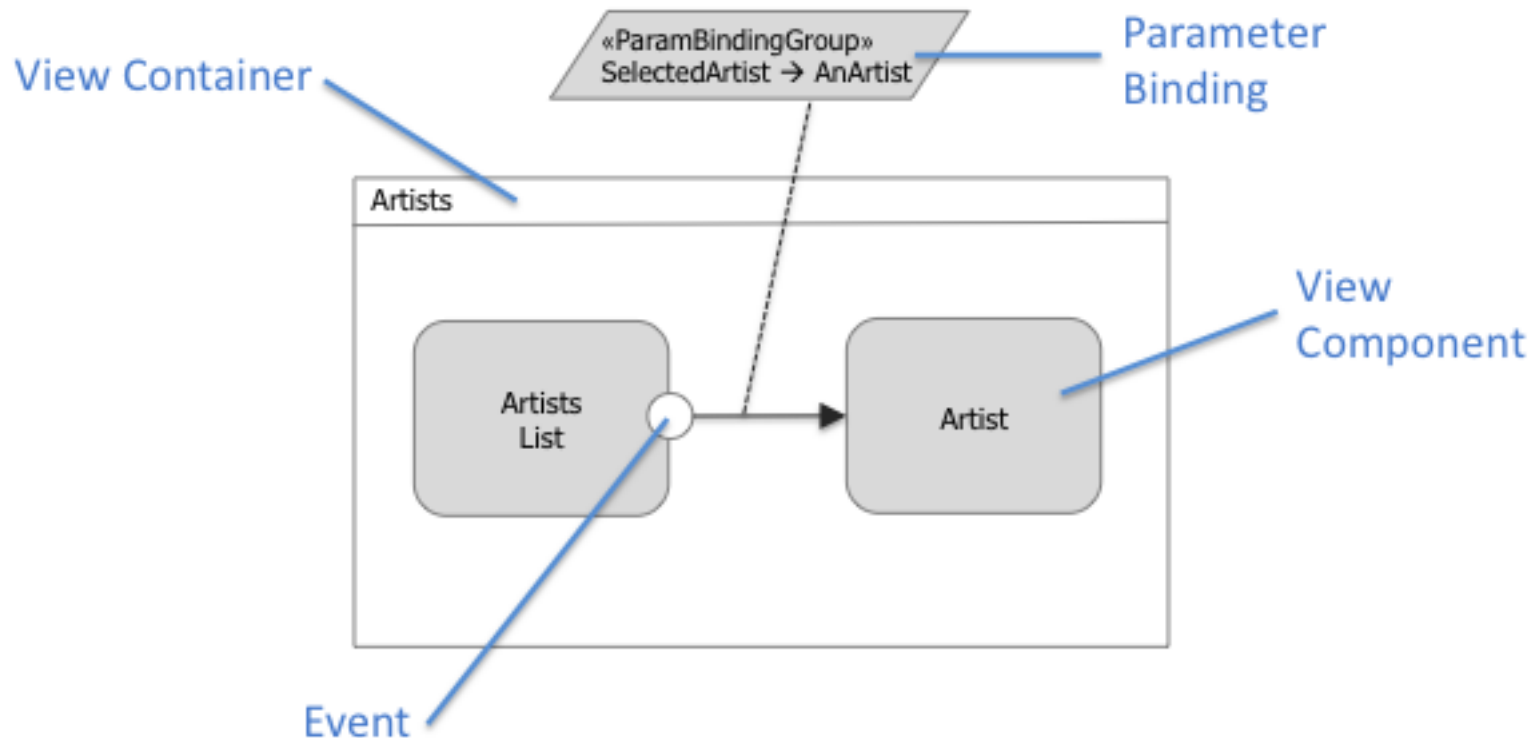


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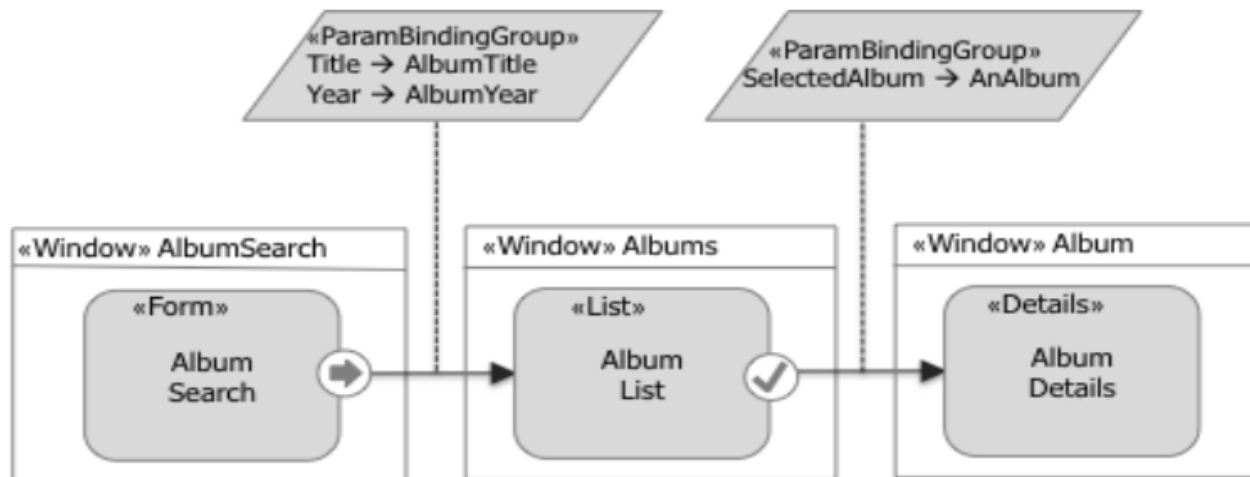
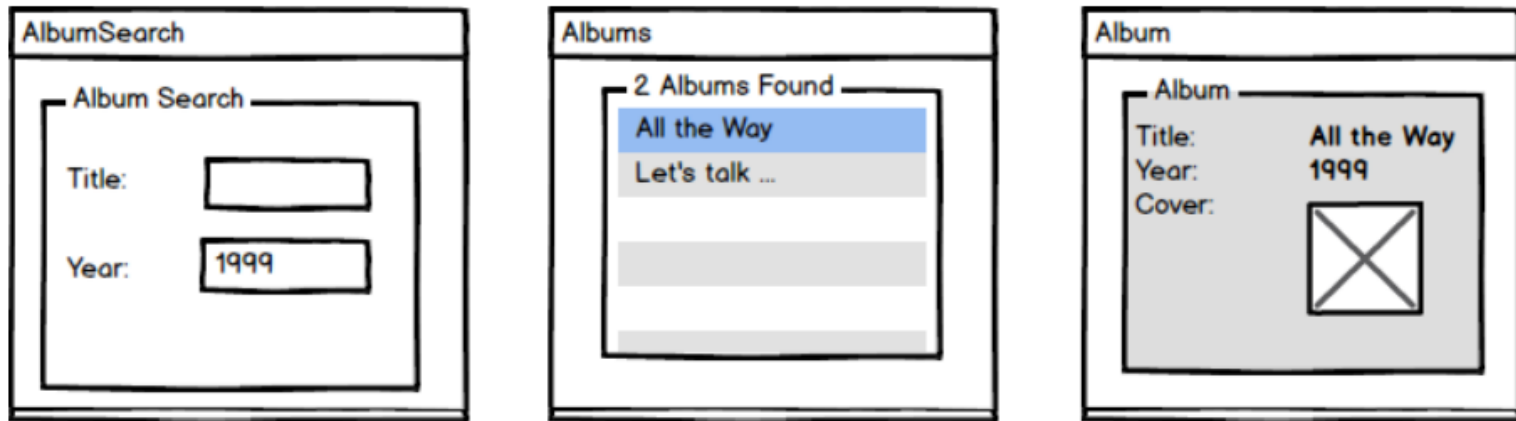
# IFML by example



Basic navigation flow between ViewComponents

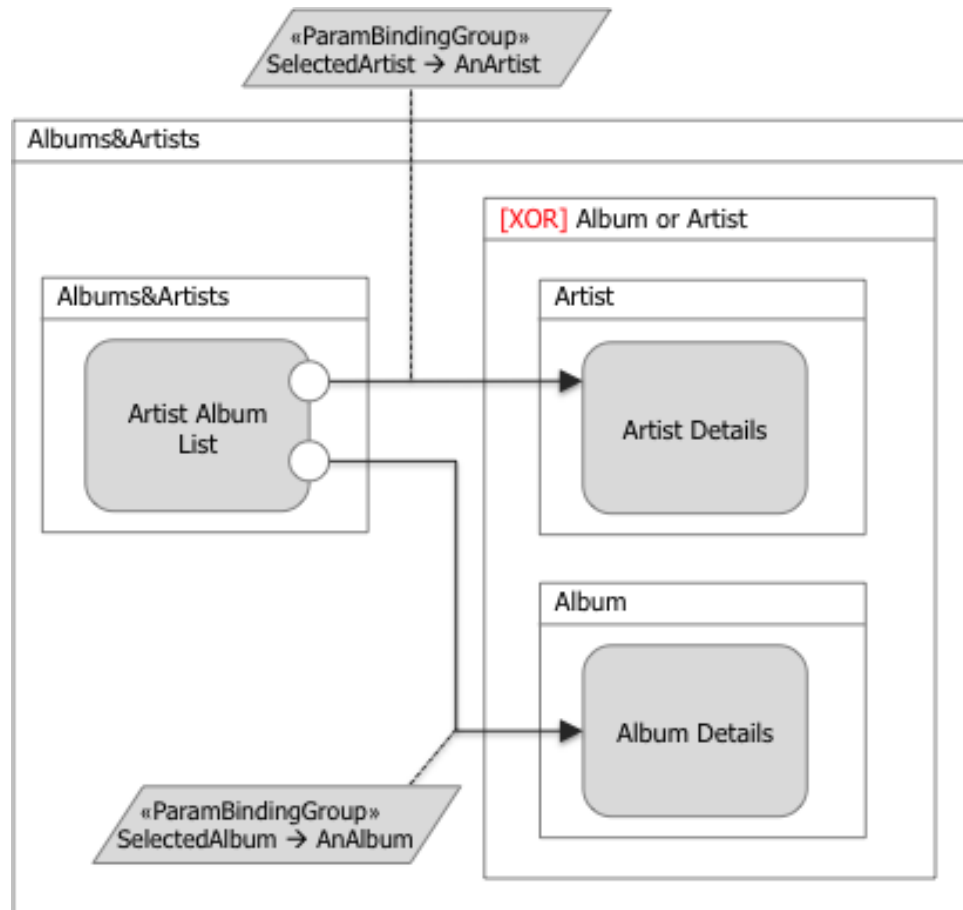


# IFML by example





# IFML by example

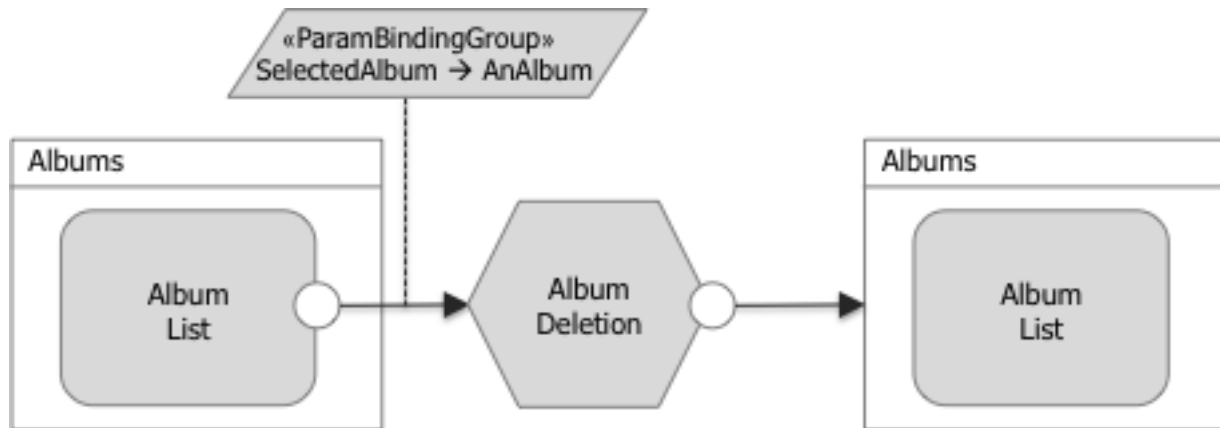


Nesting of ViewContainers

Tagged ViewContainers (XOR, L, D, Modal, Modeless)



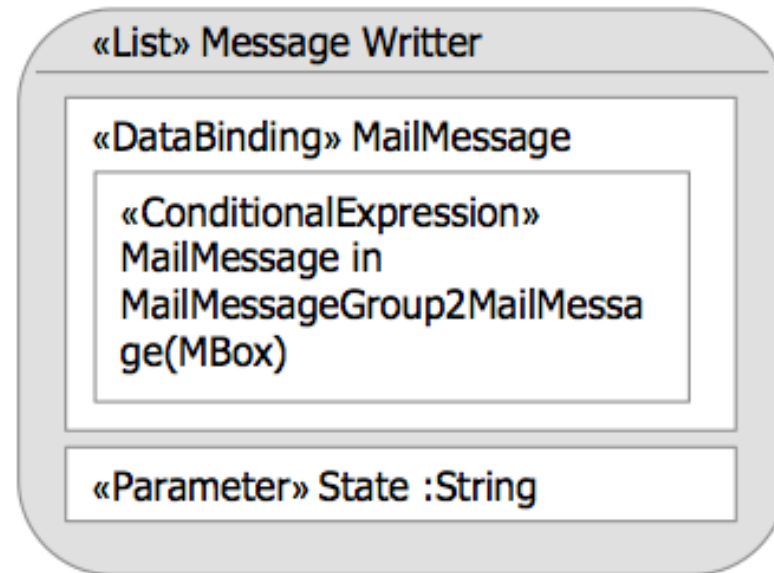
# IFML by example



Actions



# IFML – adding details to ViewComponents



ViewComponentParts:

- Data binding
- Parameters

Types of ViewComponents (<<List>>)



# Data binding

- Joint use of IFML and other modeling languages:
  - DataBinding to classes and attributes of UML Class Diagrams
  - Upcoming: also with other content models, such as: Entity-Relationship, Ontologies, ...



# Dynamic Behaviour

- Joint use of IFML and other modeling languages
- Connection of Actions to back-end business logic as
  - UML methods of classes
  - whole UML dynamic diagrams
    - activity diagram, sequence diagram, state chart diagram, ...



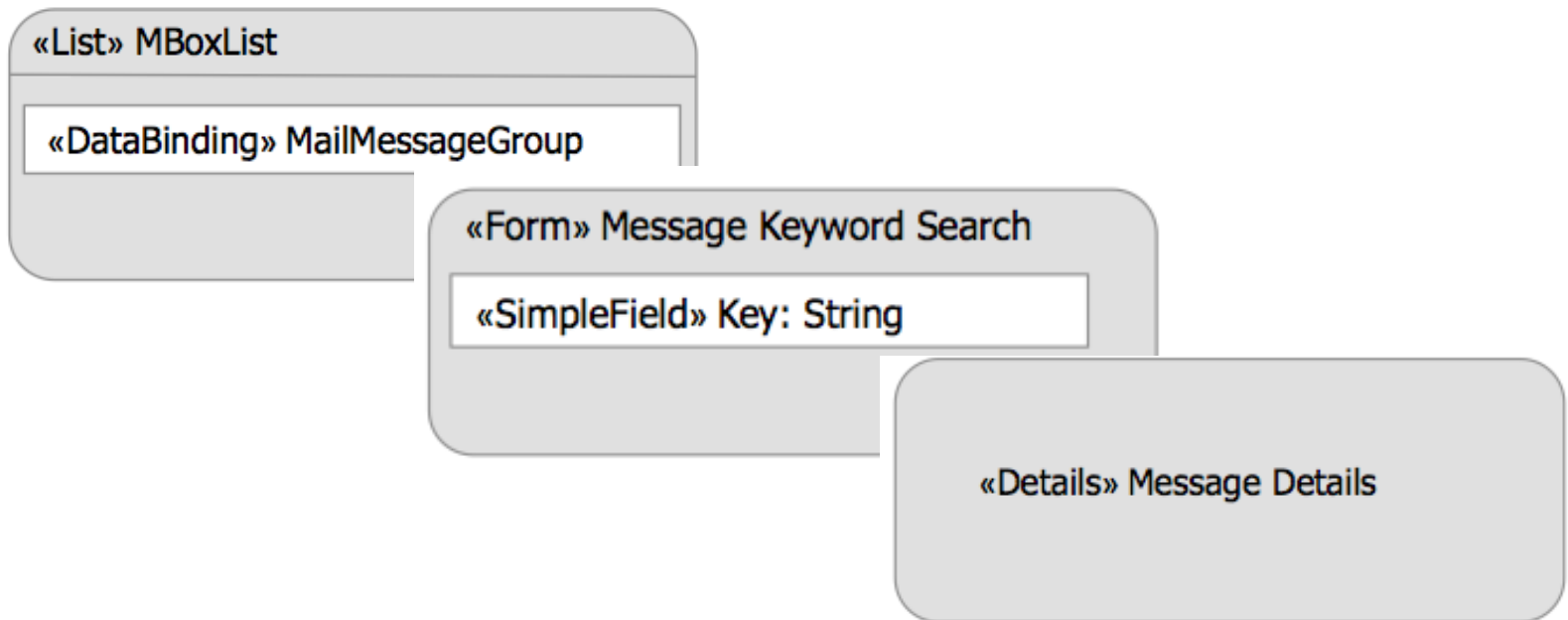


# IFML – subtyping components and events

Selection event



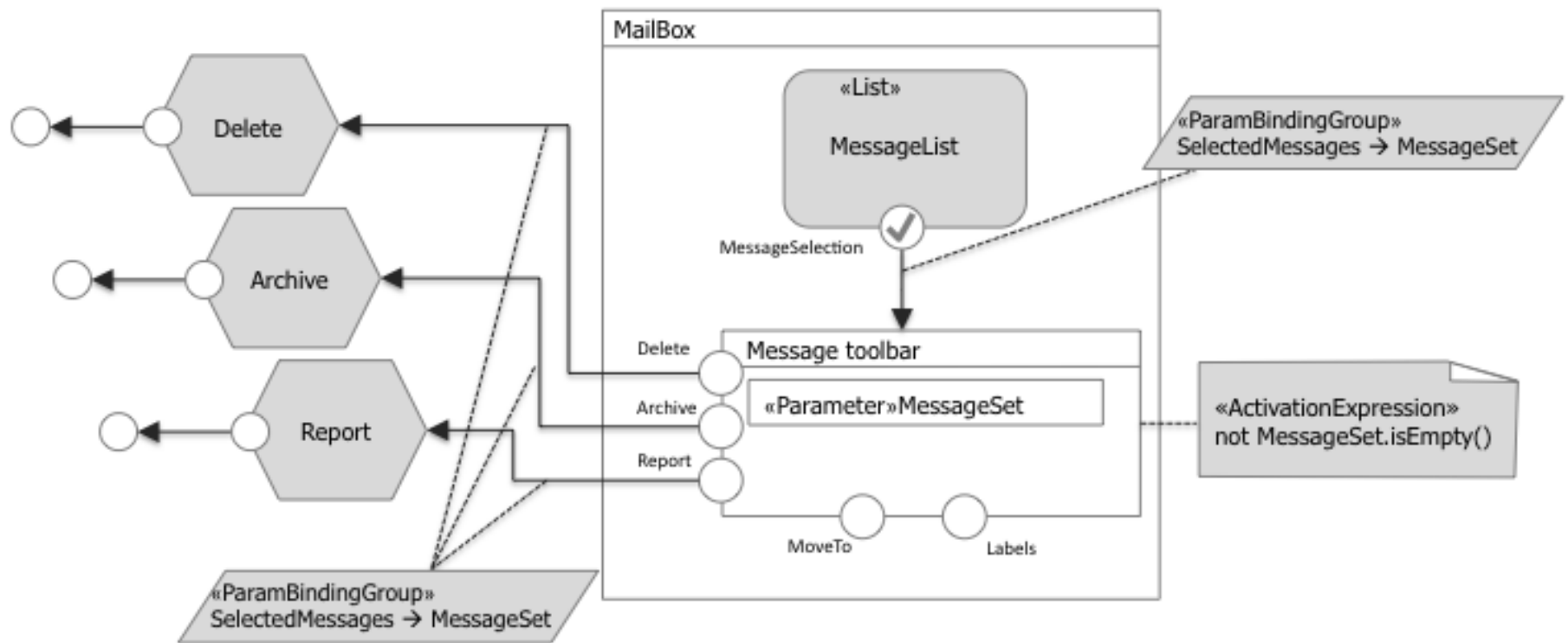
Submit event



.. And as many others as you want!



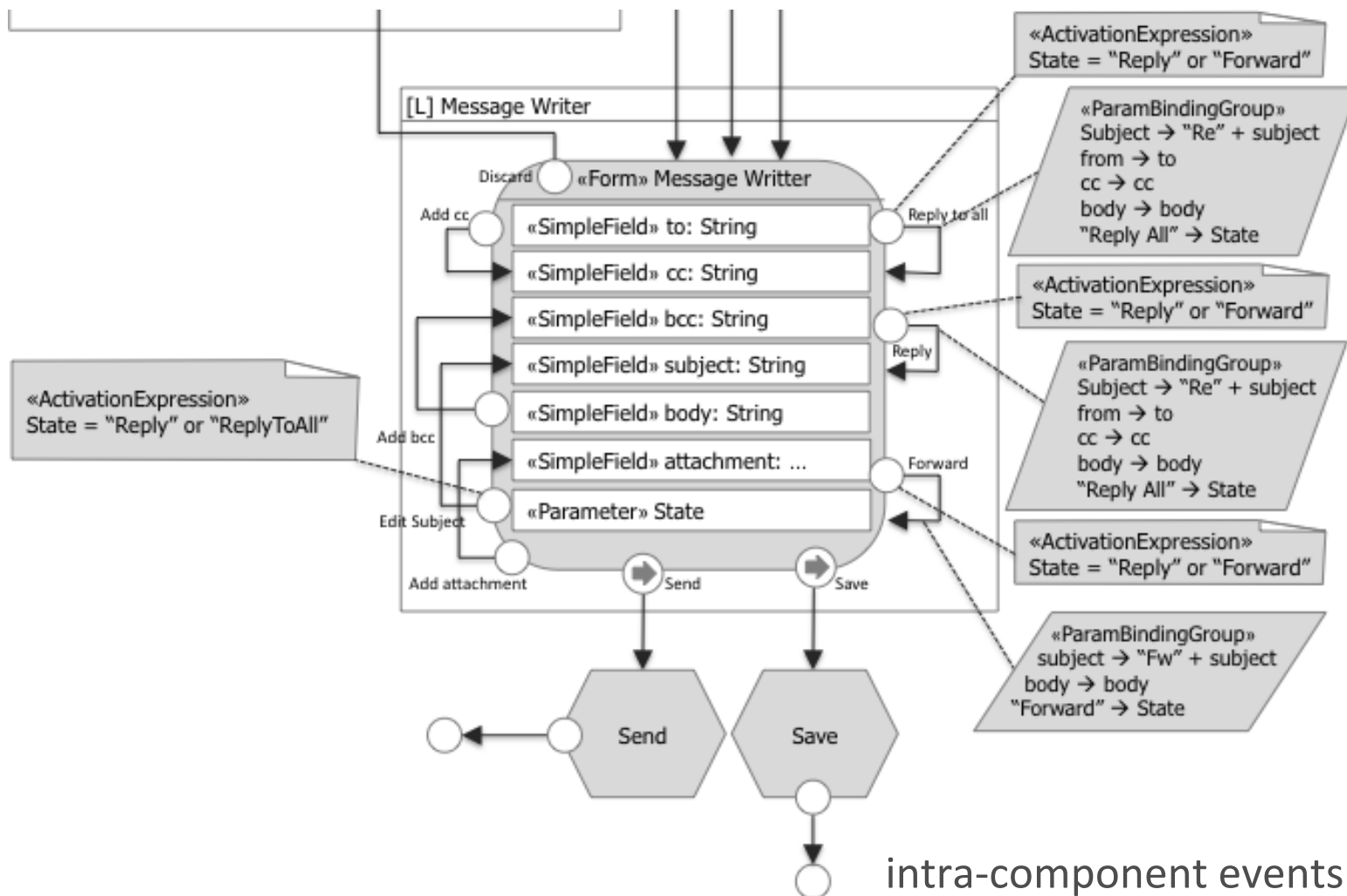
# IFML by example



ActivationExpression, SubmitEvent, Event generation



# IFML concrete syntax by example



intra-component events and flows

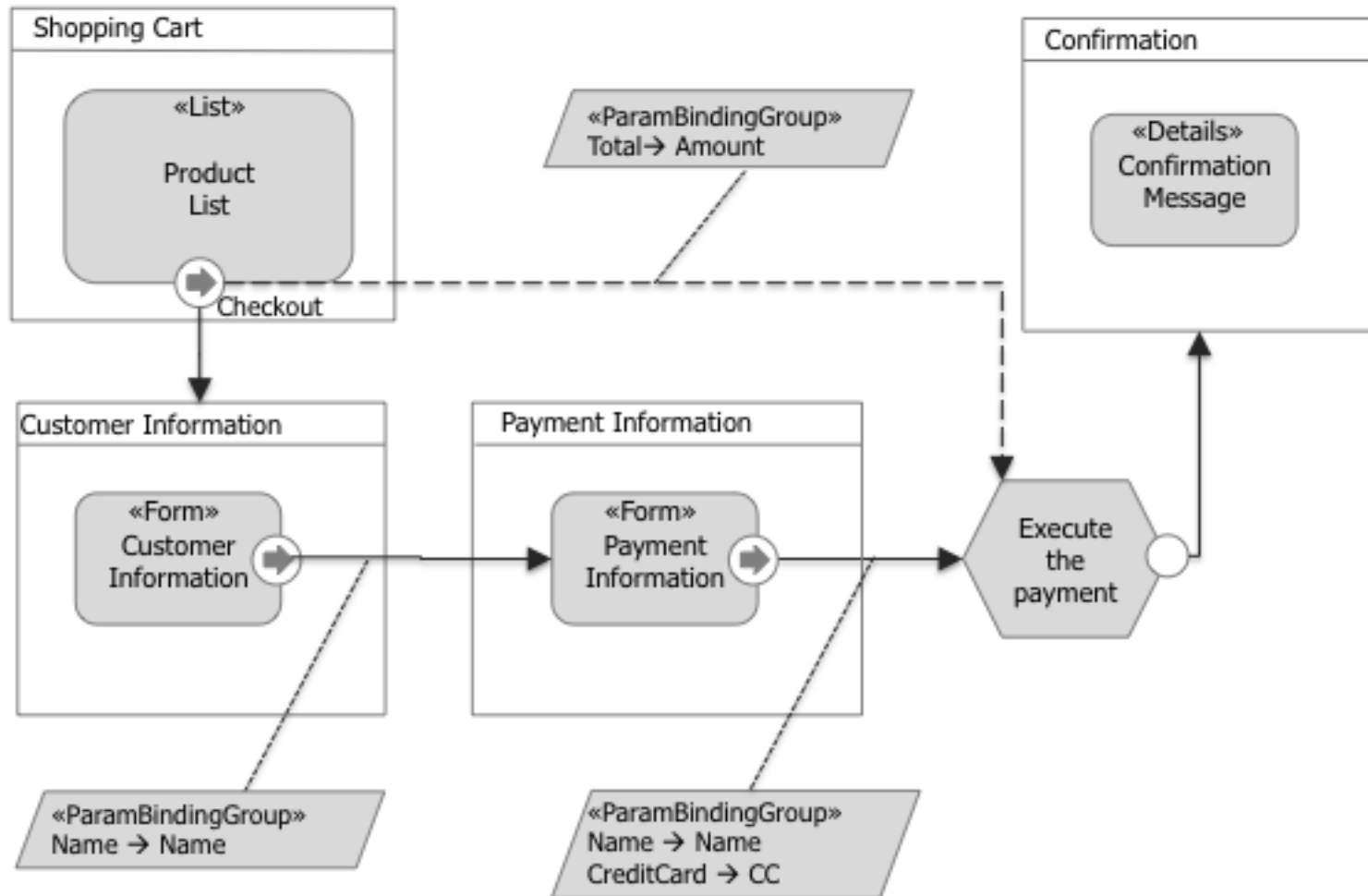


# Covered aspects

- **Multiple views** for the same application
- **Mobile and multi-device** applications
- Visualization and input of data, and production of **events**
- **Components** independent of concrete widgets and presentation
- **Interaction flow**, initiated by the user or by external events
- **User context**: the user status in the current instant of the interaction (position, history, machine, platform,...)
- **Modularization** of the model (design-time containers for reuse purpose)
- User input **validation**, according to OCL or other existing constraint languages



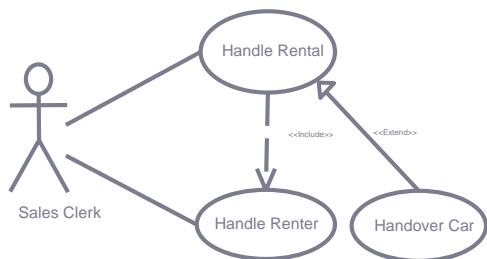
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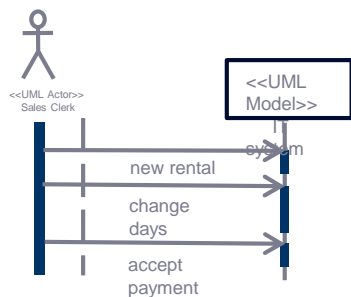


# Multiple aspects modeling – 1 (business and requirements)

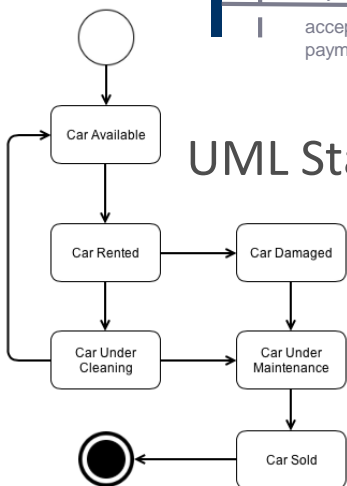
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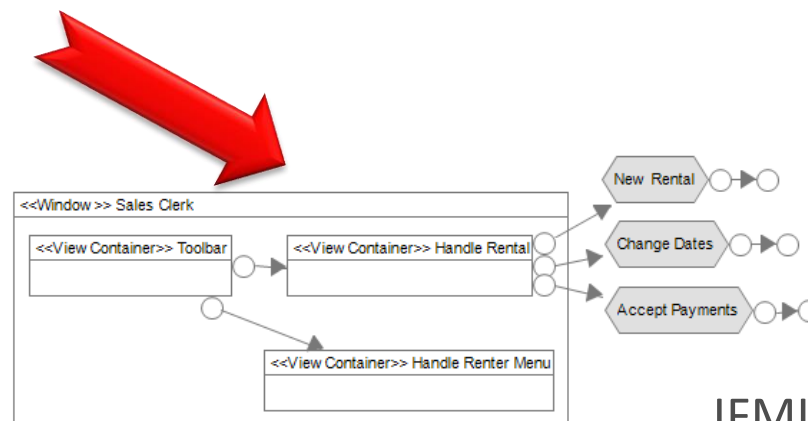
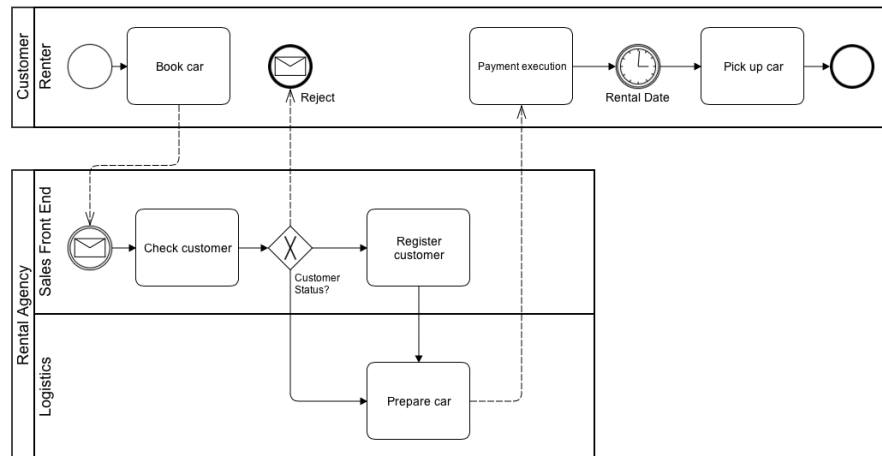
### UML Sequence



### UML Statechart



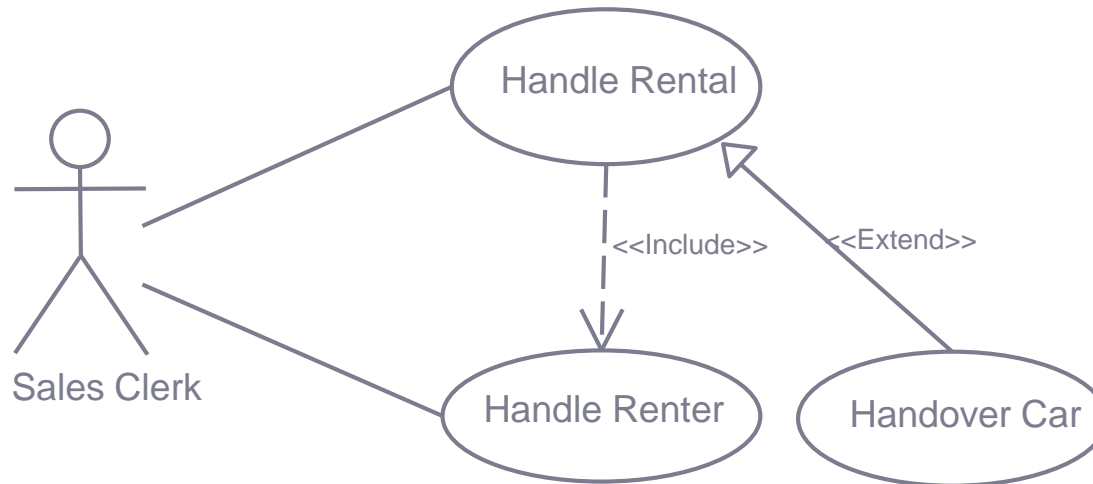
### BPMN process



IFML



# Integration with UML Use Cases

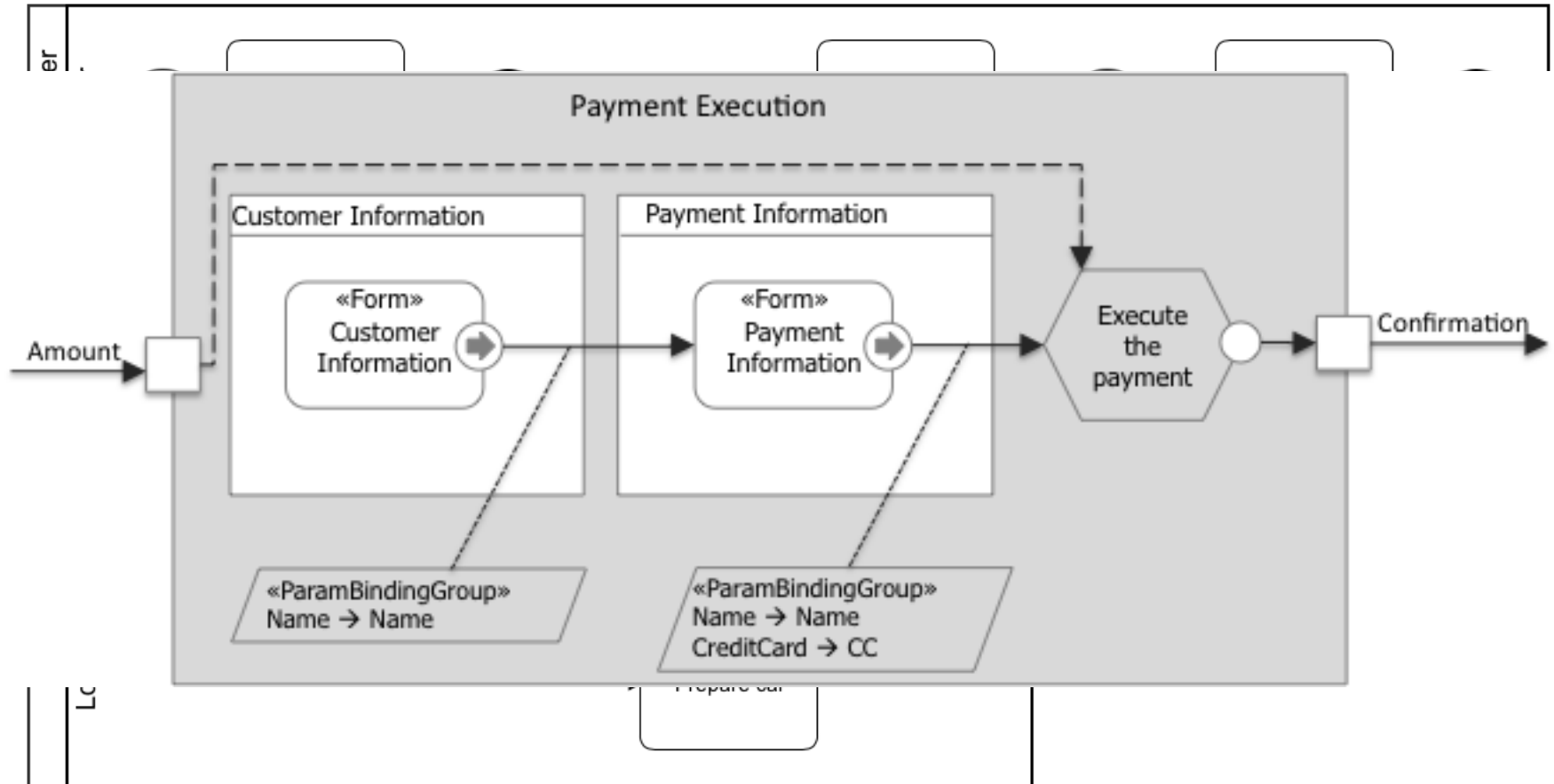


Each use case can be described by

- A business process
- A plain UI description in IFML
- Some UML dynamic diagrams (e.g., activity, sequence, ...)



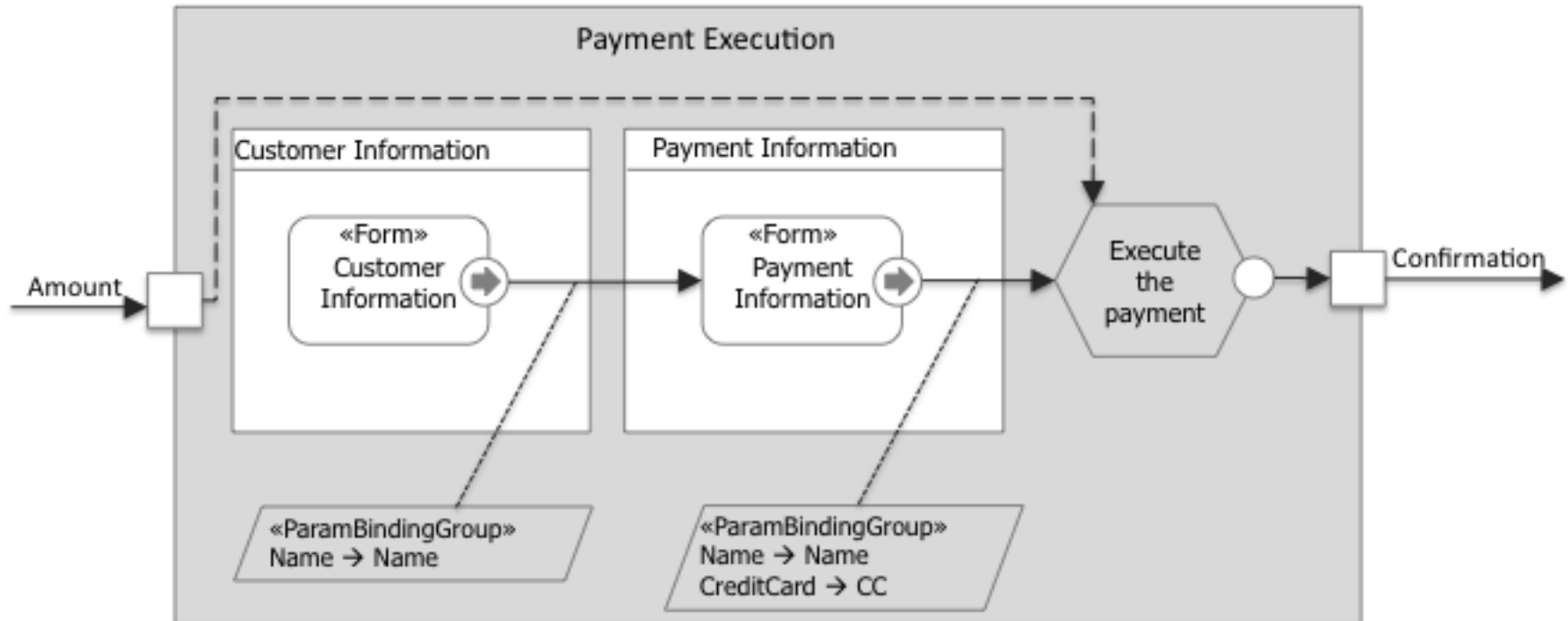
# Integration with BPMN







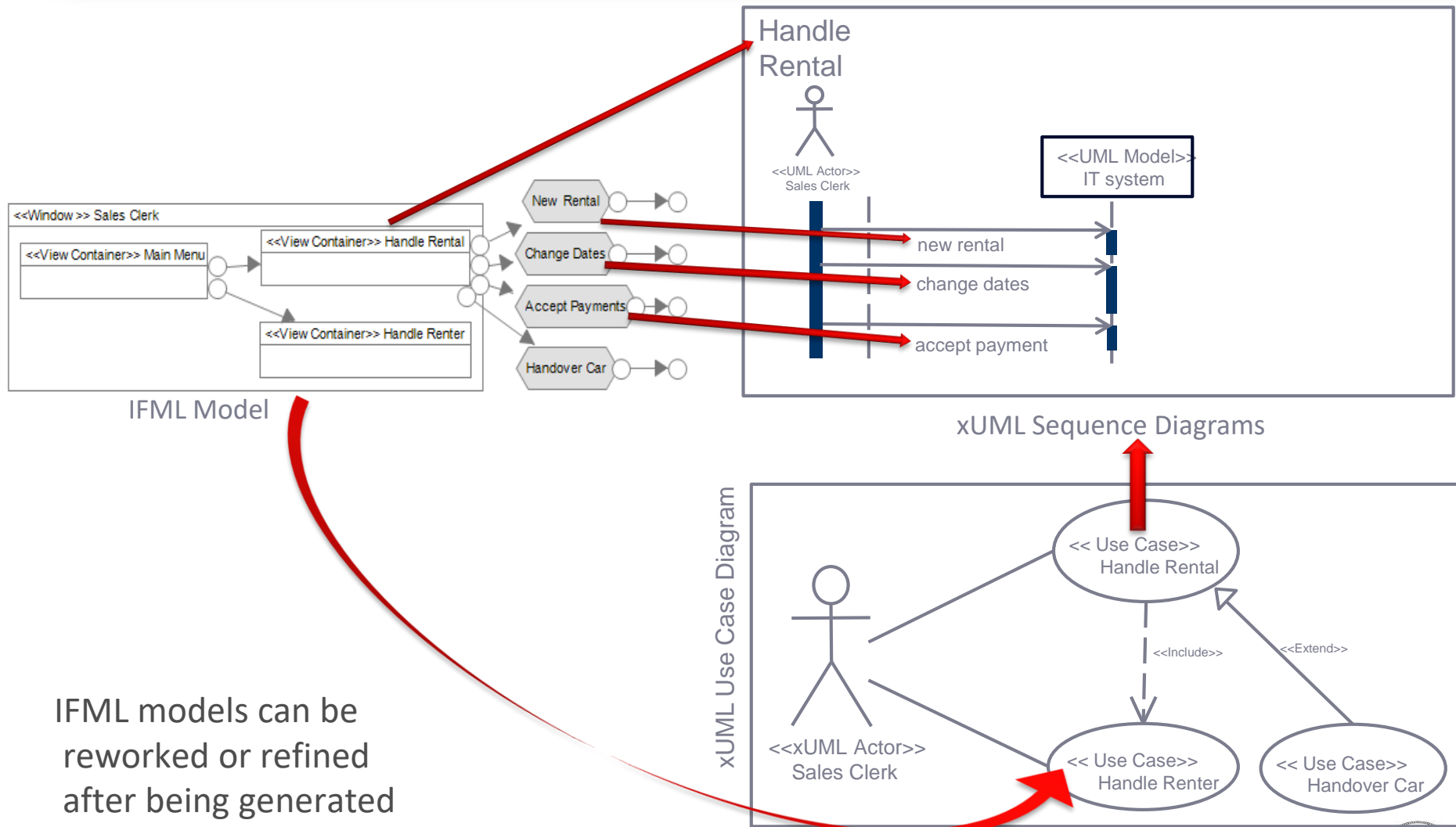
# IFML concrete syntax by example



IFML Modules - definition



# Example of UML - IFML mapping



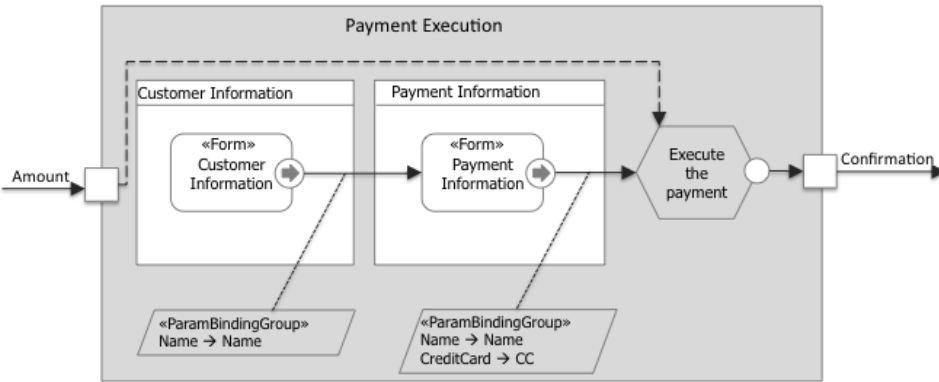
IFML models can be reworked or refined after being generated



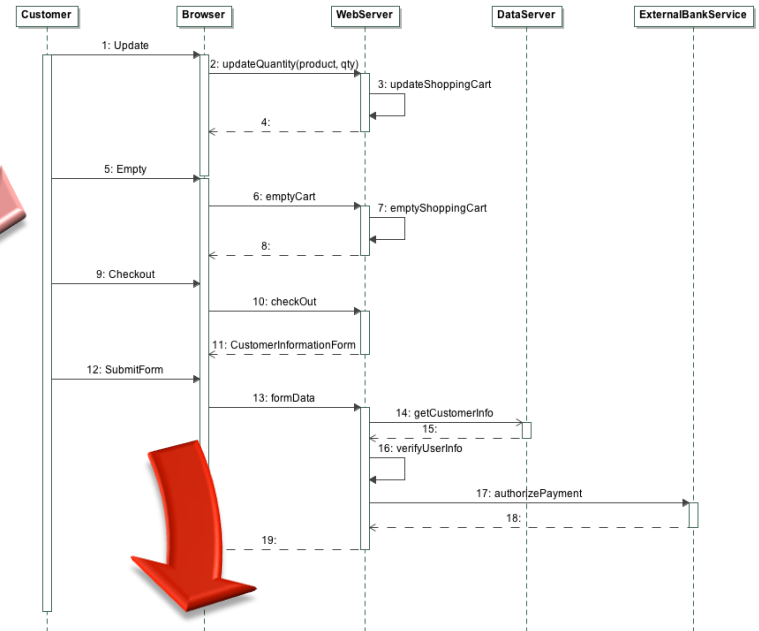
# Multiple aspects modeling – 2

## (implementation and architecture)

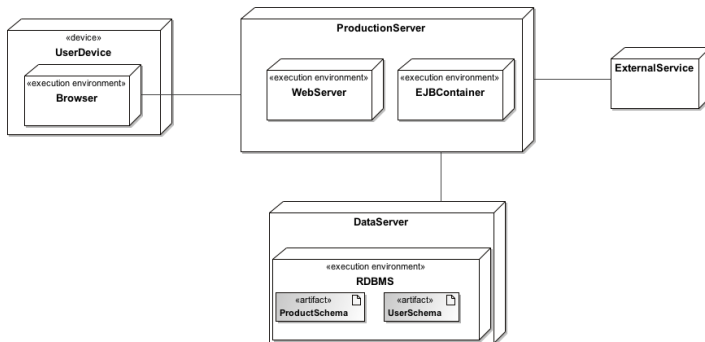
### IFML



### UML Sequence



### UML Deployment



### UI Mockup models

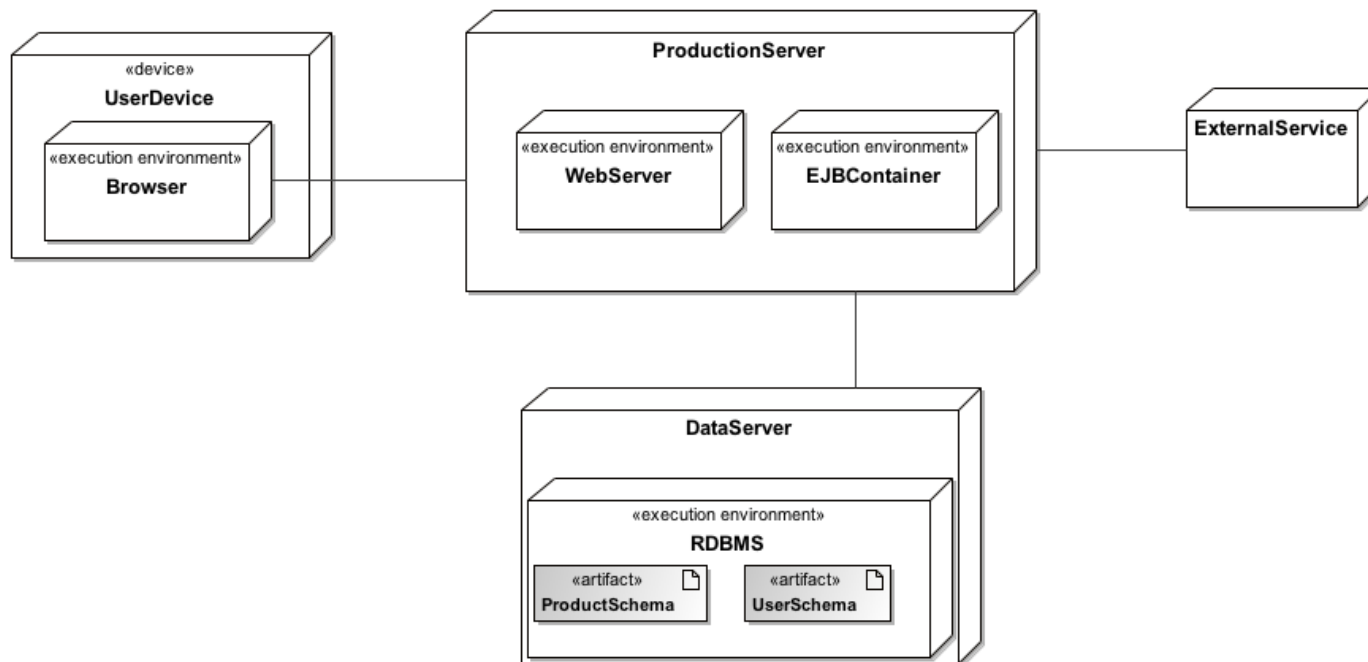




# Integration with UML

## Description of deployment architecture

- UI is just one facet of system design
- Often need to position it in a broader architectural vision

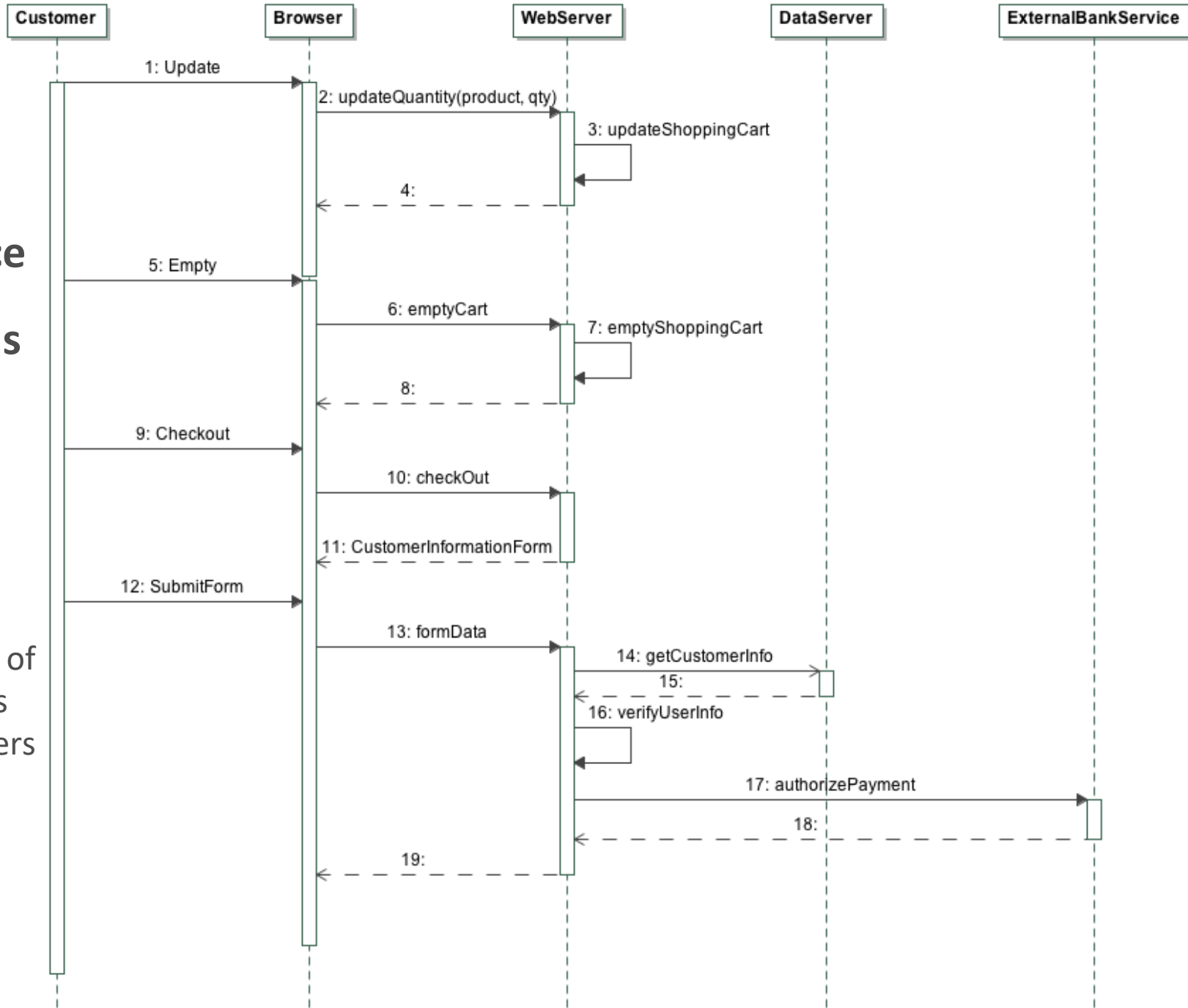


- UML deployment diagram

# UML Sequence Diagrams

## Tiers and calls

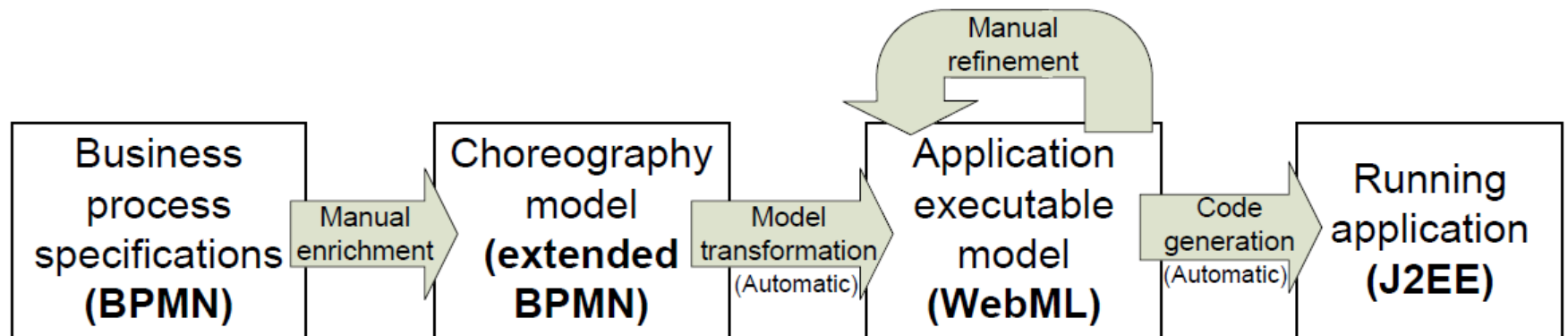
Explicit  
description of  
interactions  
between tiers





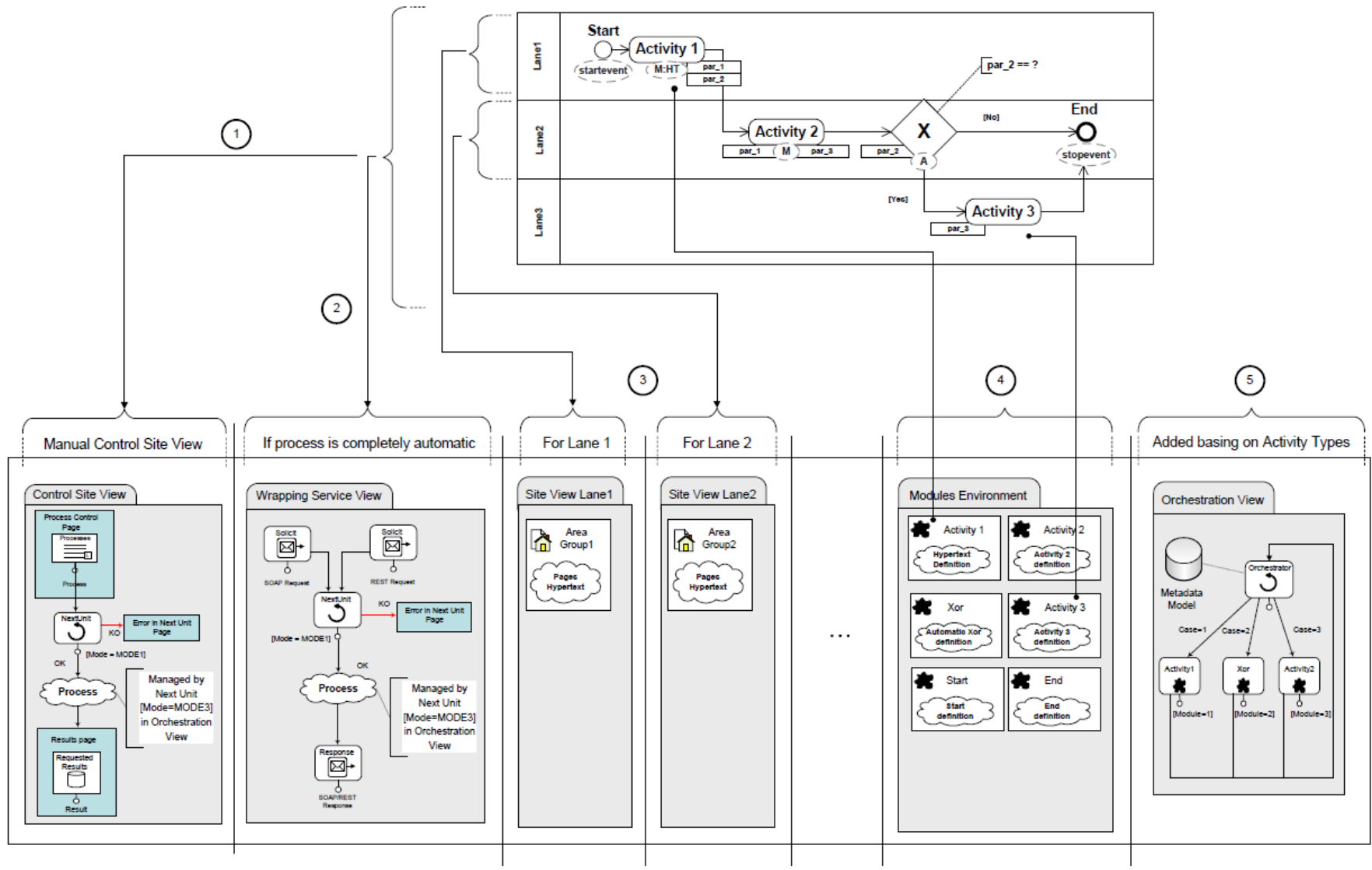
# Model-driven Development Process

- Manual specification of BPMN process model
- Automatic transformation of BPMN to WebML
- Possible manual refinement of WebML models
- Automatic running code generation on J2EE platform
- Virtuous development cycle





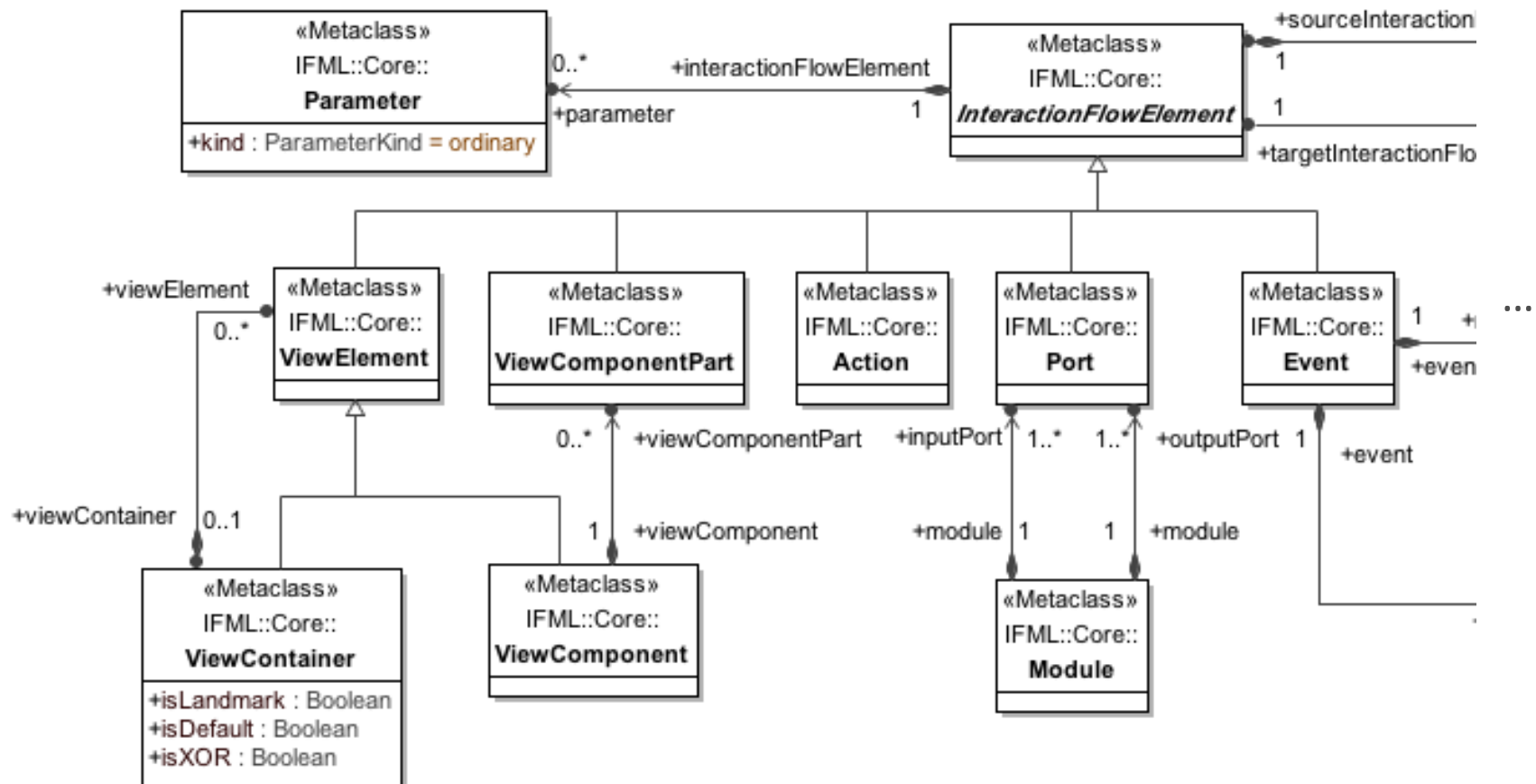
# The generated model artifacts





# How does it work? IFML metamodel (1)

IFML is defined through a metamodel

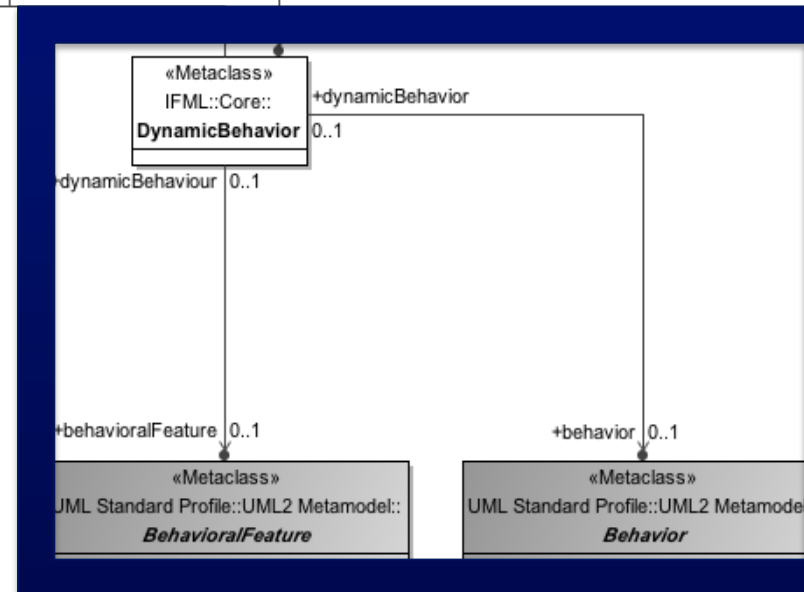
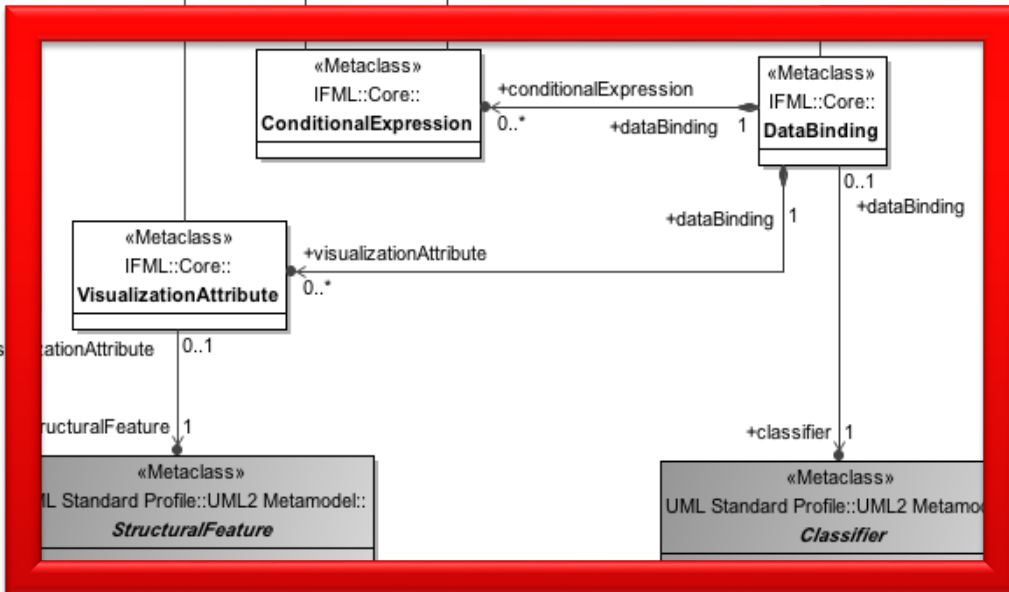
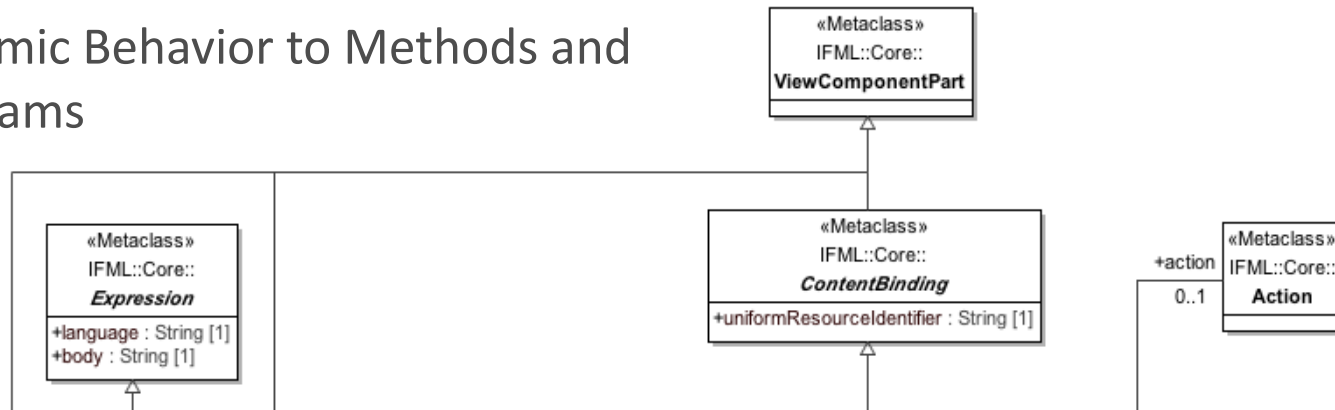






# IFML metamodel (2): Content Binding

- Data binding to Classes and Attributes
- Dynamic Behavior to Methods and Diagrams





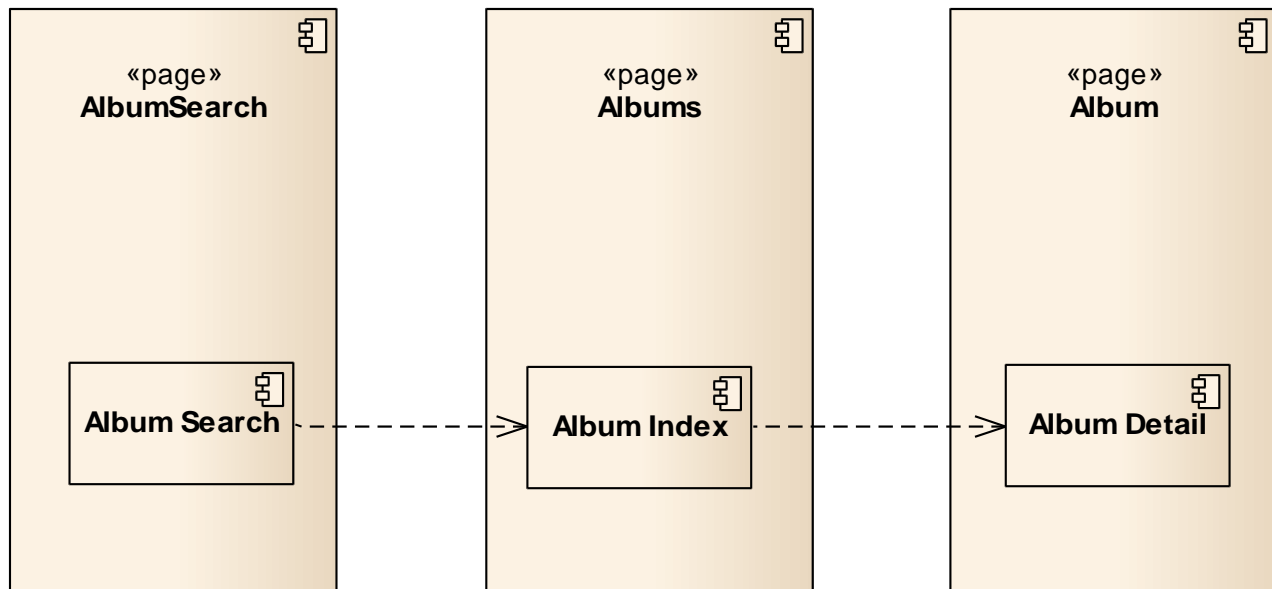
# Practical results of having a standard

- An official **metamodel of the language** which describes the semantics of and relations between the modeling constructs
- A **graphical concrete syntax for the interaction flow notation** which provides an intuitive representation of the user interface composition, interaction and control logic for the front-end designer
- A **UML Profile** consistent to the metamodel
- An **interchange format** between tools using XMI
- All this, specified through standard notations themselves

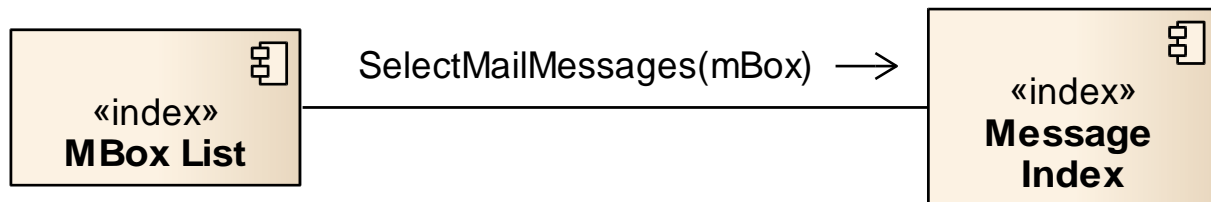


# Also: interchange with profile-based diagrams. The UML Profile for IFML

## Static aspects



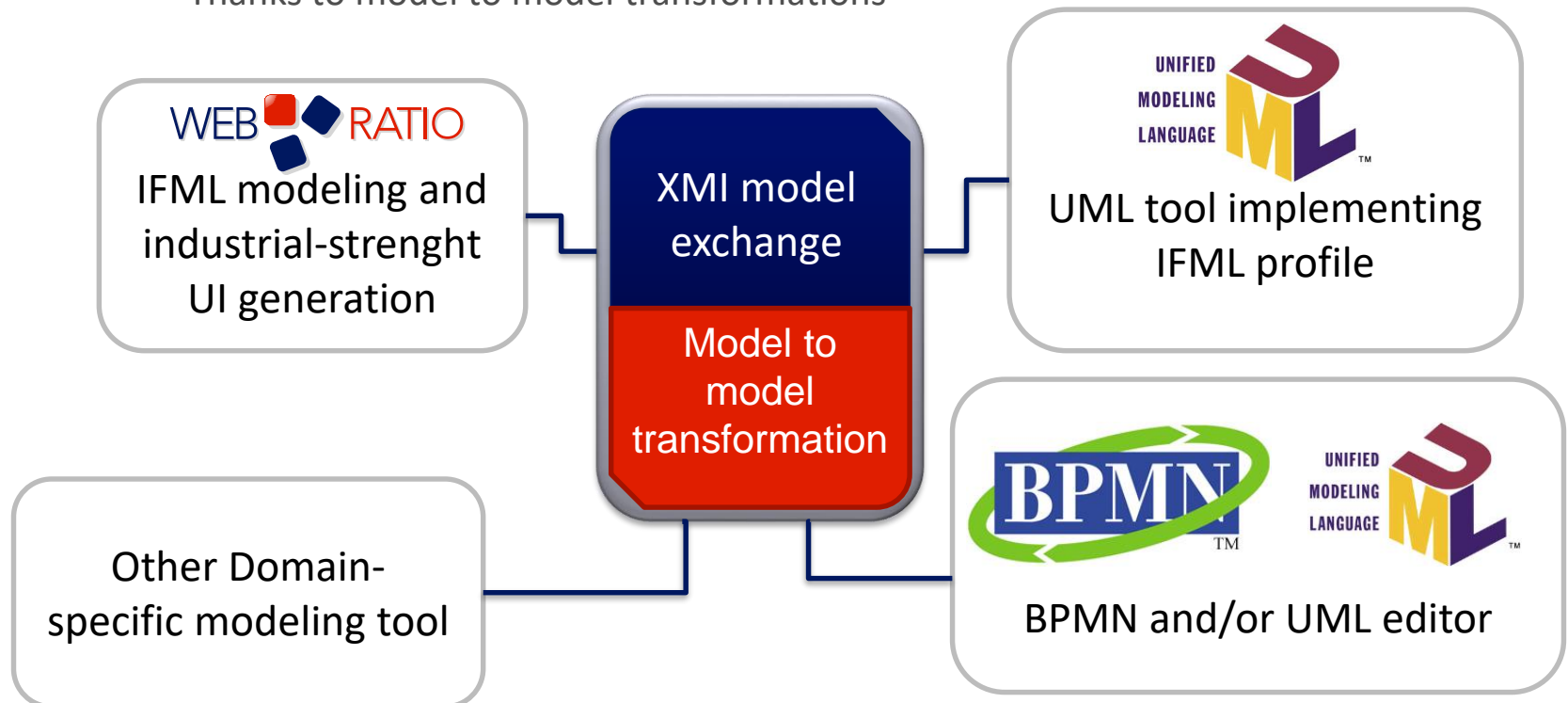
## Dynamic aspects





# Model integration and interchange

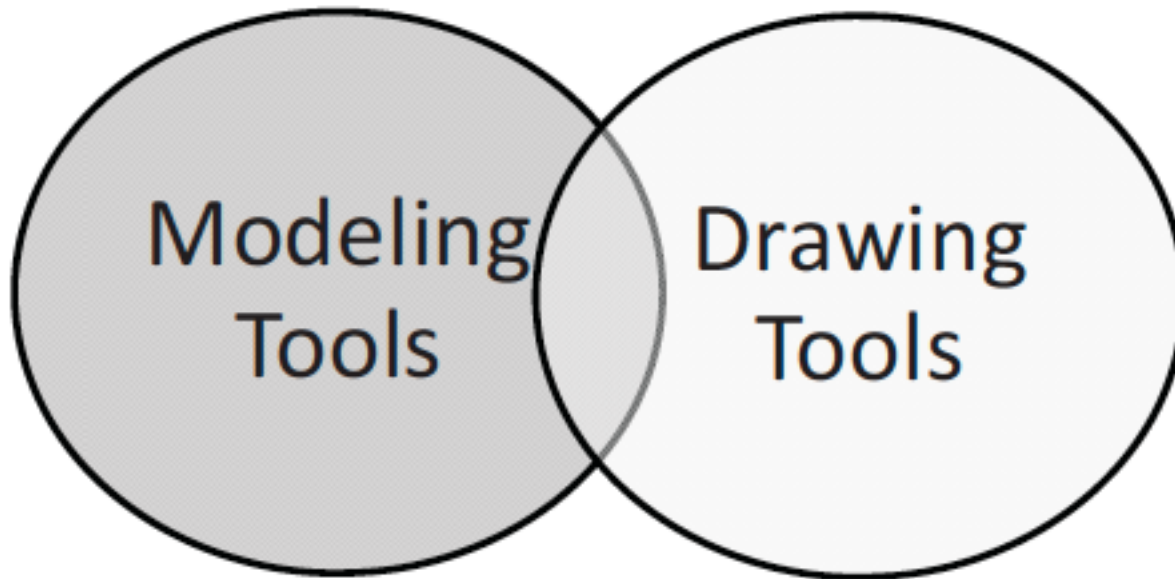
- Tight and seamless integration between different modeling tools
  - Thanks to XMI interchange format, UML profiles, vendor-specific notation implementations
  - Thanks to model to model transformations





# Tool support for MDE/MDD

## Drawing vs. modeling

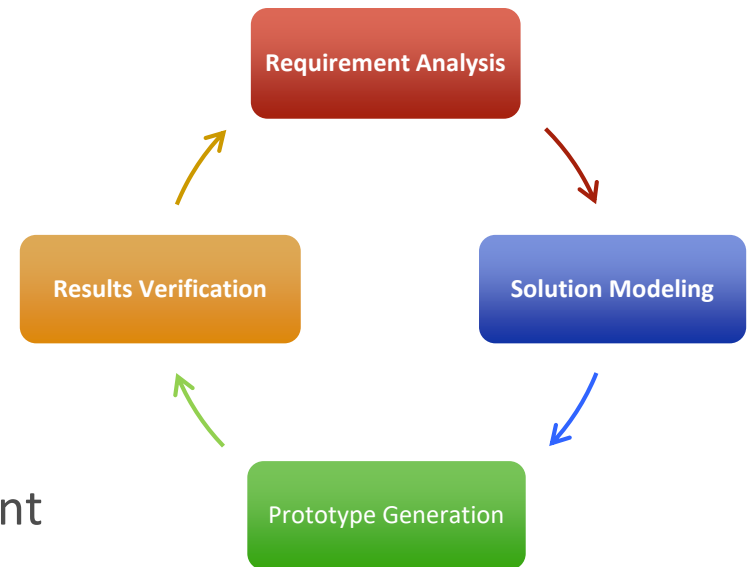




# What is WebRatio

## An Eclipse-based development environment allowing:

- Modeling: ER + IFML + BPMN
- **100% code generation** of standard JEE applications
  - Clear separation between design time and run time
  - No proprietary runtime
- Quick and agile development cycles
- Extending the generation rules
  - Defining new presentation styles
  - Defining new components
- Versioning, teamwork, full lifecycle mgt
- Truly multi-role model-driven development





# Some numbers

## WebRatio is

- now at 7<sup>th</sup> release
- on the market since 2001

## WebRatio customers

- 130+ companies and 500+ commercial users
- mainly Italy, USA, Europe and Latin America

## WebRatio adoption

- 15,000+ users of the free edition
- Used in hundreds of universities all over the world

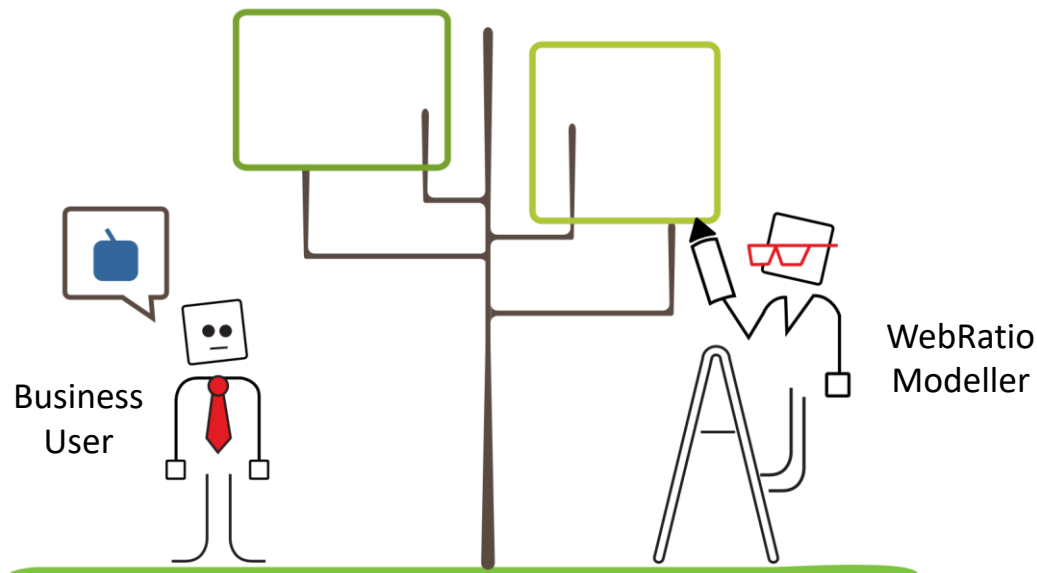
## WebRatio partners

- 40+ software houses and system integrators
- 300+ universities worldwide, 13.000+ students



# WebRatio – Step 1

You capture business requirements in abstract, technology independent models



**BPMN + IFML**





# WebRatio – Step 3

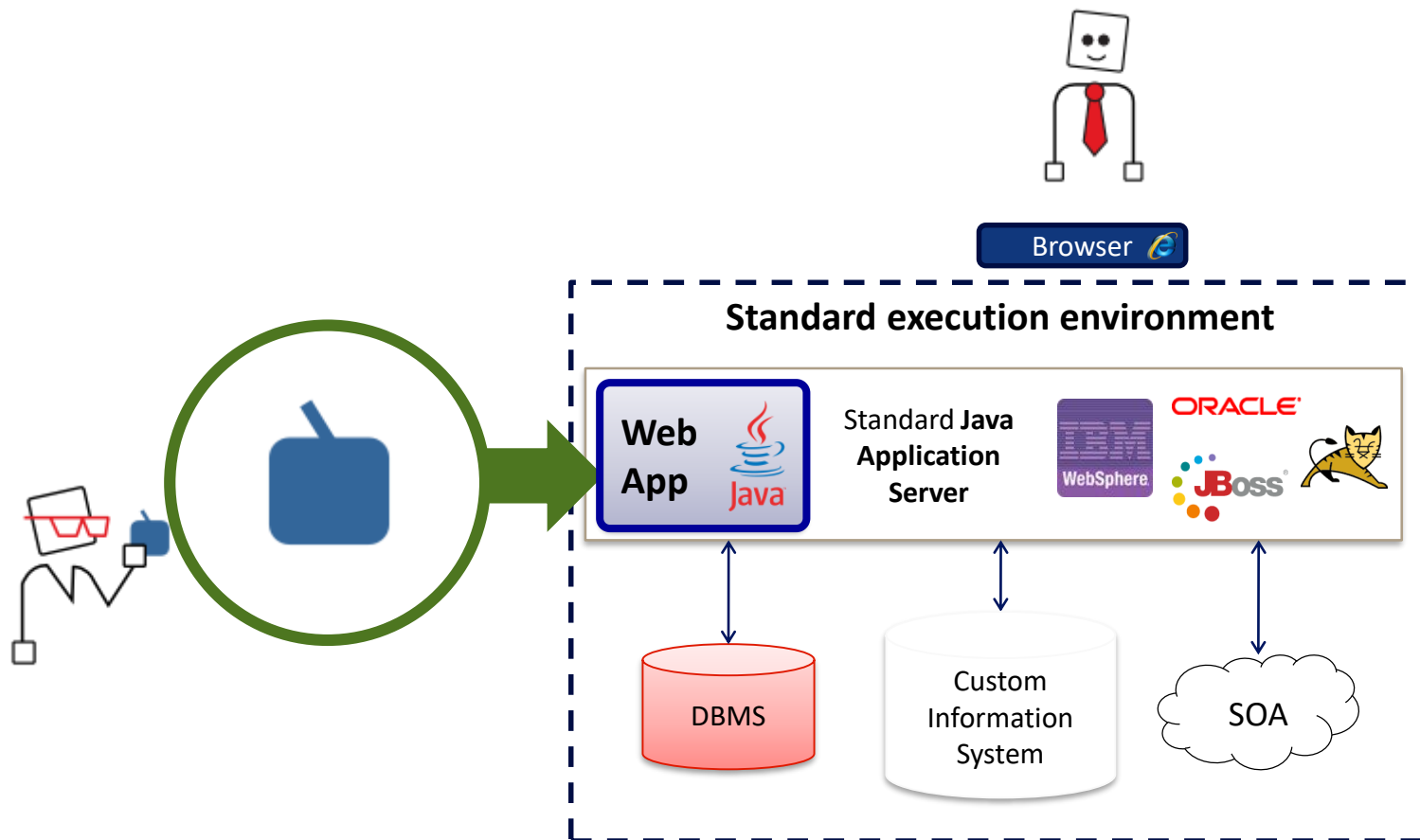
You get a tailored, yet standard, Java Web application with no proprietary runtime



**Code generation**



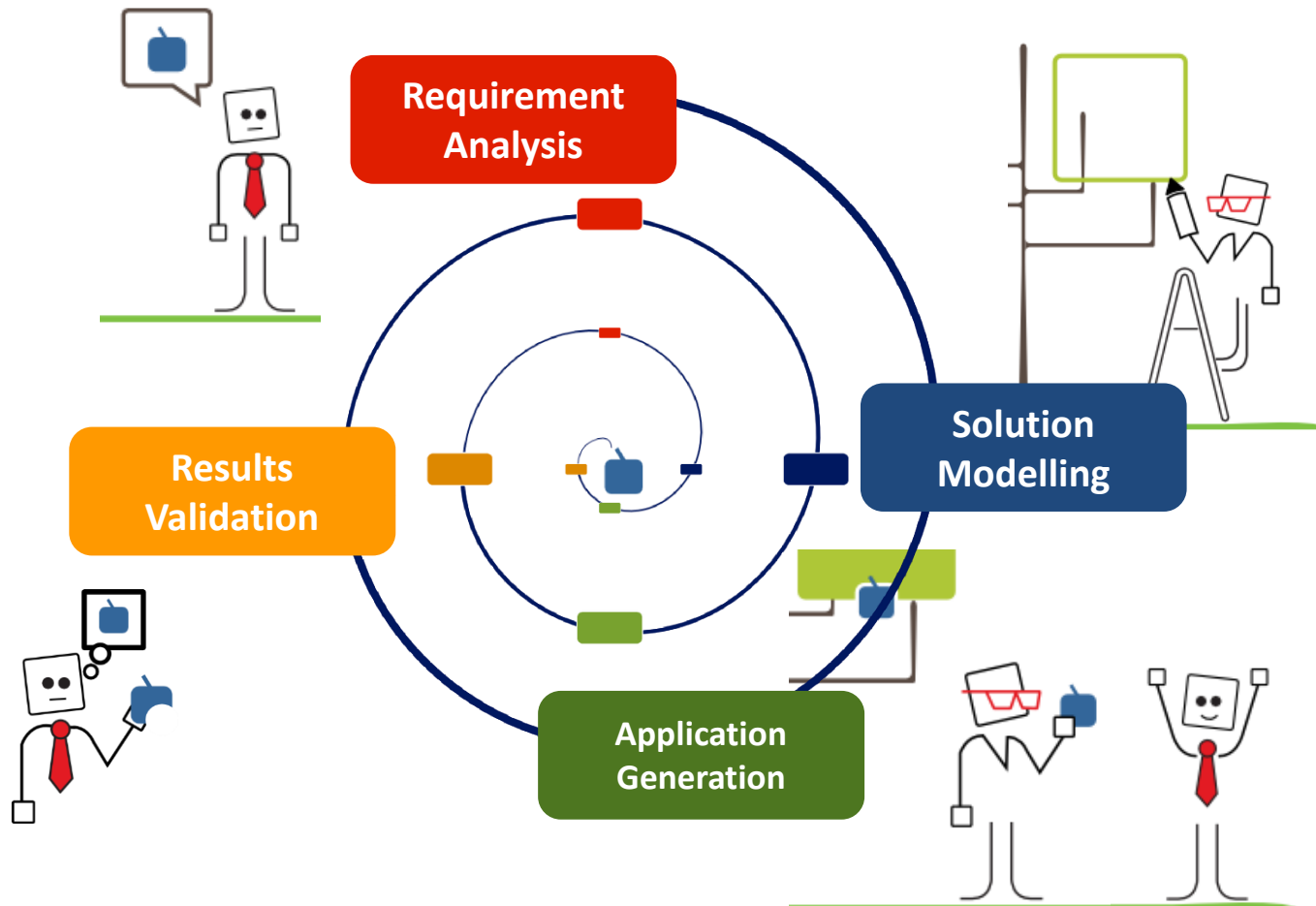
# Get the application



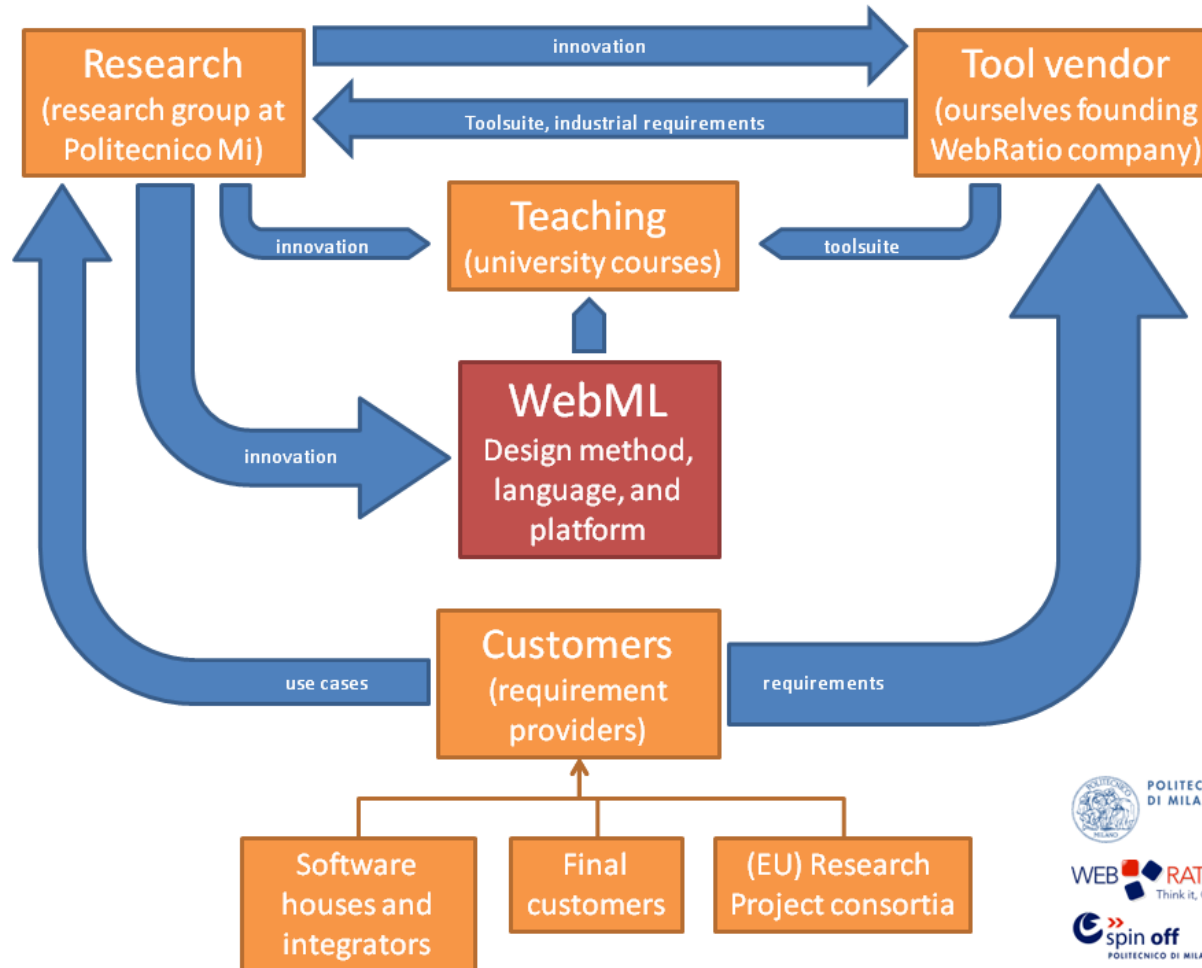


# Agile, quick prototyping

Involve business users in the development process and converge quickly to the target

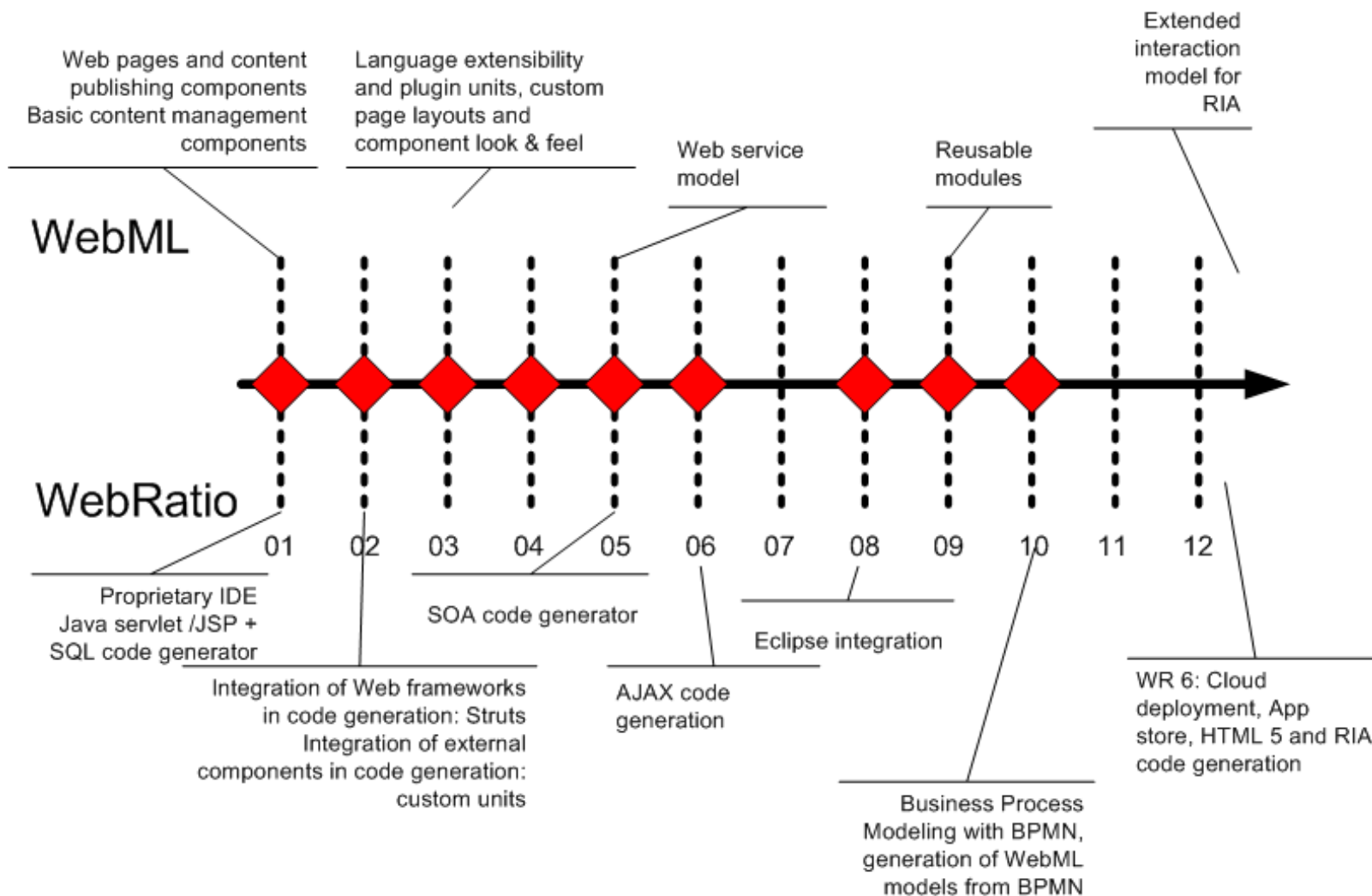


# Our innovation environment



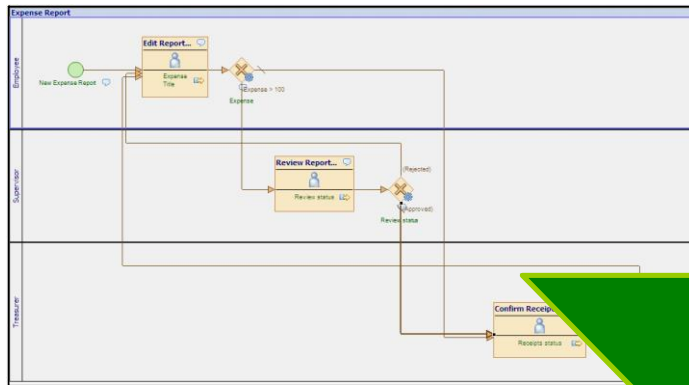


# Evolution of tool (and language)





# The final picture



Iterative refinement of the process enactment applications

Business Process Model

Application model

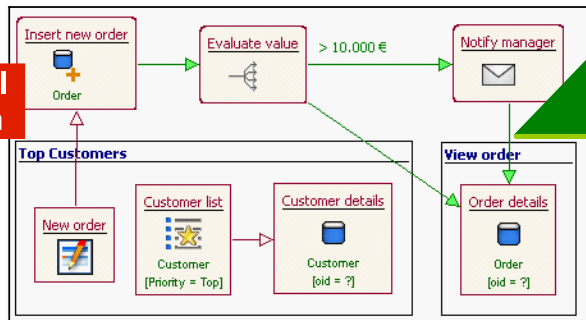
Model to code transformation

Standard Java application

Iterative refinement of the activity execution applications

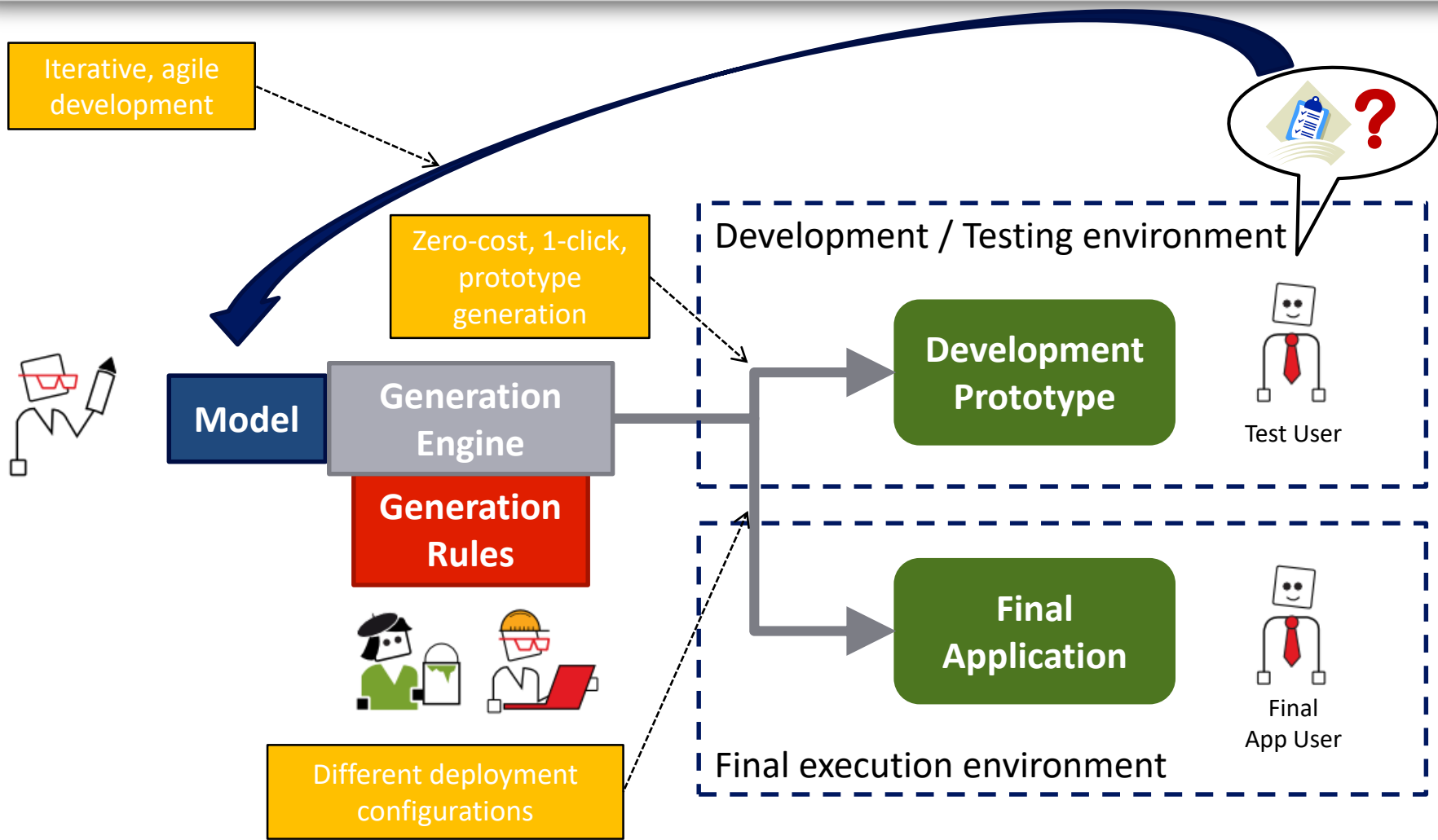


Model to model transformation





# Agility + MDD

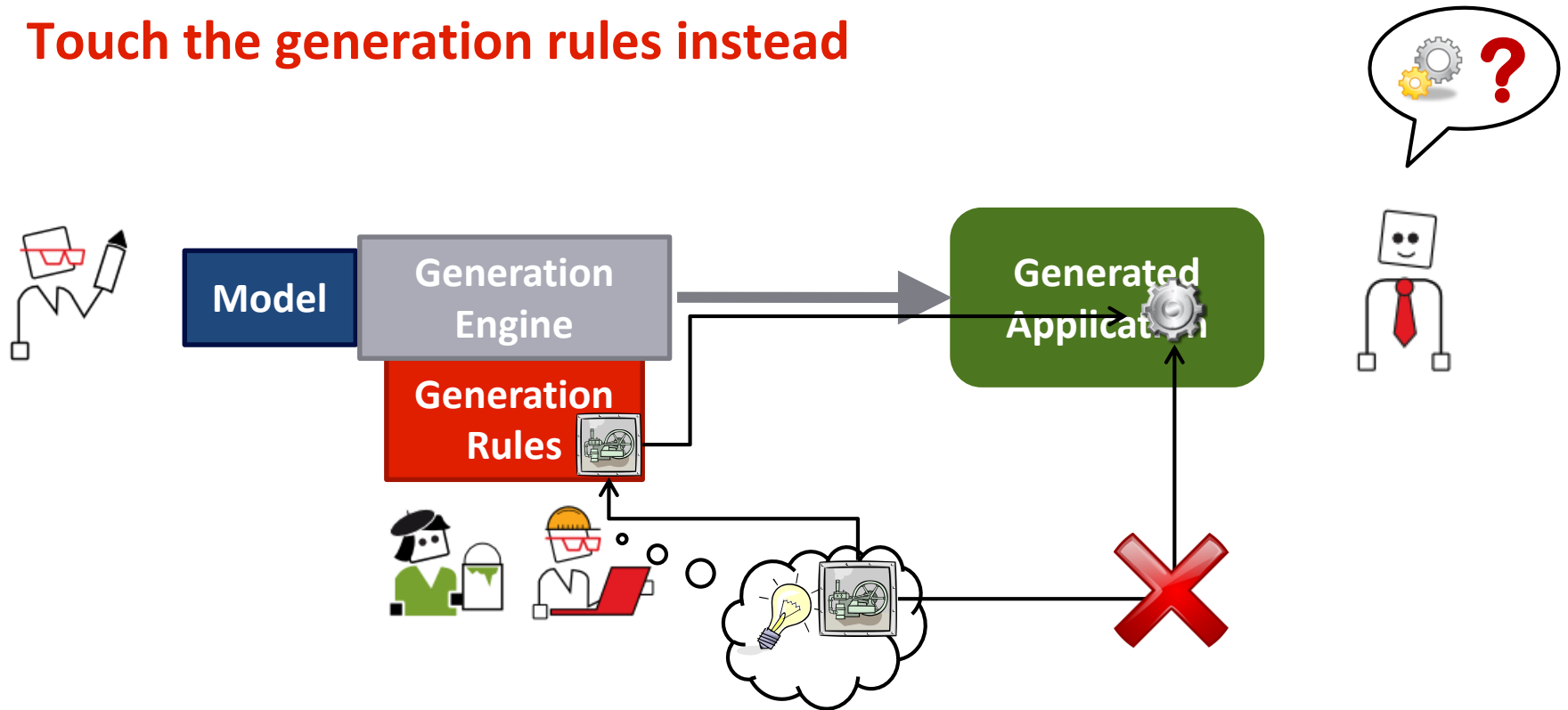




# The MDE Virtuous Cycle

Do not change the generated application code

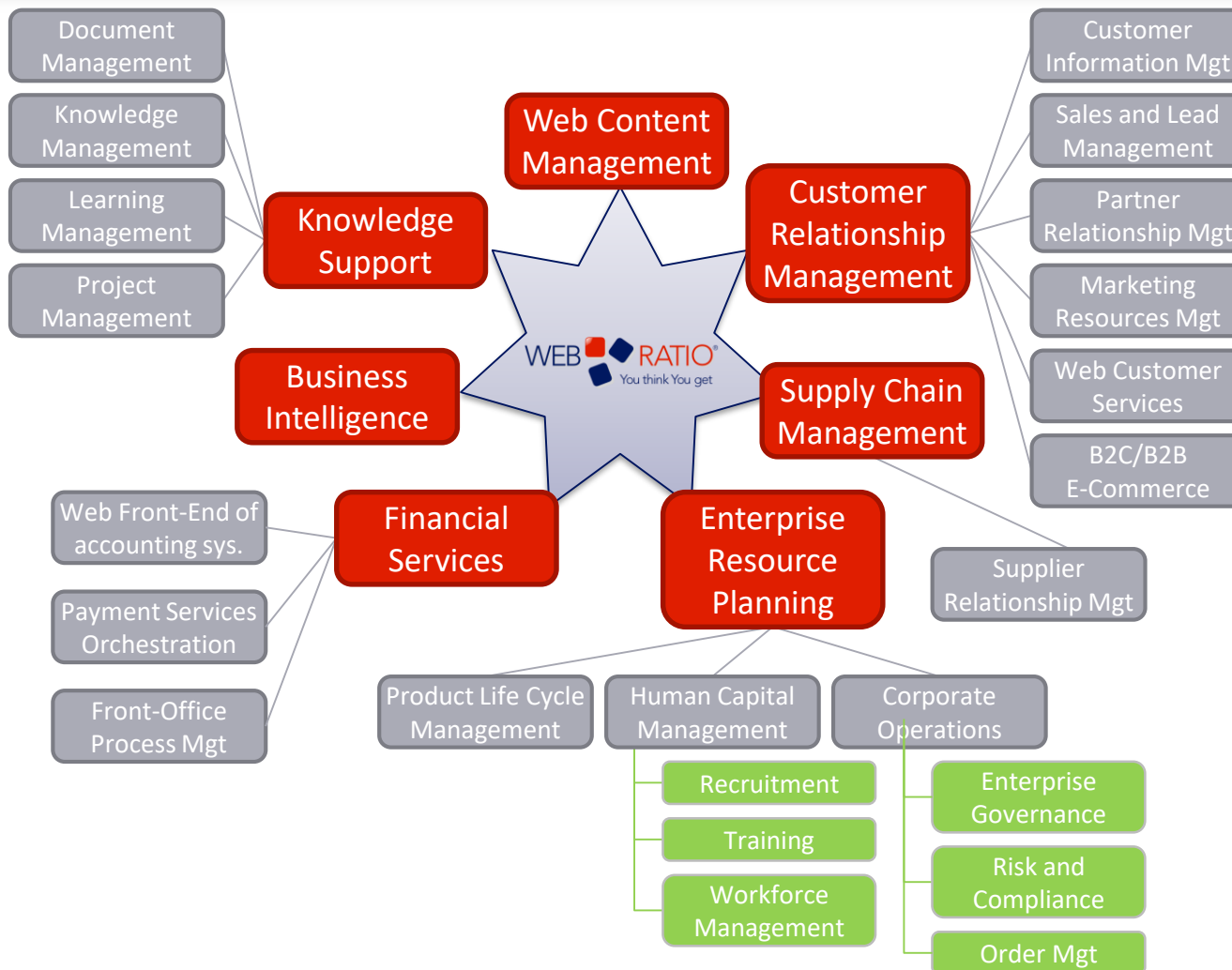
Touch the generation rules instead





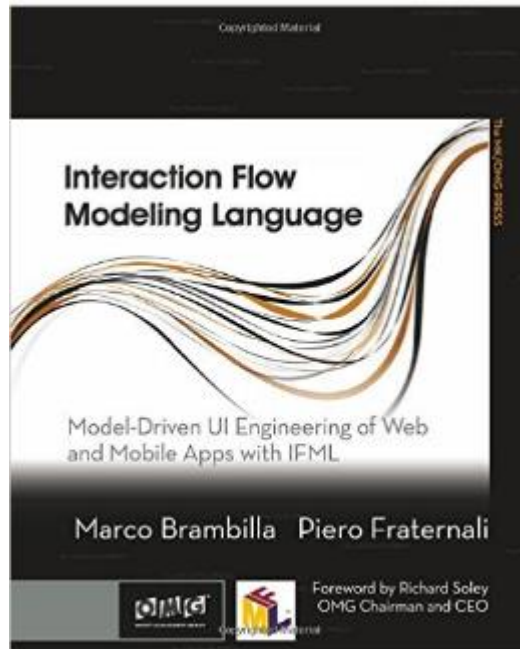


# Examples of application areas

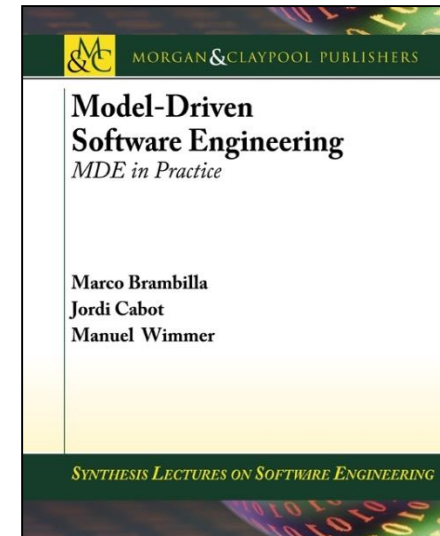




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