INF5120 and INF9120
”Modelbased System development”

Lecture 5: 13.02.2016

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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 13th, 0900)-1300

This lecture, February 13, 2017

IFML and WebRatio

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

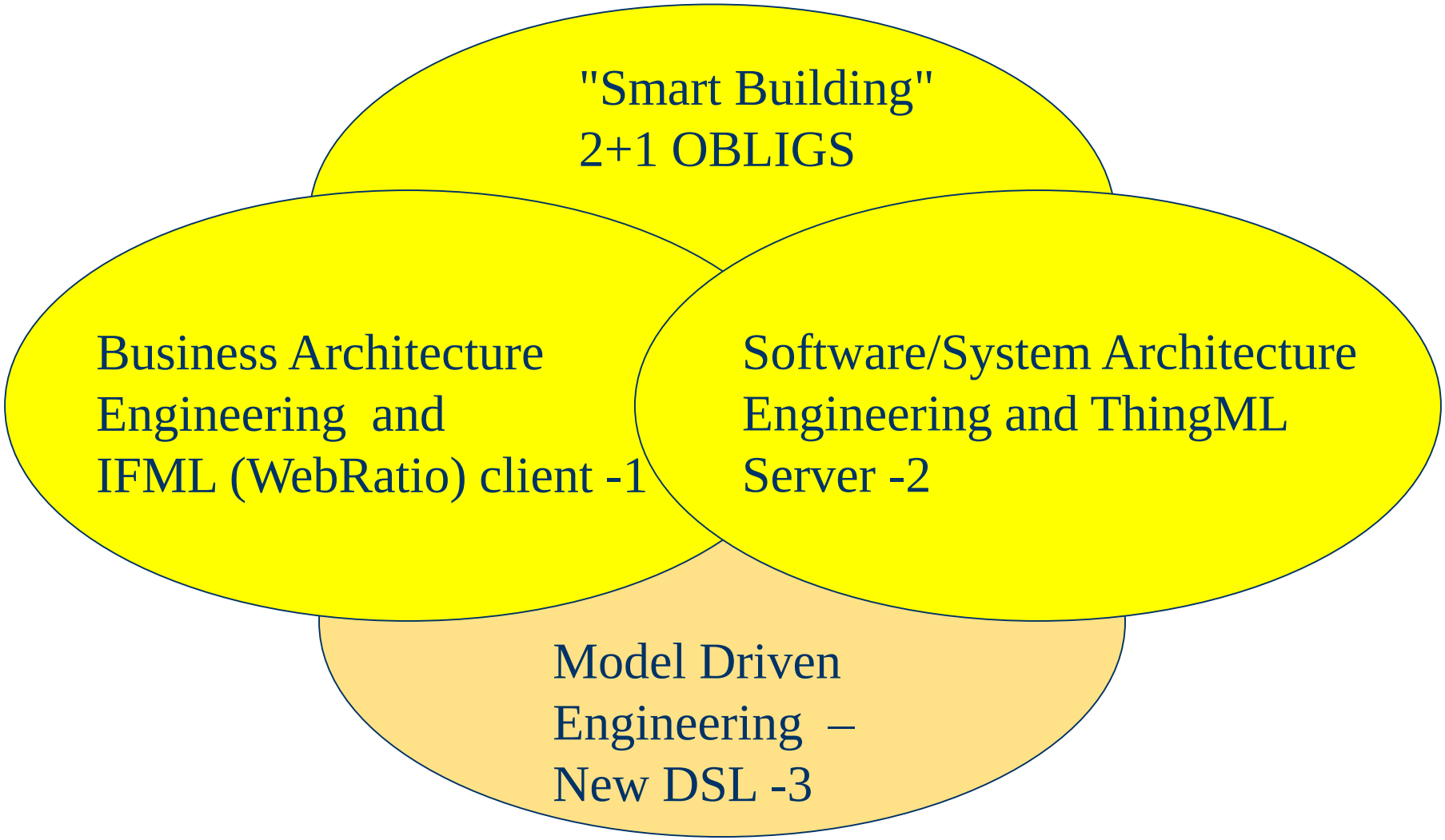
Next lecture, February 20, 2017

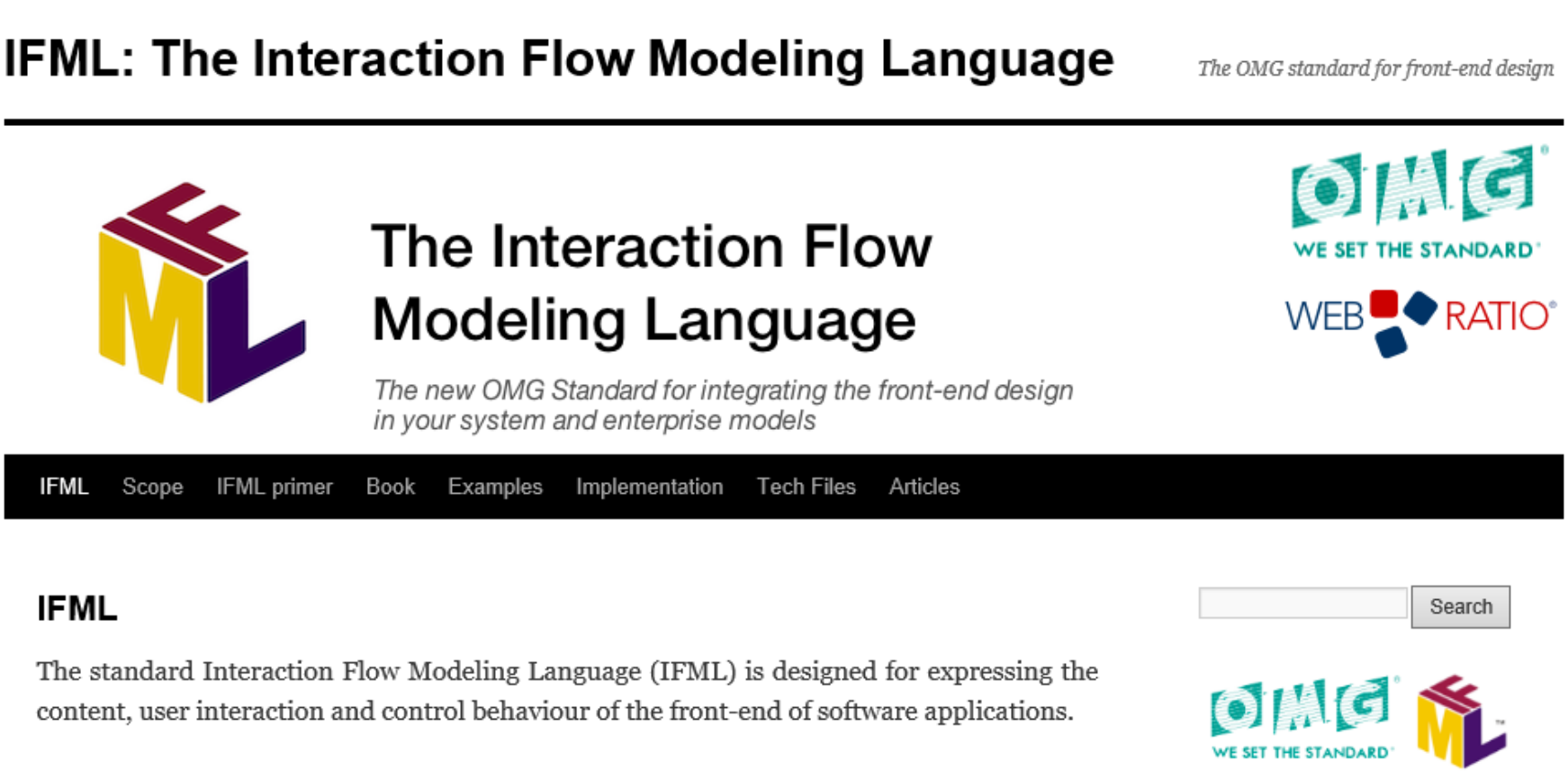
BPMN and Process modeling

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

- More on IFML …

Course components





http://www.ifml.org/

IFML Objectives

Content

Navigation Path

Event

Binding to Business Logic

Binding to Persistence Layer

IFML Objectives: Content

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IFML Objectives: Navigation Path

IFML Objectives: Navigation Path

IFML Objectives: Events

IFML Objectives: Events

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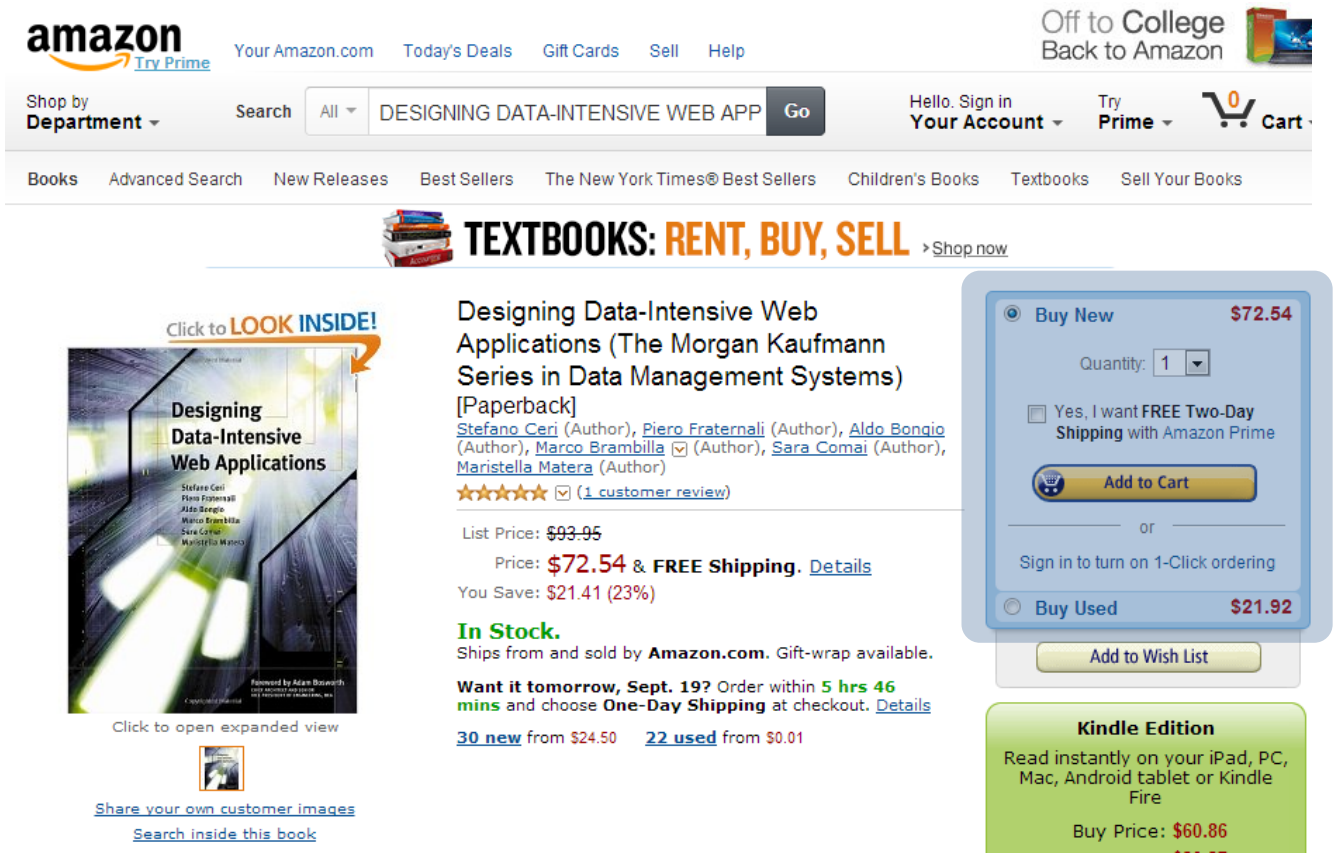
IFML Objectives: Binding to business logic



IFML Objectives: Binding to business logic

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IFML Objectives: Binding to persistence

Book

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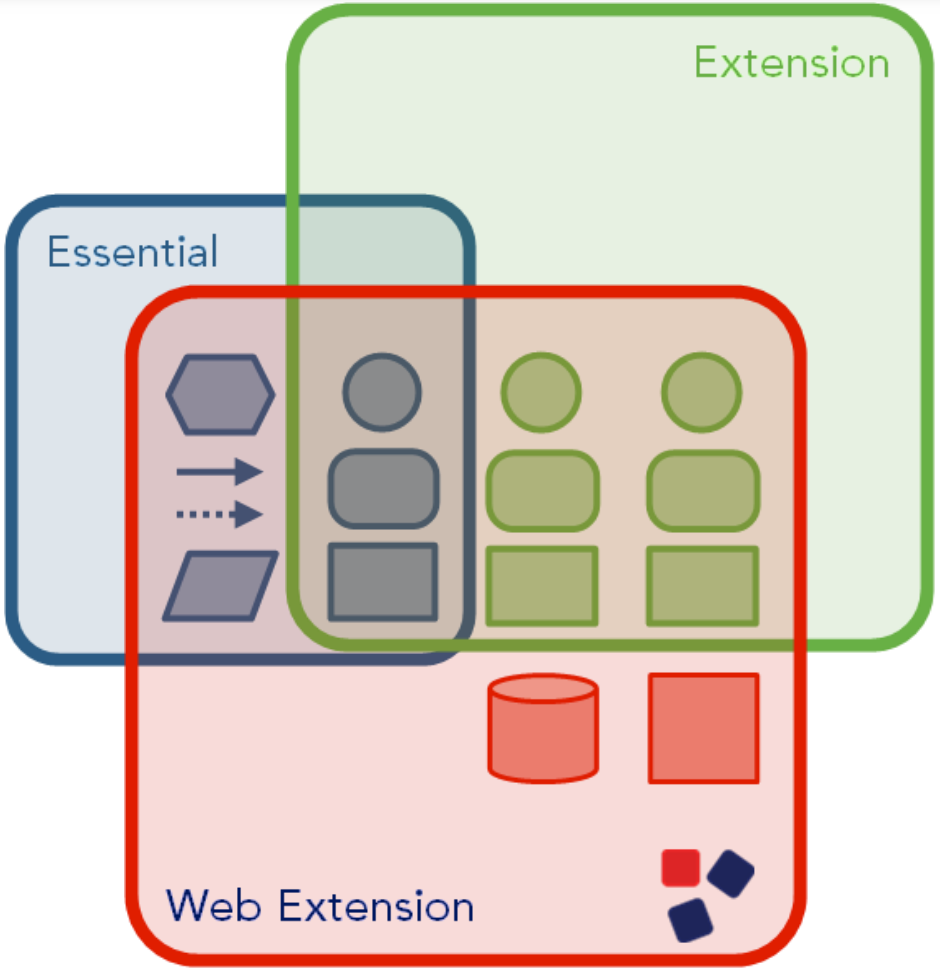
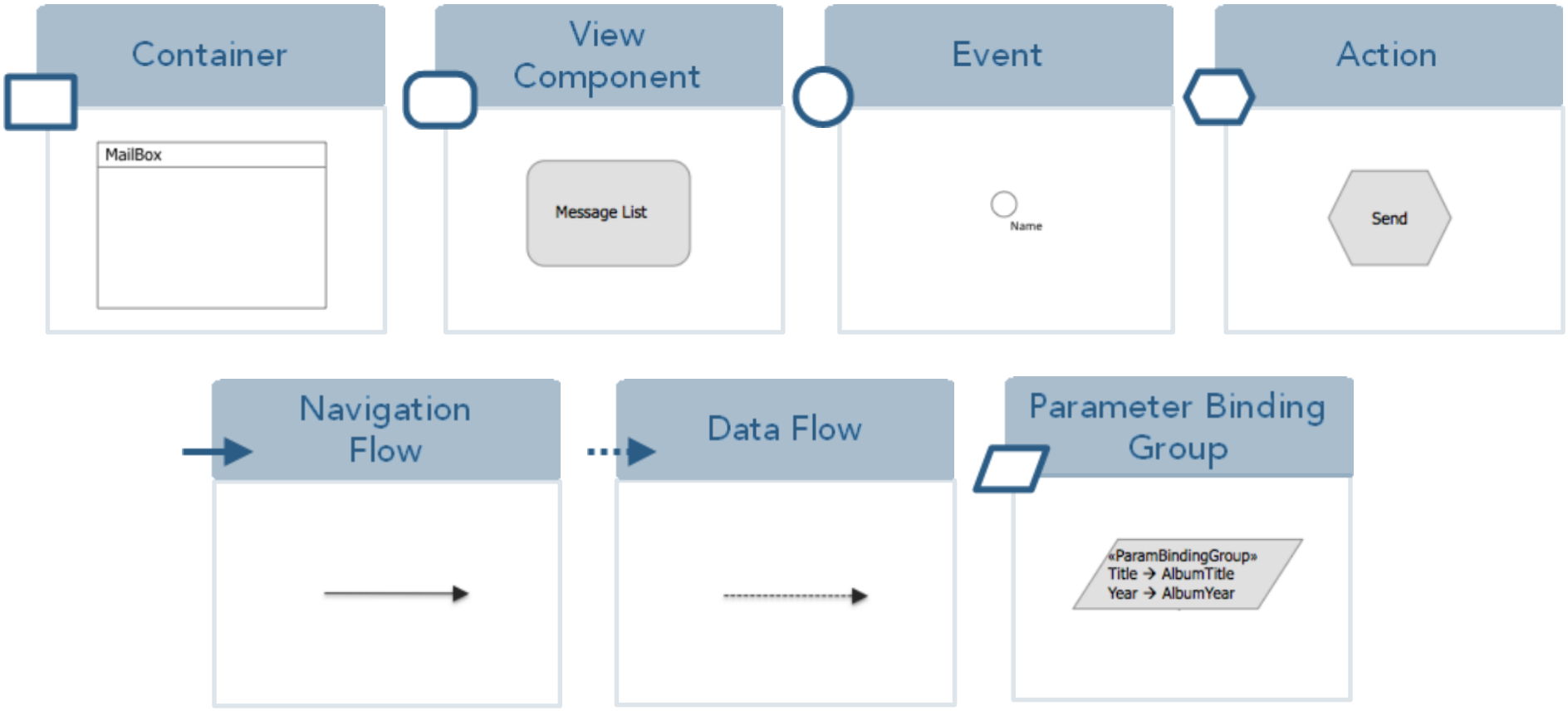
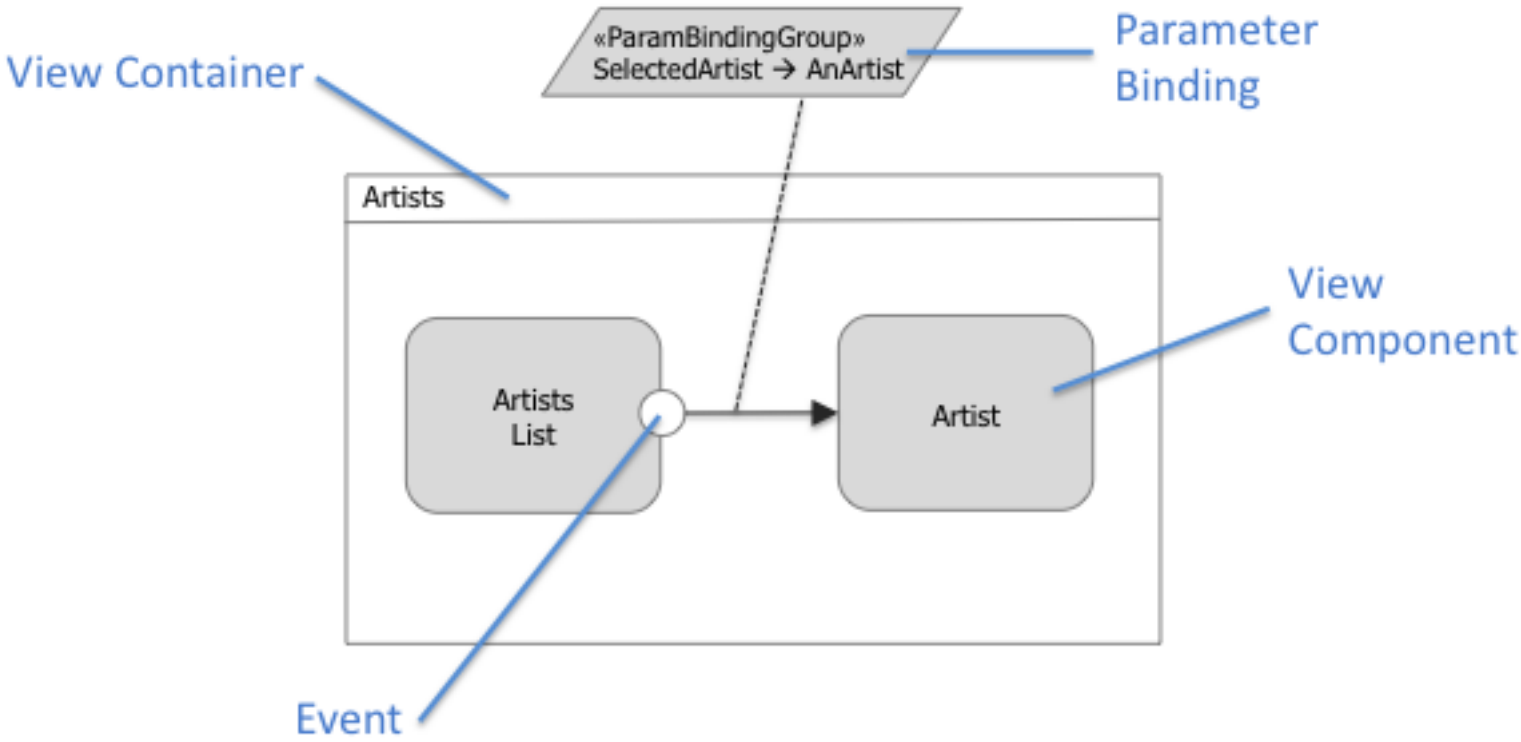
IFML Overview



IFML Essentials

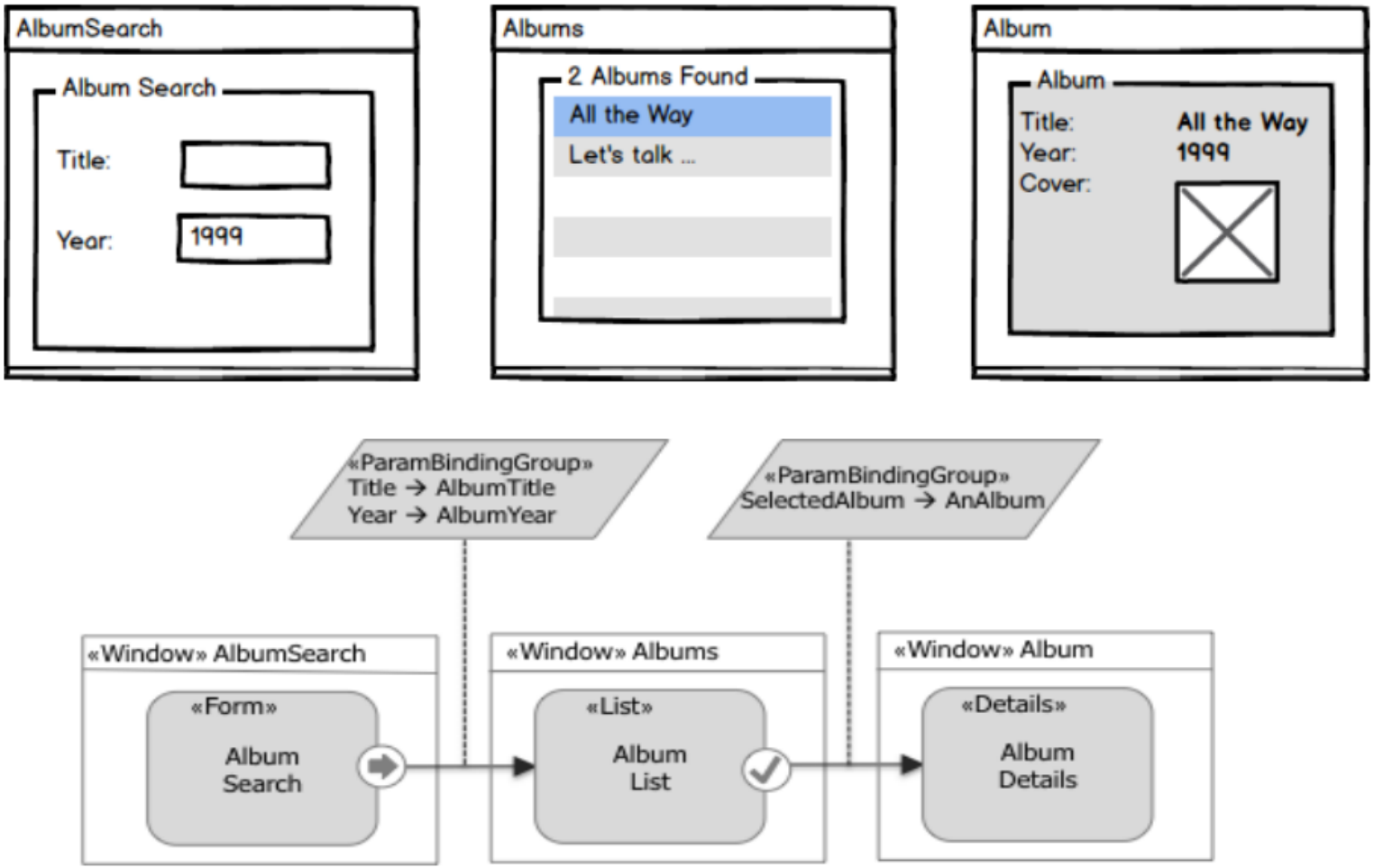


IFML by example

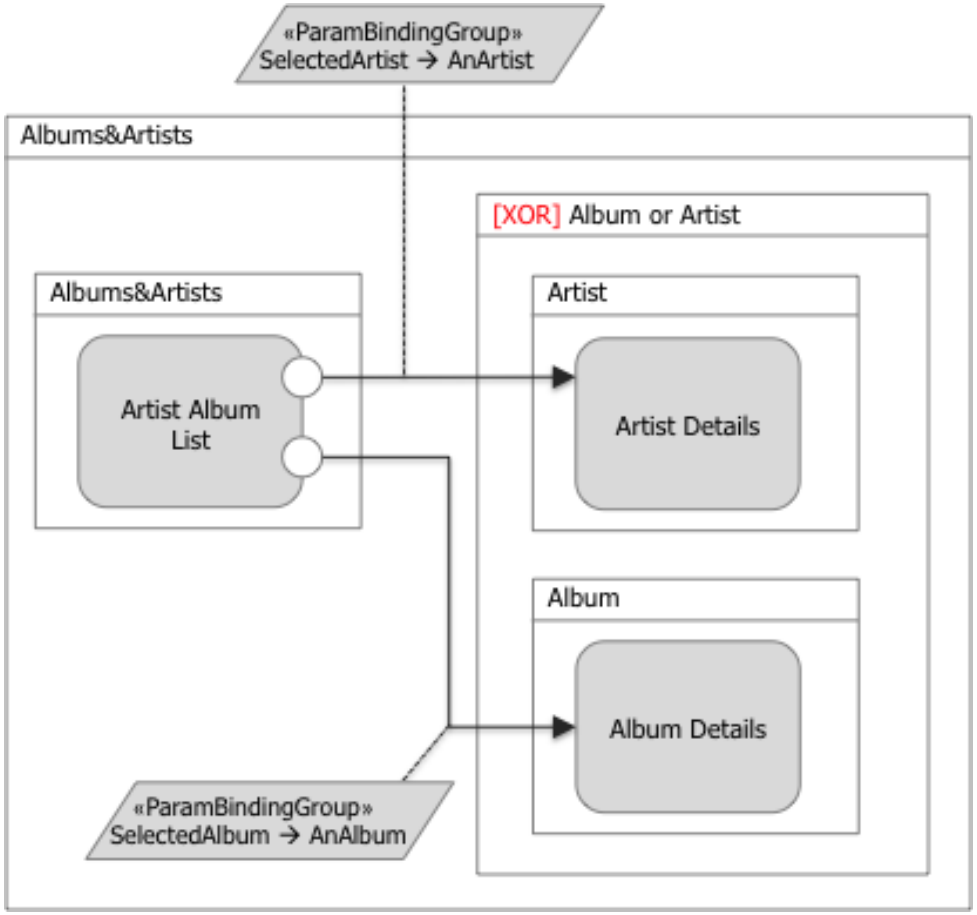


Basic navigation flow between ViewComponents

IFML by example



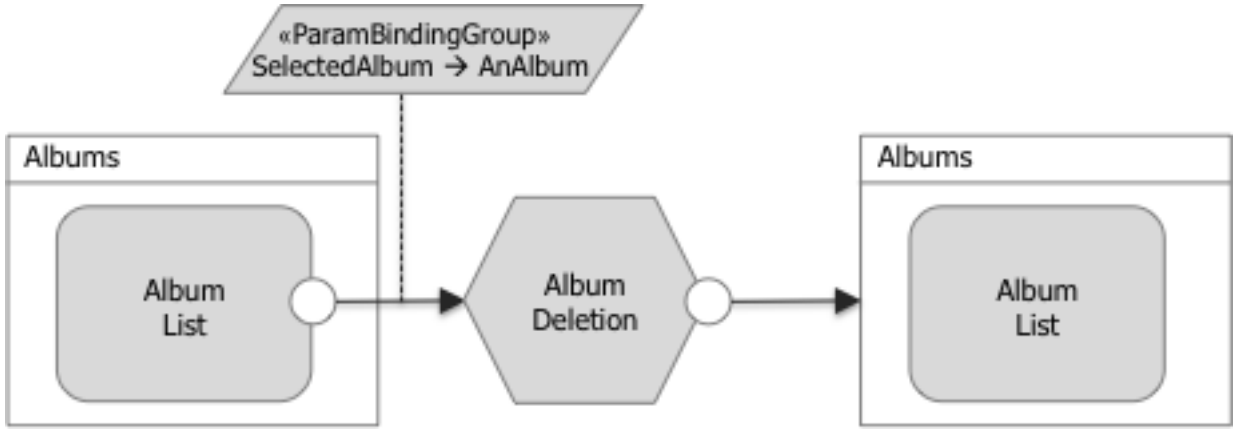
IFML by example



Nesting of ViewContainers

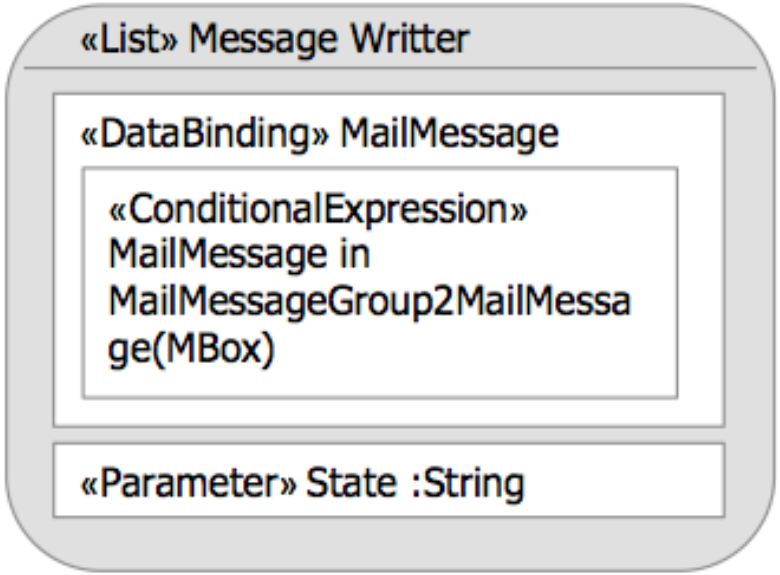
Tagged ViewContainers (XOR, L, D, Modal, Modeless)

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, …

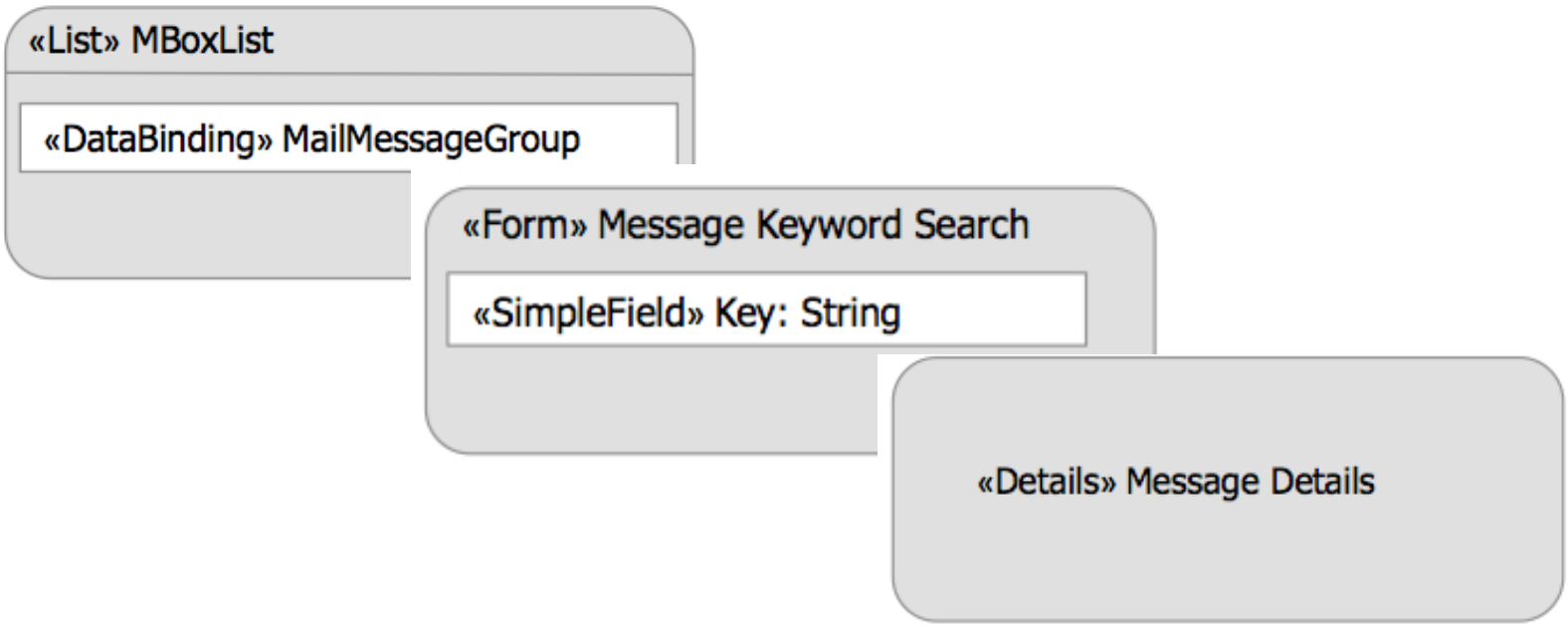
Dynamic Behaviour

- 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

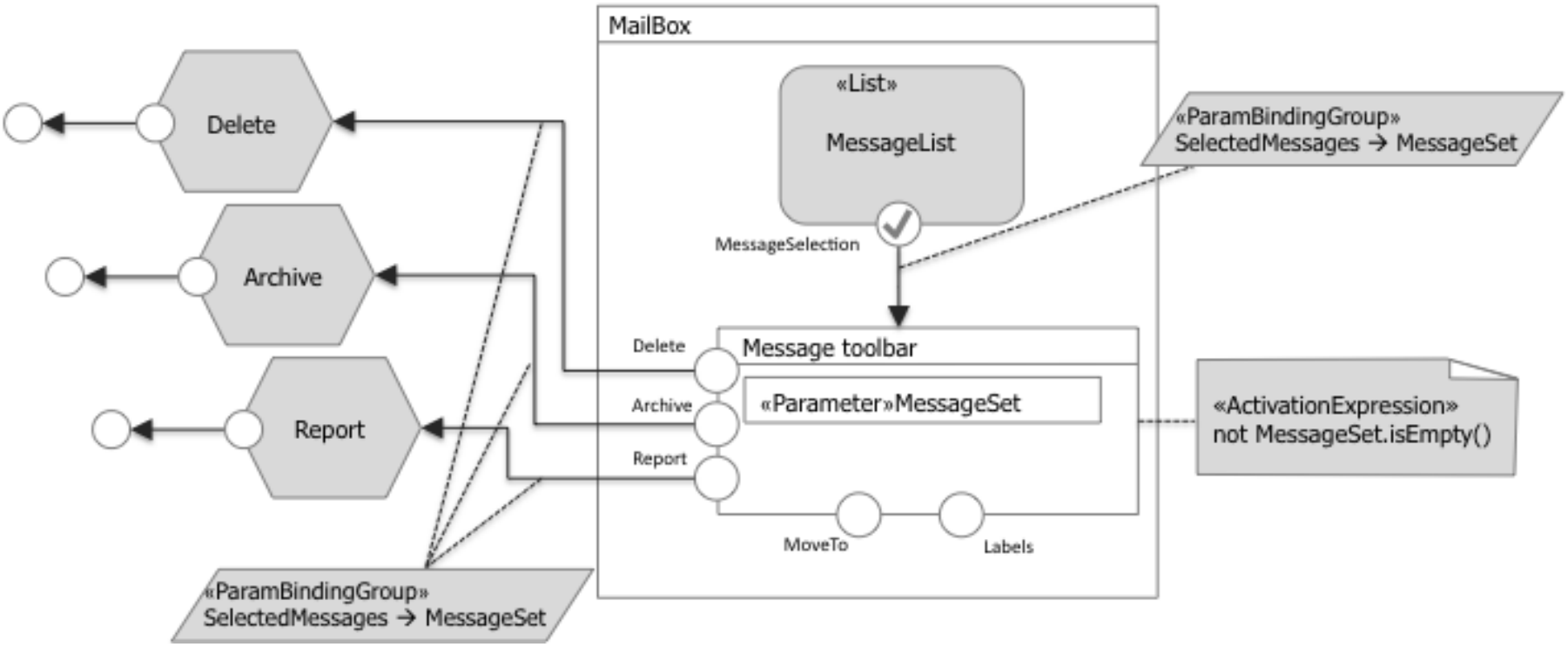
Selection event

Submit event



.. And as many others as you want!

IFML by example



ActivationExpression, SubmitEvent, Event generation

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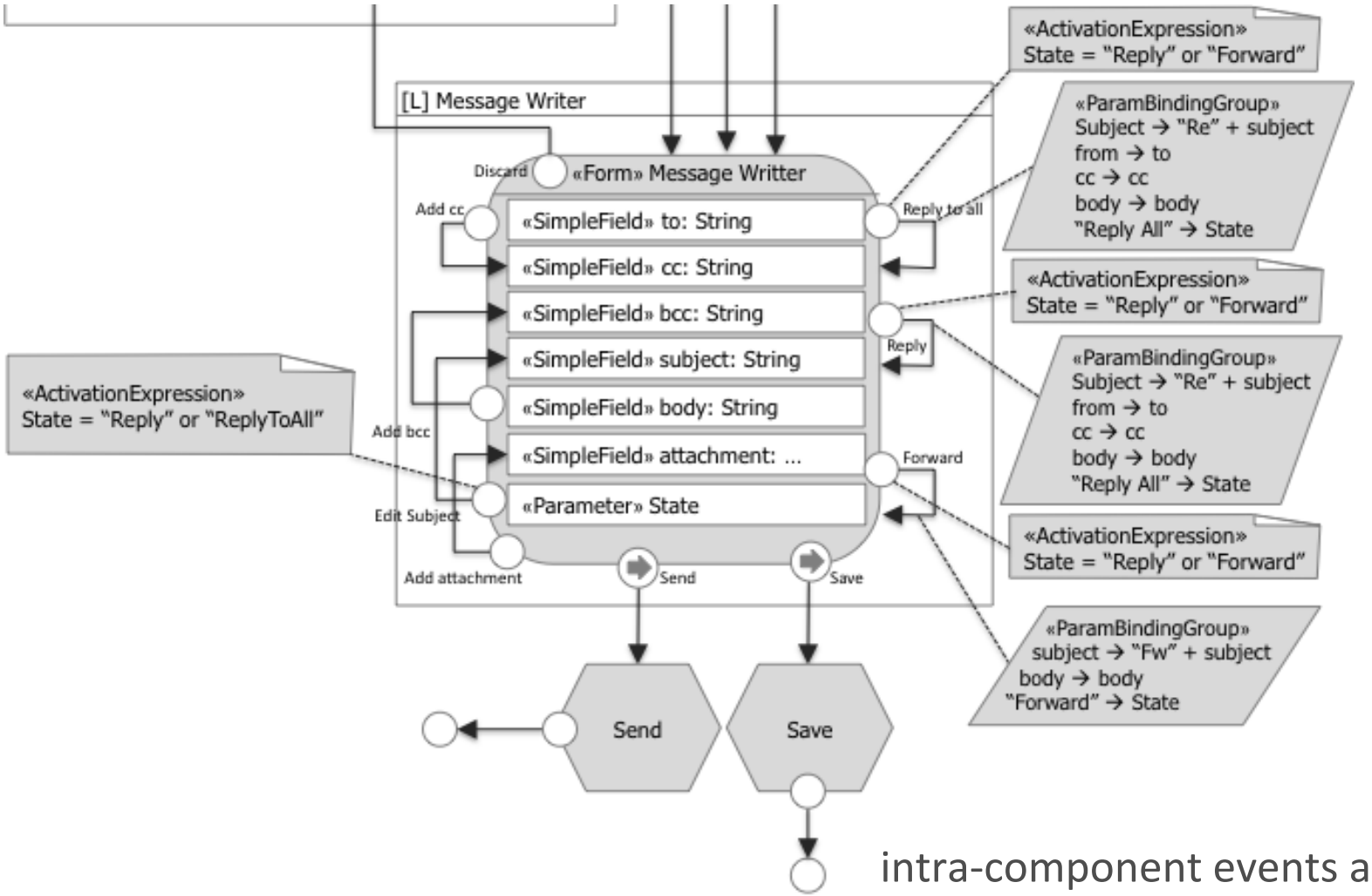
IFML concrete syntax by example

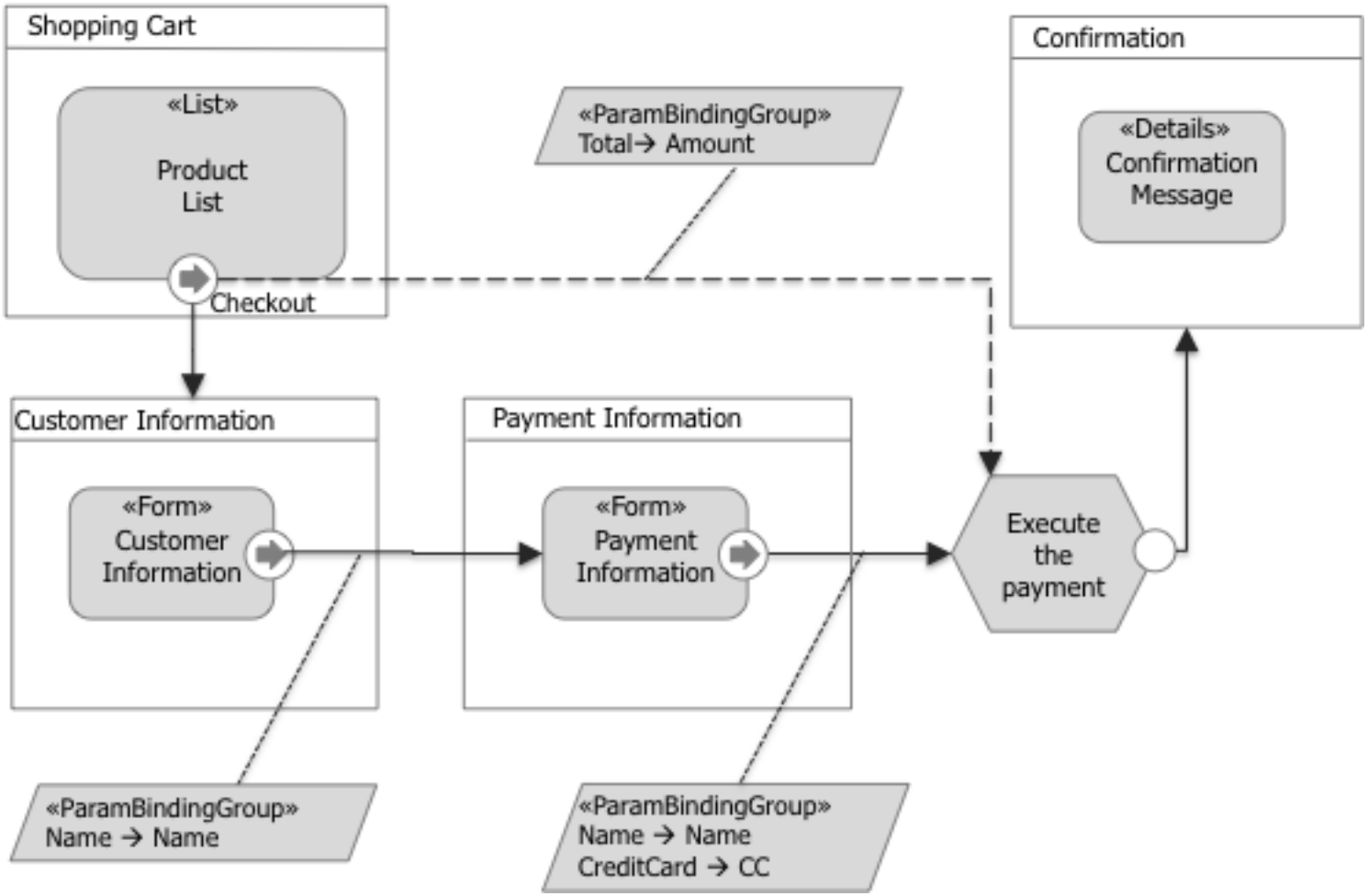


intra-component events and flows

Covered aspects

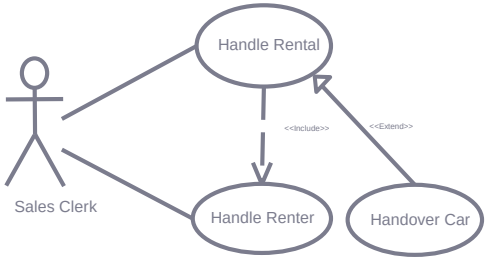
- **Multiple views** for the same application
- **Mobile and multi-device** applications
- Visualization and input of data, and production of **events**
- **Components** independent of concrete widgets and presentation
- **Interaction flow**, initiated by the user or by external events
- **User context**: 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

IFML example – online payment

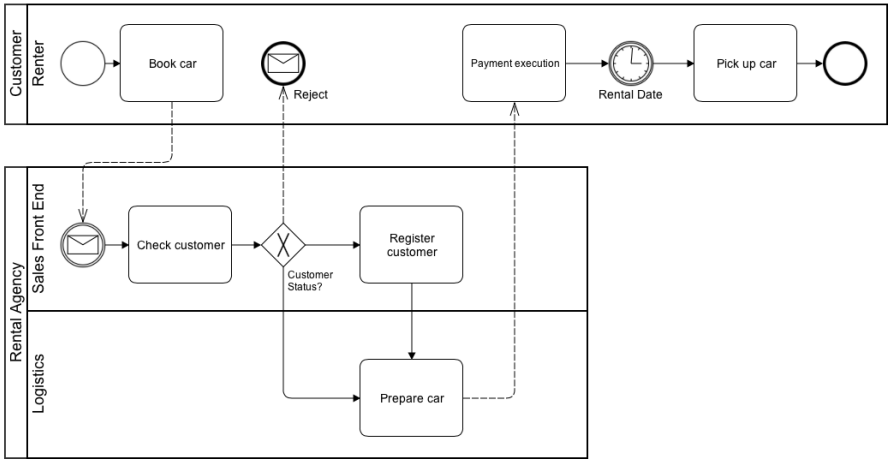


Multiple aspects modeling – 1
(business and requirements)

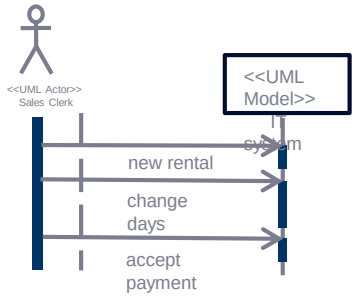
UML Use Case



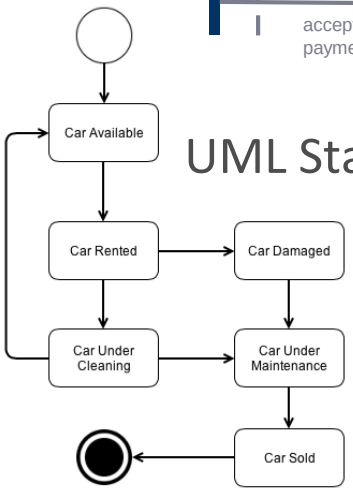
BPMN process

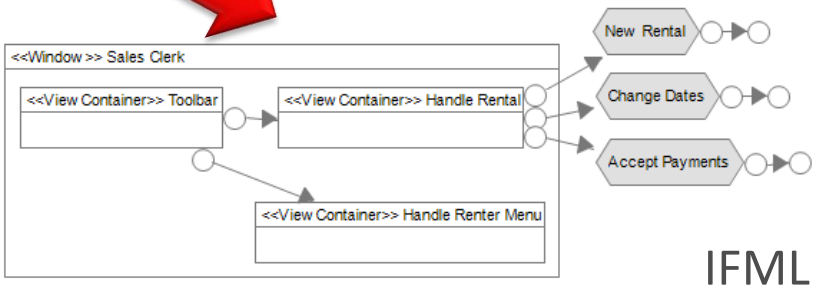


UML Sequence



UML Statechart





IFML

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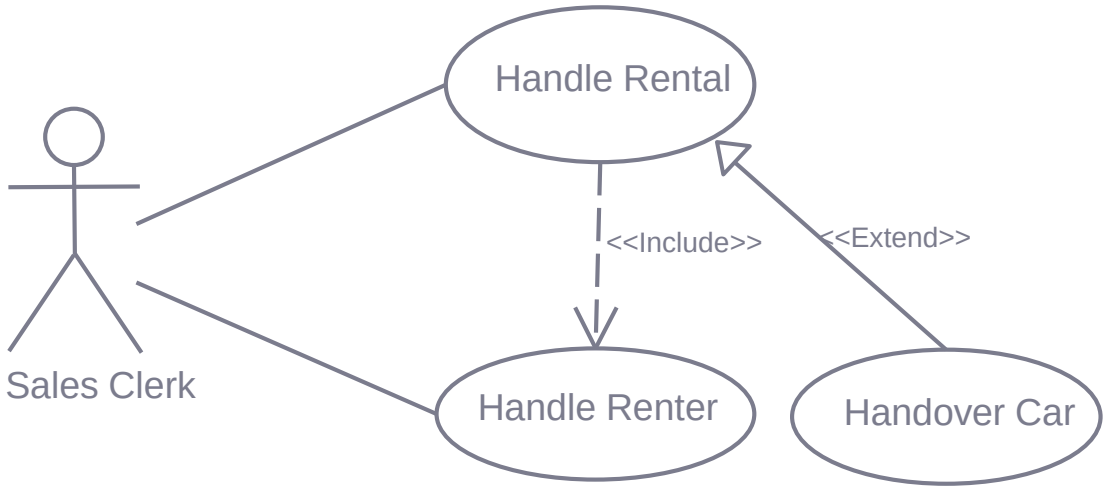
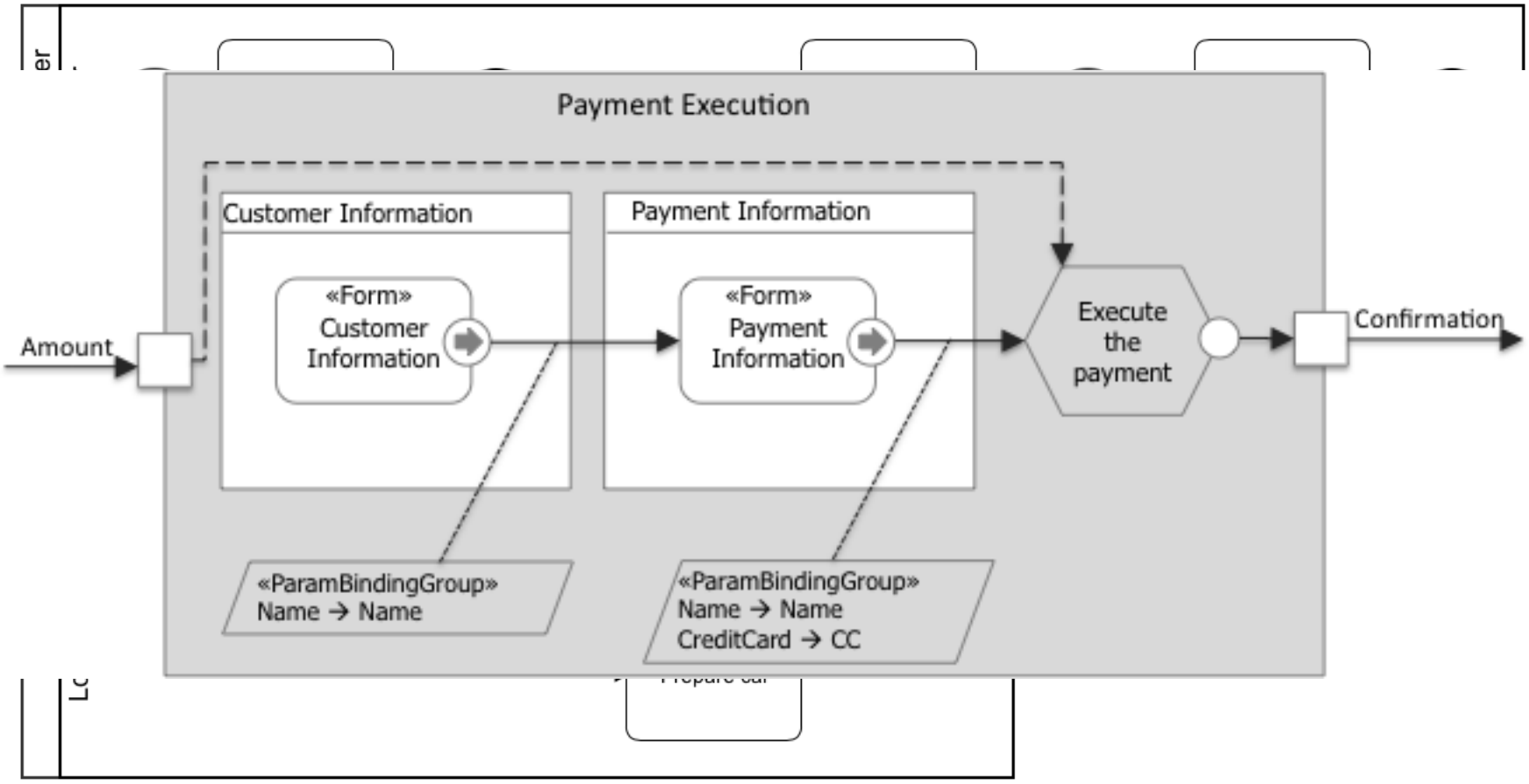
Integration with UML Use Cases



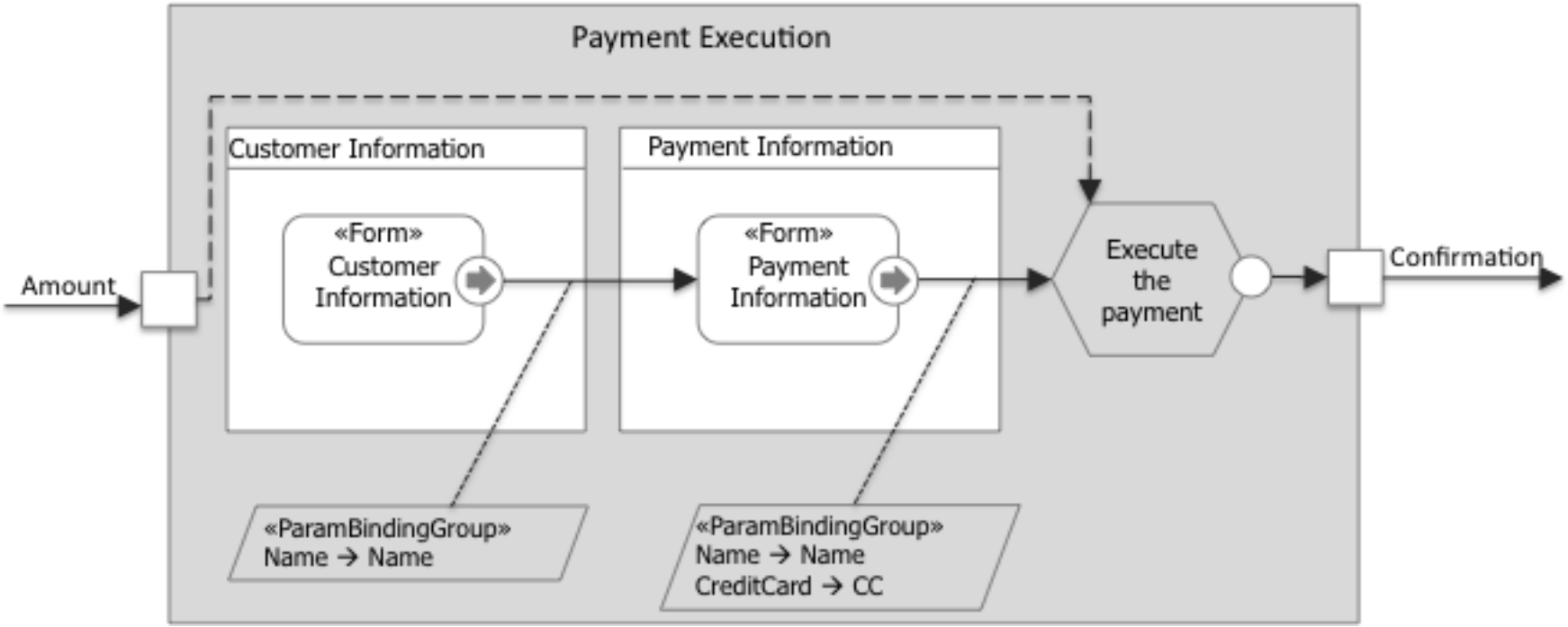
Each use case can be described by

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

Integration with BPMN

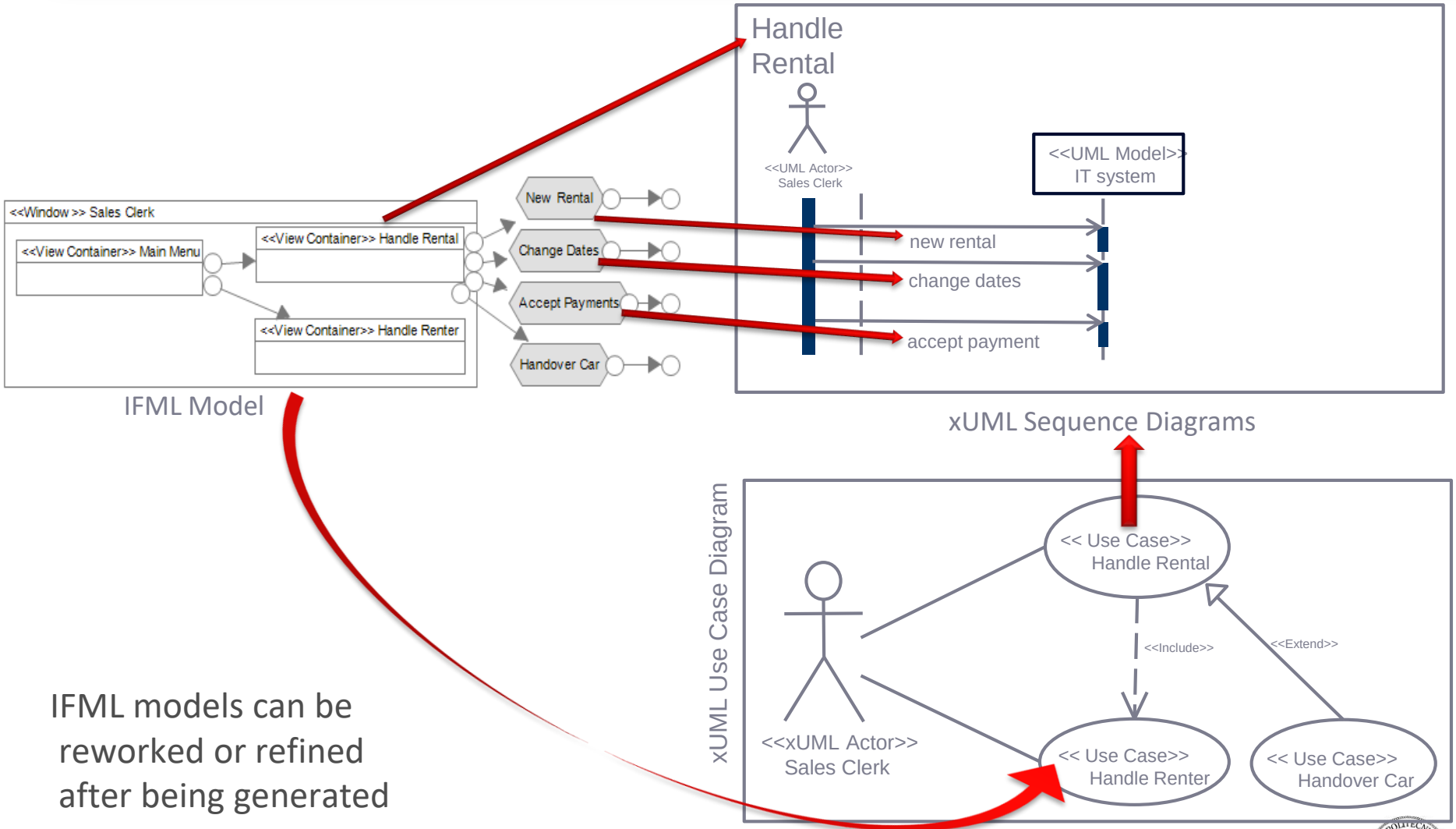


IFML concrete syntax by example



IFML Modules - definition

Example of UML - IFML mapping



IFML models can be reworked or refined after being generated

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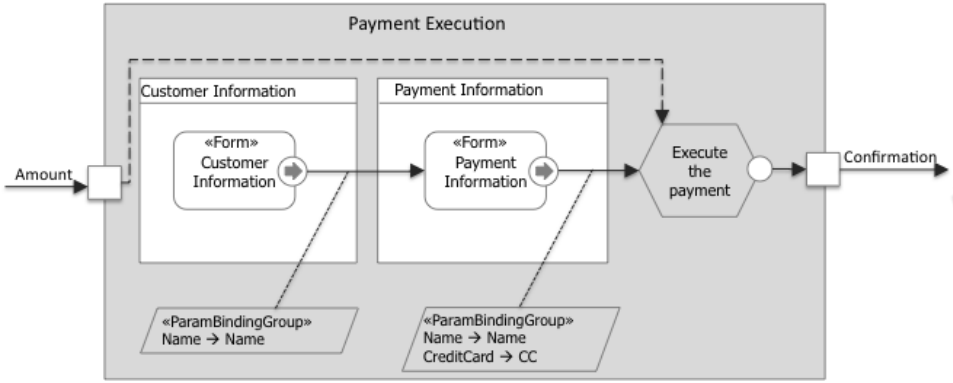
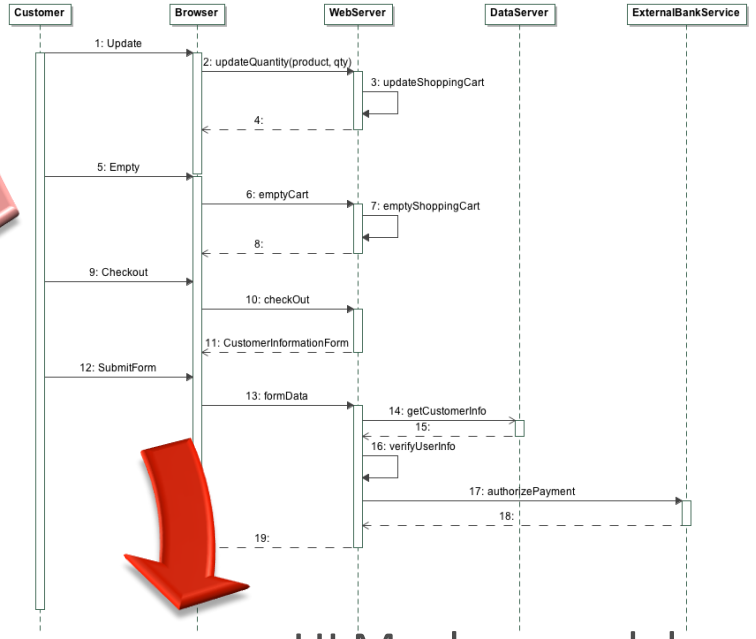
Multiple aspects modeling – 2
(implementation and architecture)

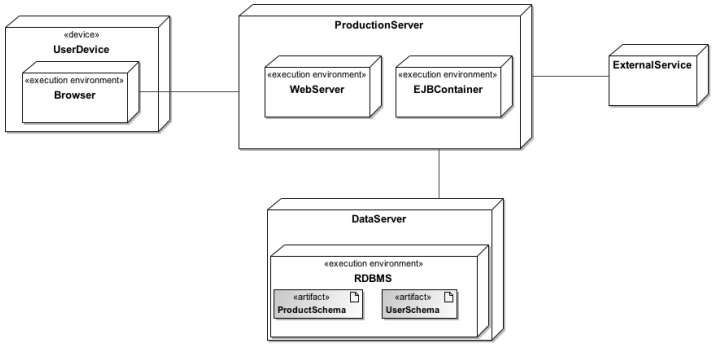
IFML



UML Sequence



UML Deployment



UI Mockup models

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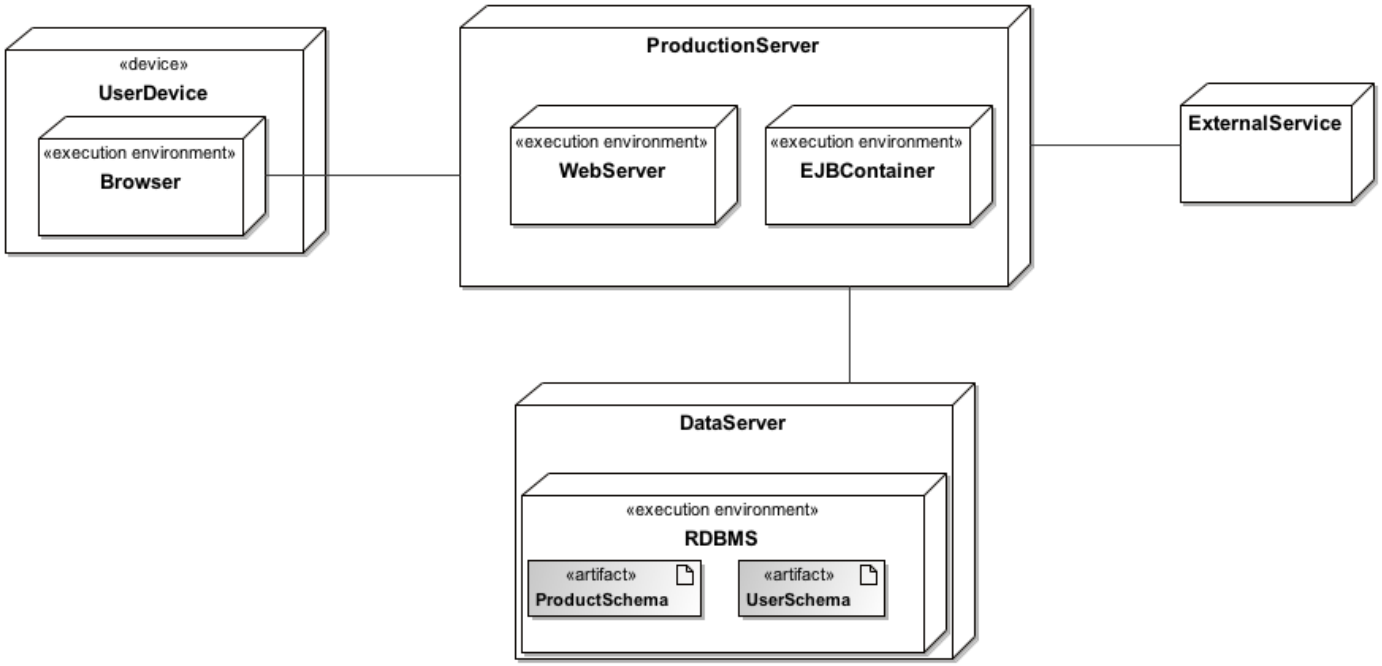
Integration with UML

Description of deployment architecture

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

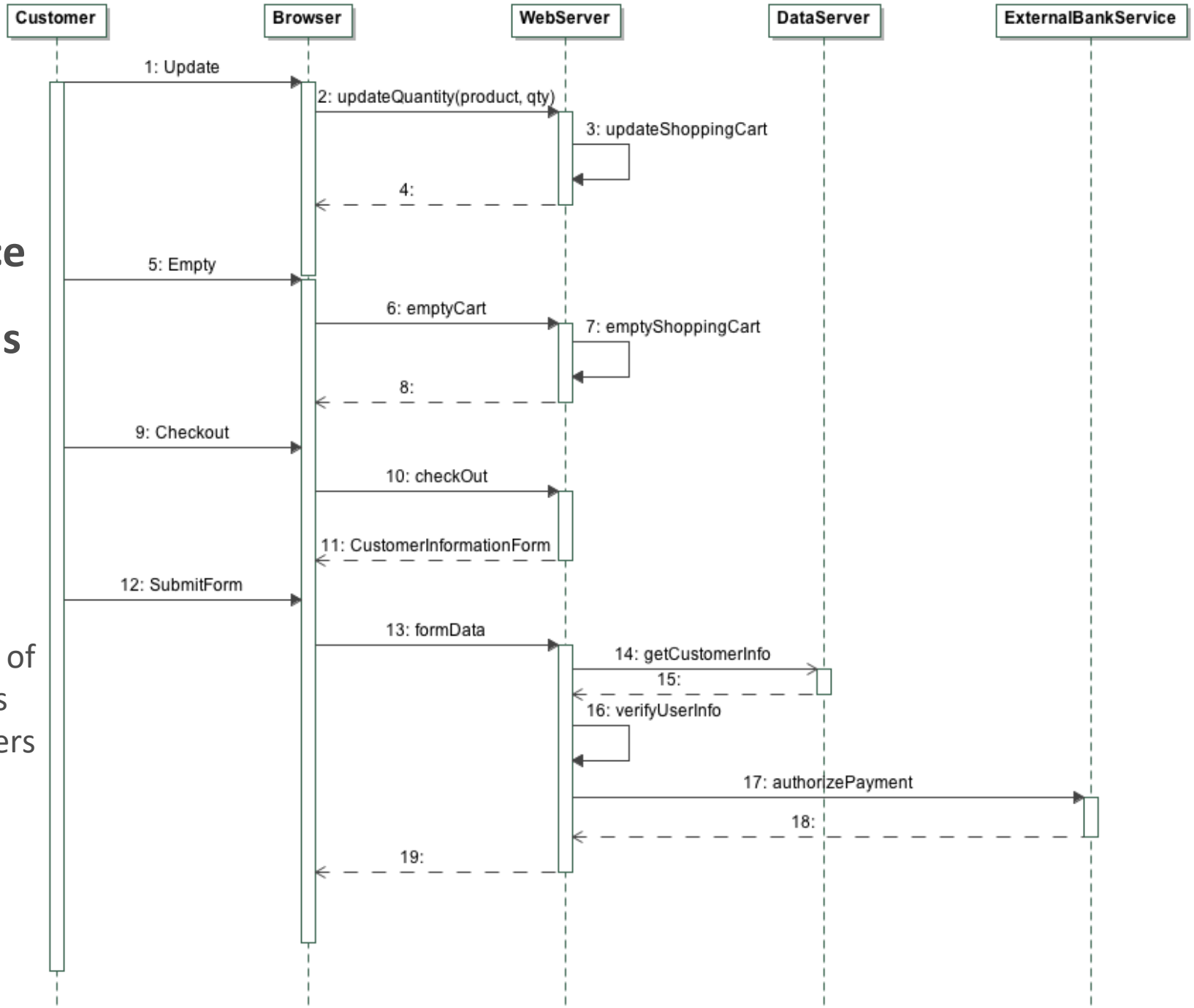


- UML deployment diagram

UML Sequence Diagrams

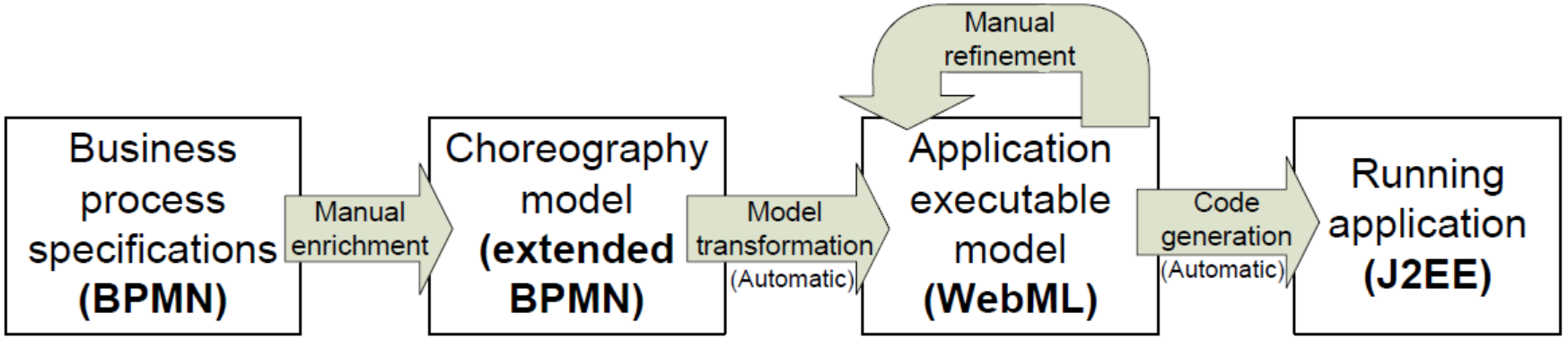
Tiers and calls

Explicit description of interactions between tiers

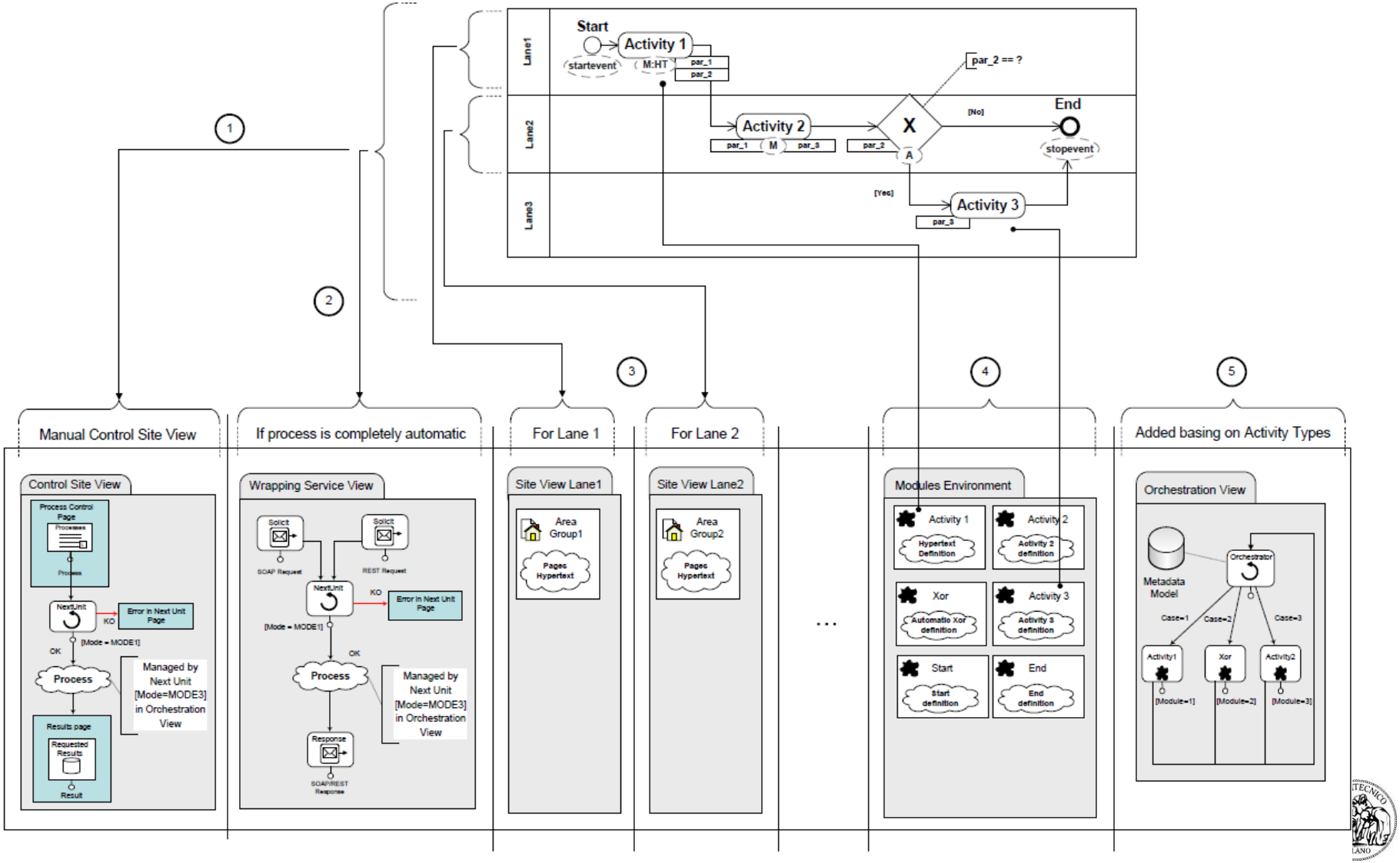


Model-driven Development Process

- 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

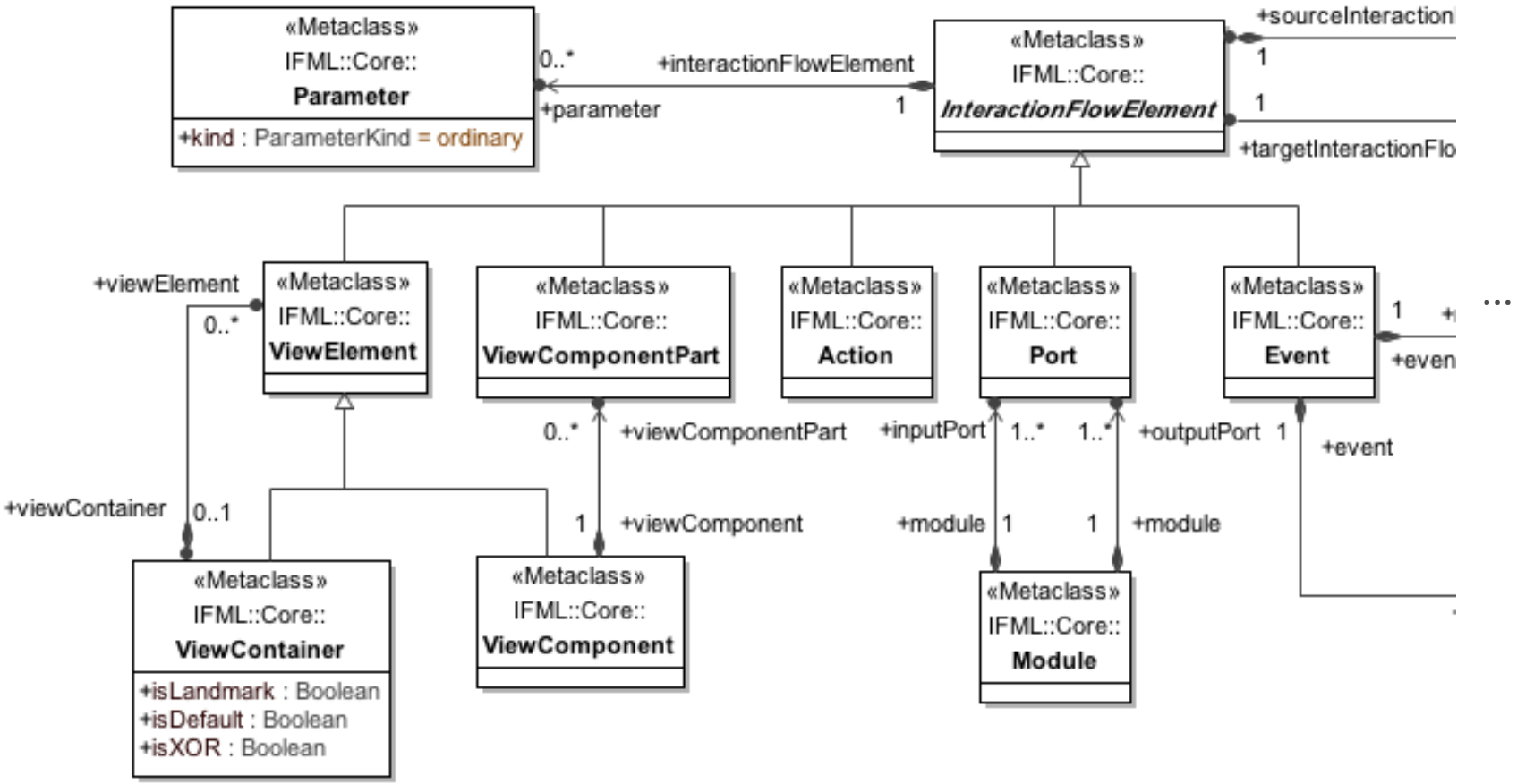


The generated model artifacts



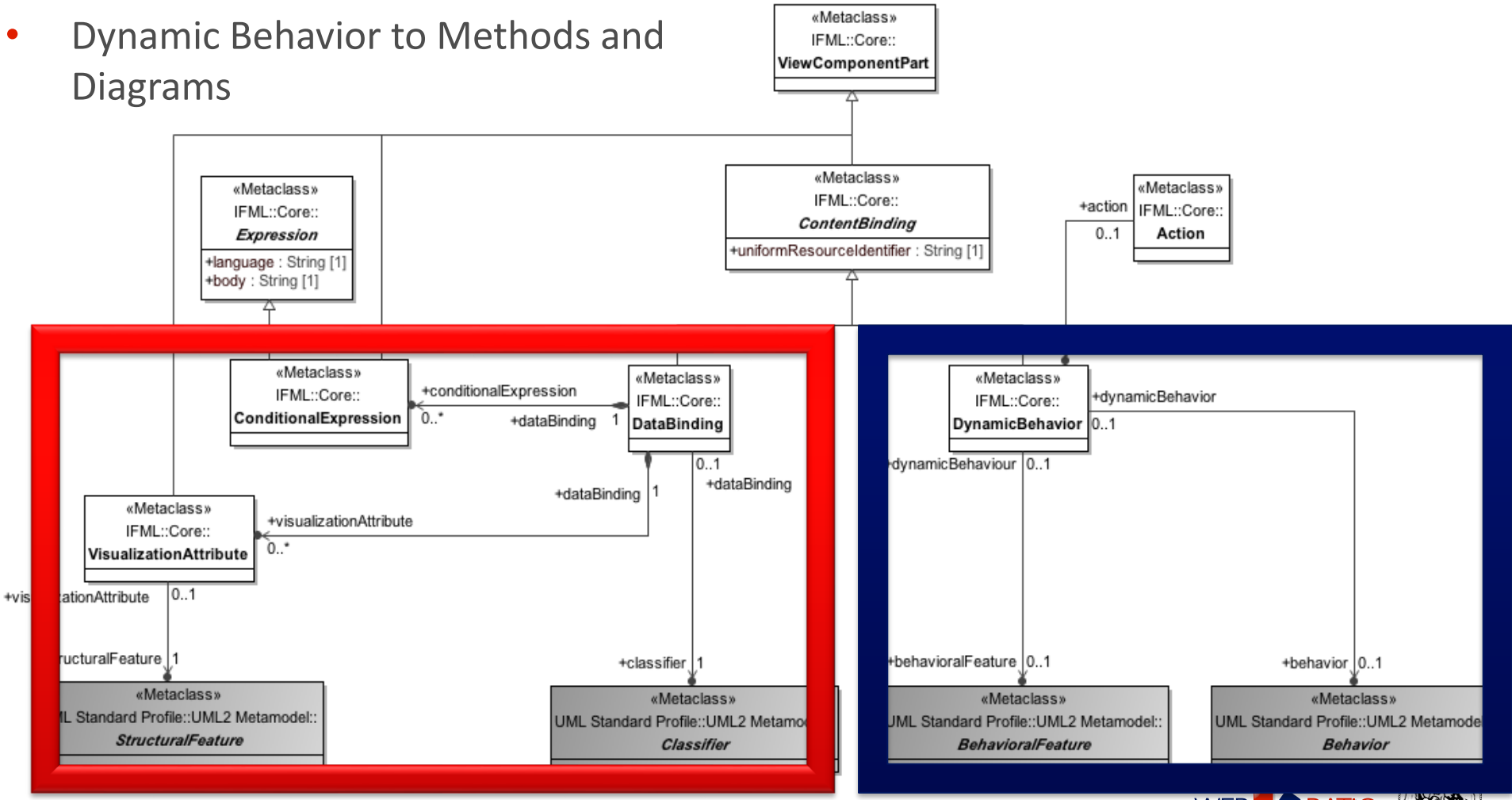
How does it work? IFML metamodel (1)

IFML is defined through a metamodel



IFML metamodel (2): Content Binding

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



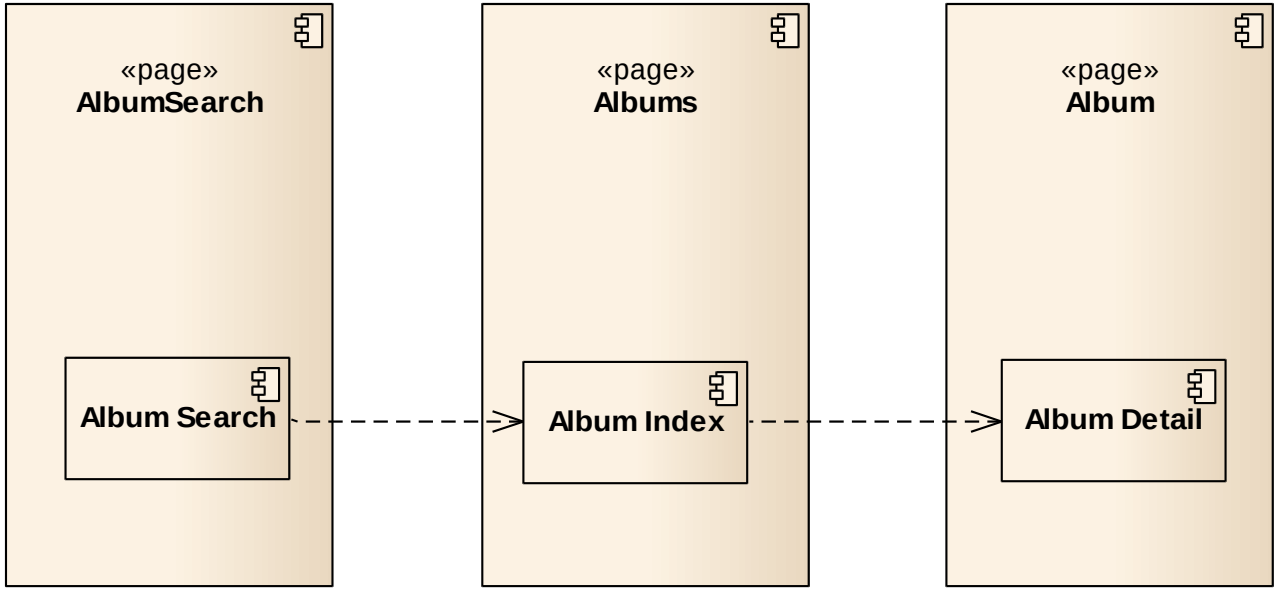
Practical results of having a standard

- 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

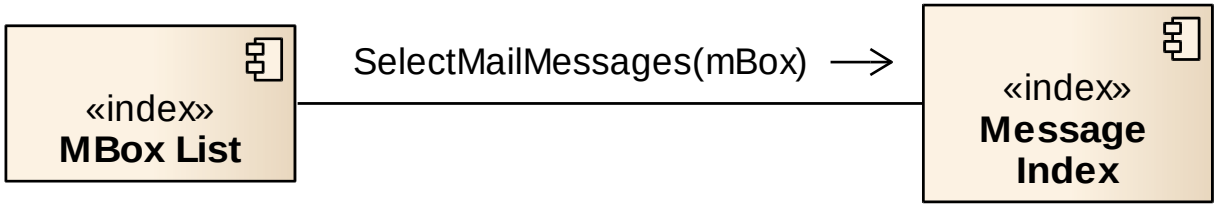
- All this, specified through standard notations themselves

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

Static aspects

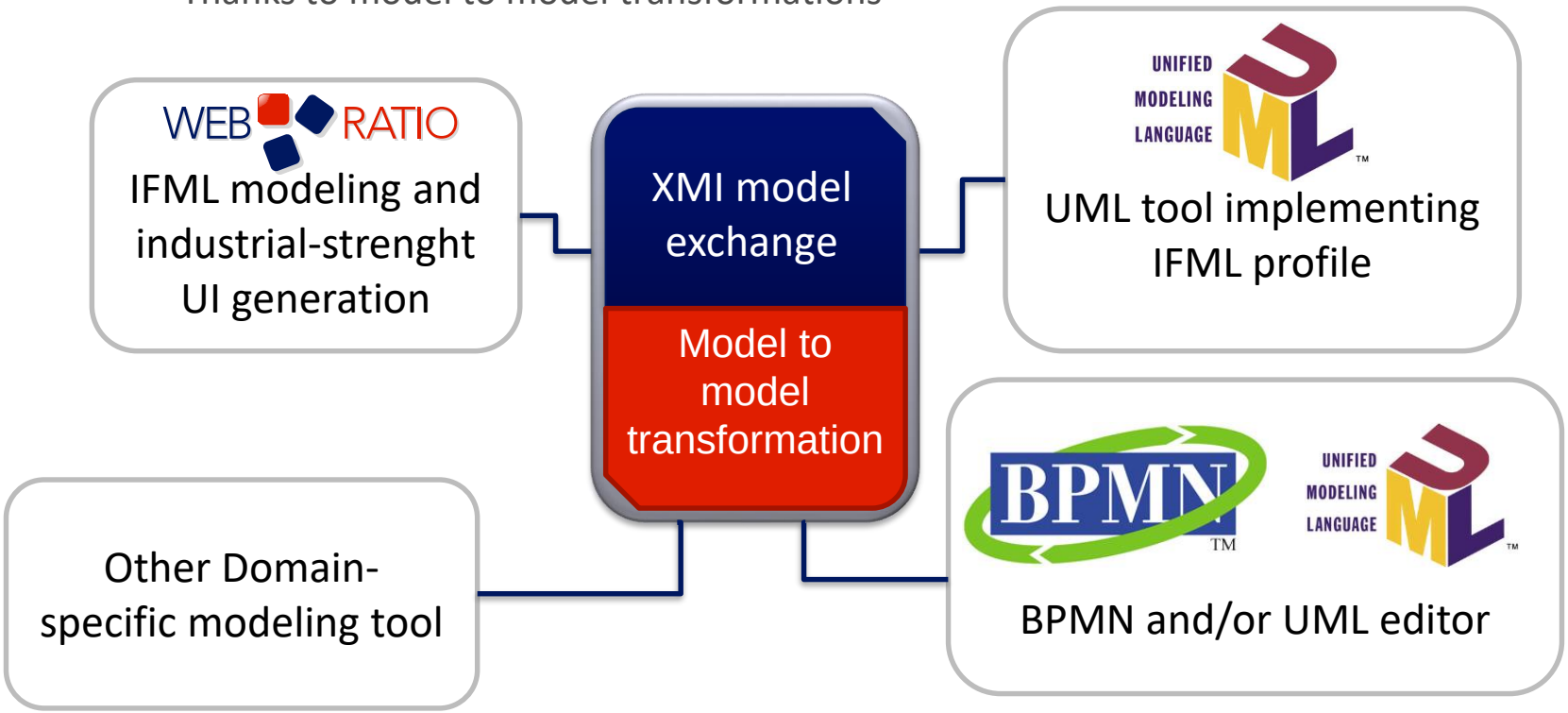


Dynamic aspects



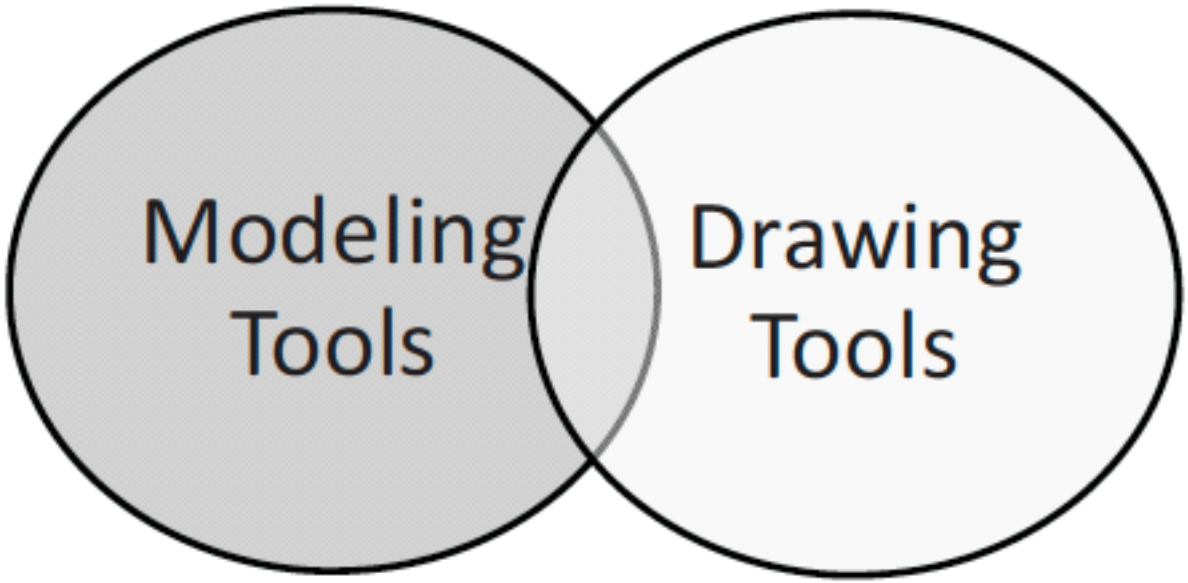
Model integration and interchange

- 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

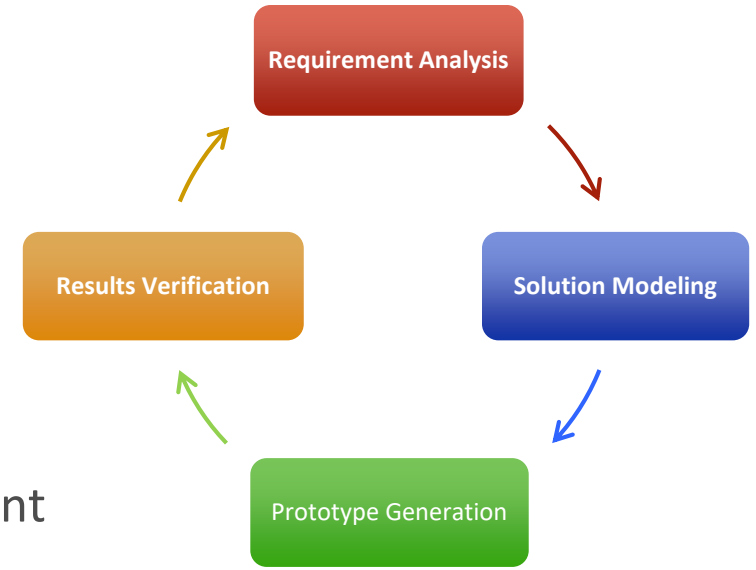
Drawing vs. modeling



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



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Some numbers

WebRatio is

- now at 7th 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

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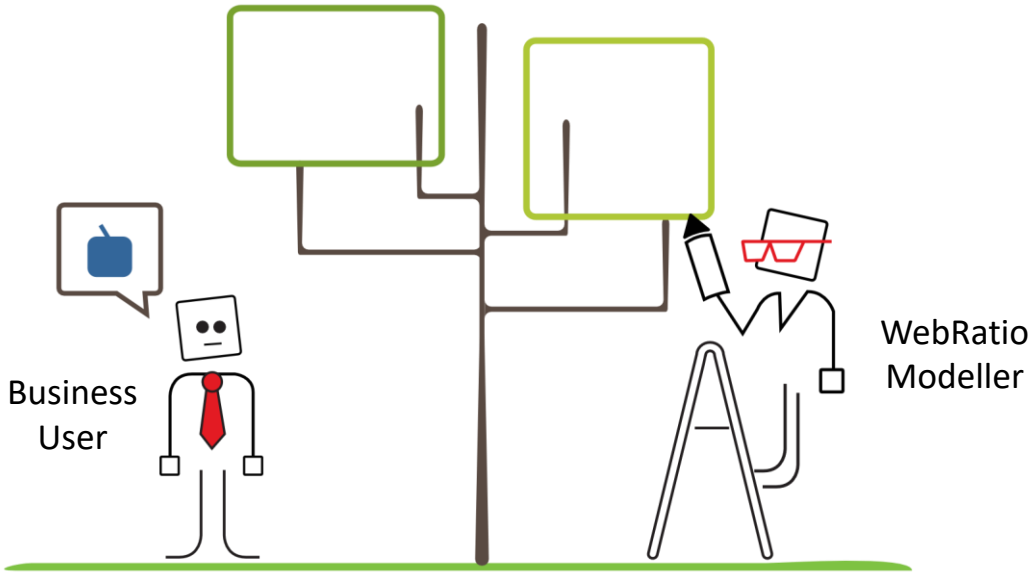
WebRatio – Step 1

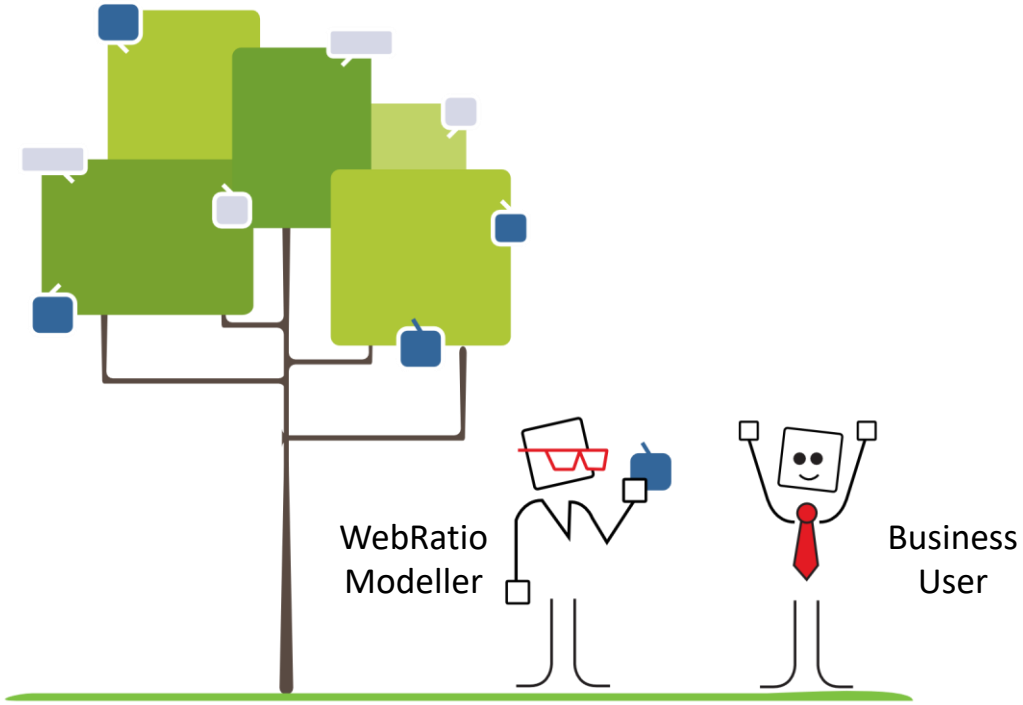
You capture business requirements in abstract, technology independent models



BPMN + IFML

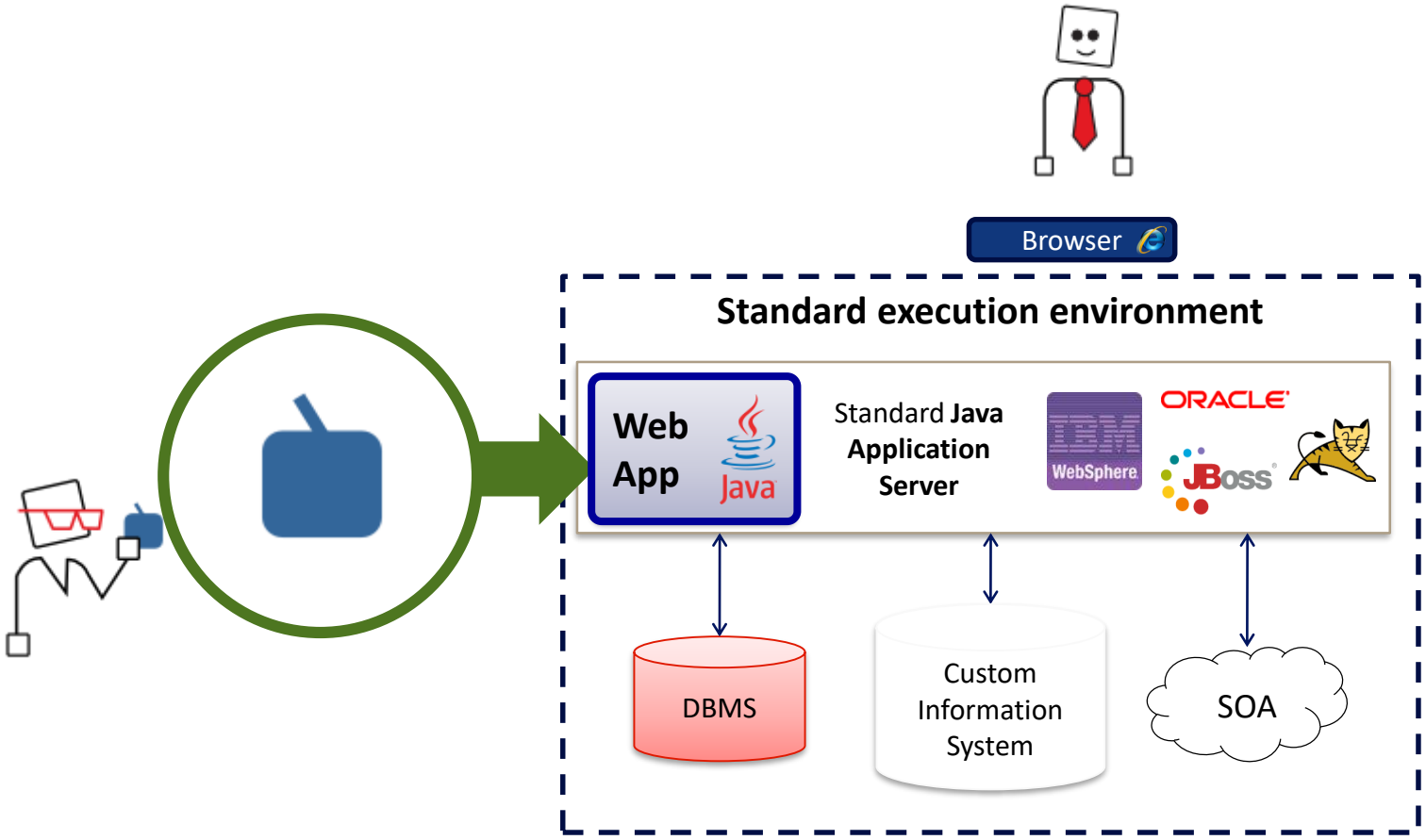
WebRatio – Step 3

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



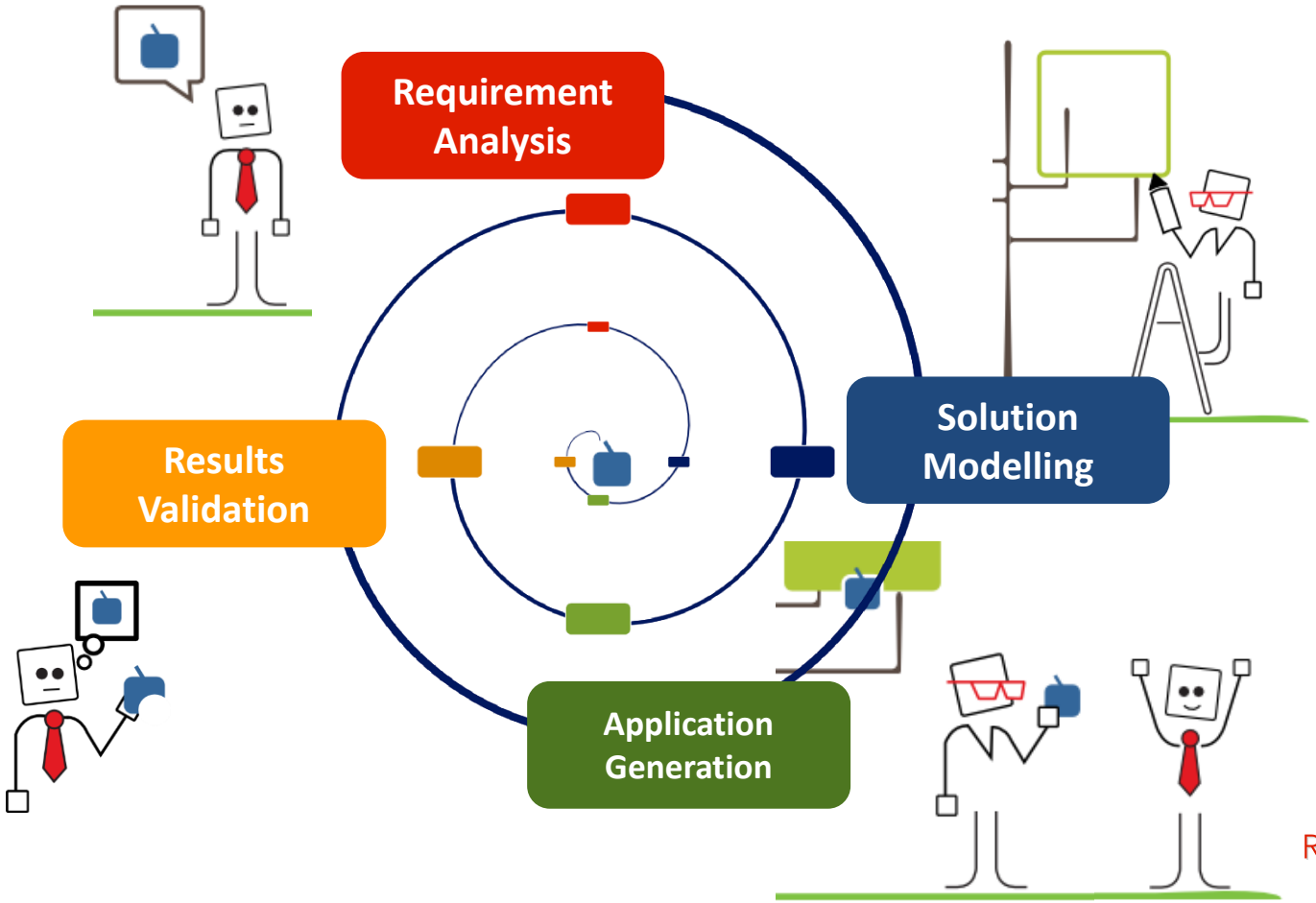
Code generation

Get the application



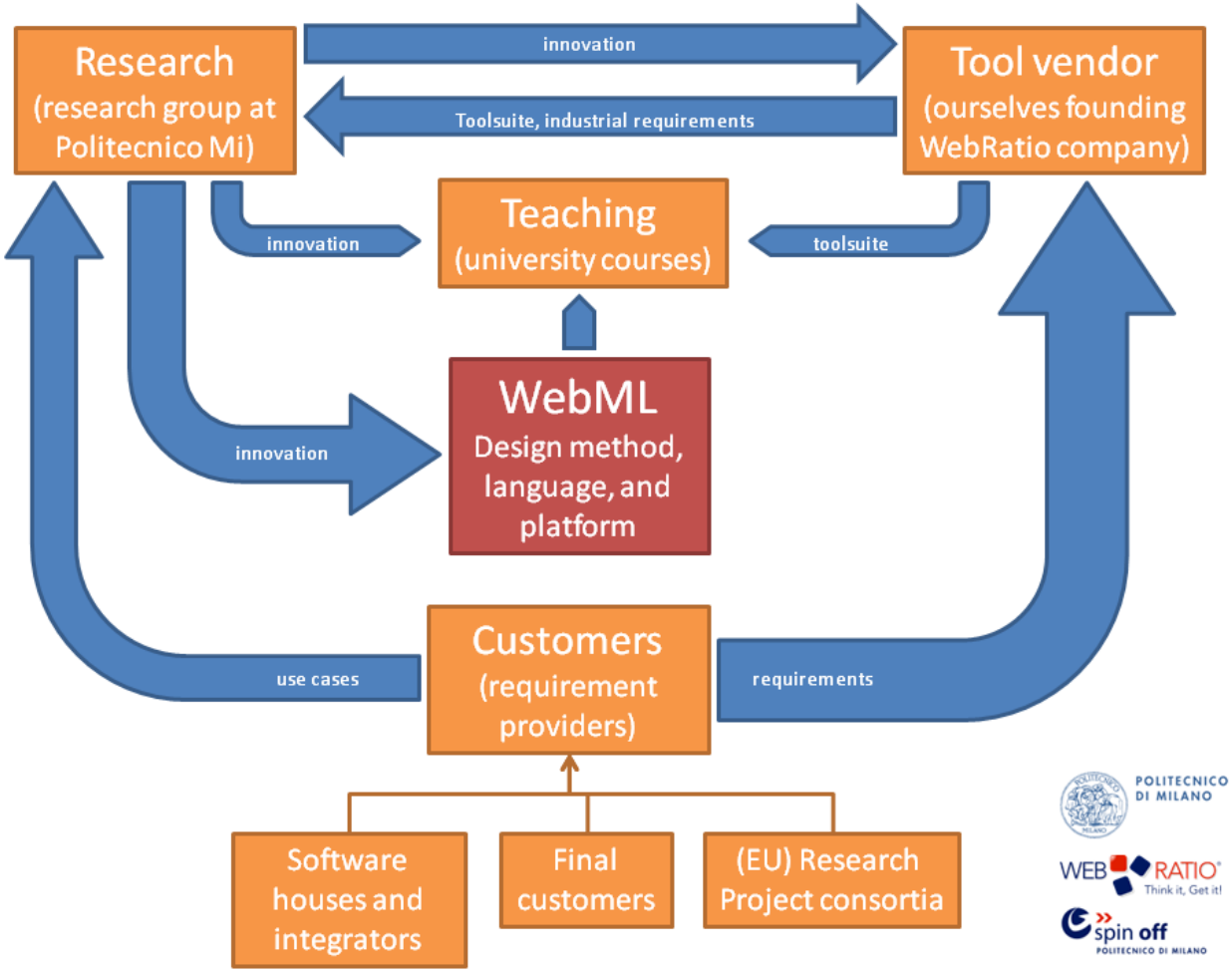
Agile, quick prototyping

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



RATIO

Our innovation environment



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spin off POLITECNICO DI MILANO

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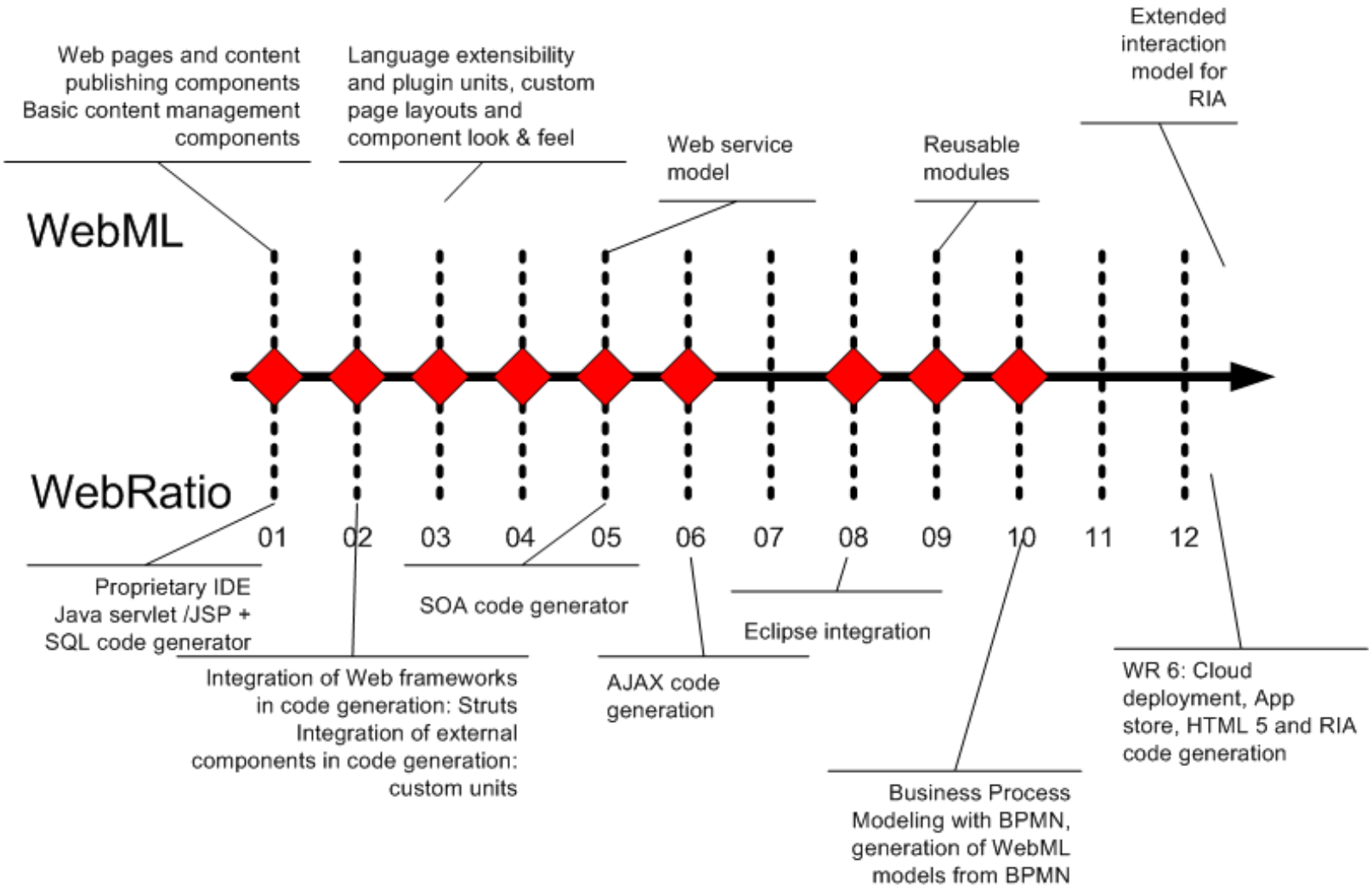
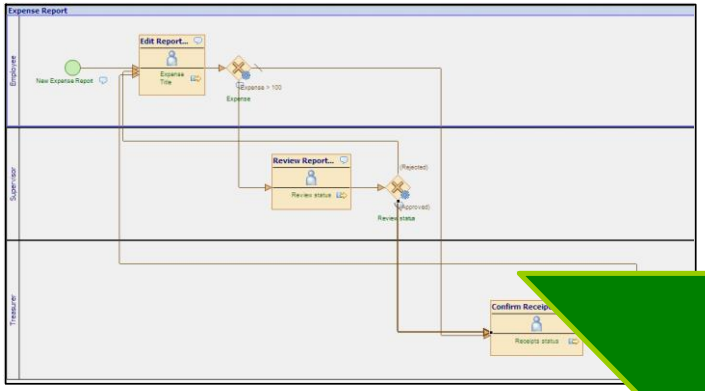
Evolution of tool (and language)



The final picture



Iterative refinement of the process enactment applications

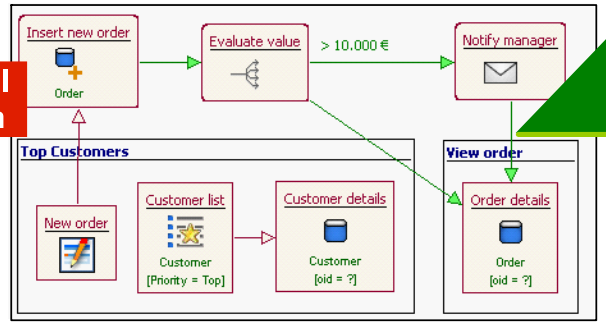
Business Process Model

Application model

Model to model transformation

Model to code transformation

Standard Java application



Iterative refinement of the activity execution applications

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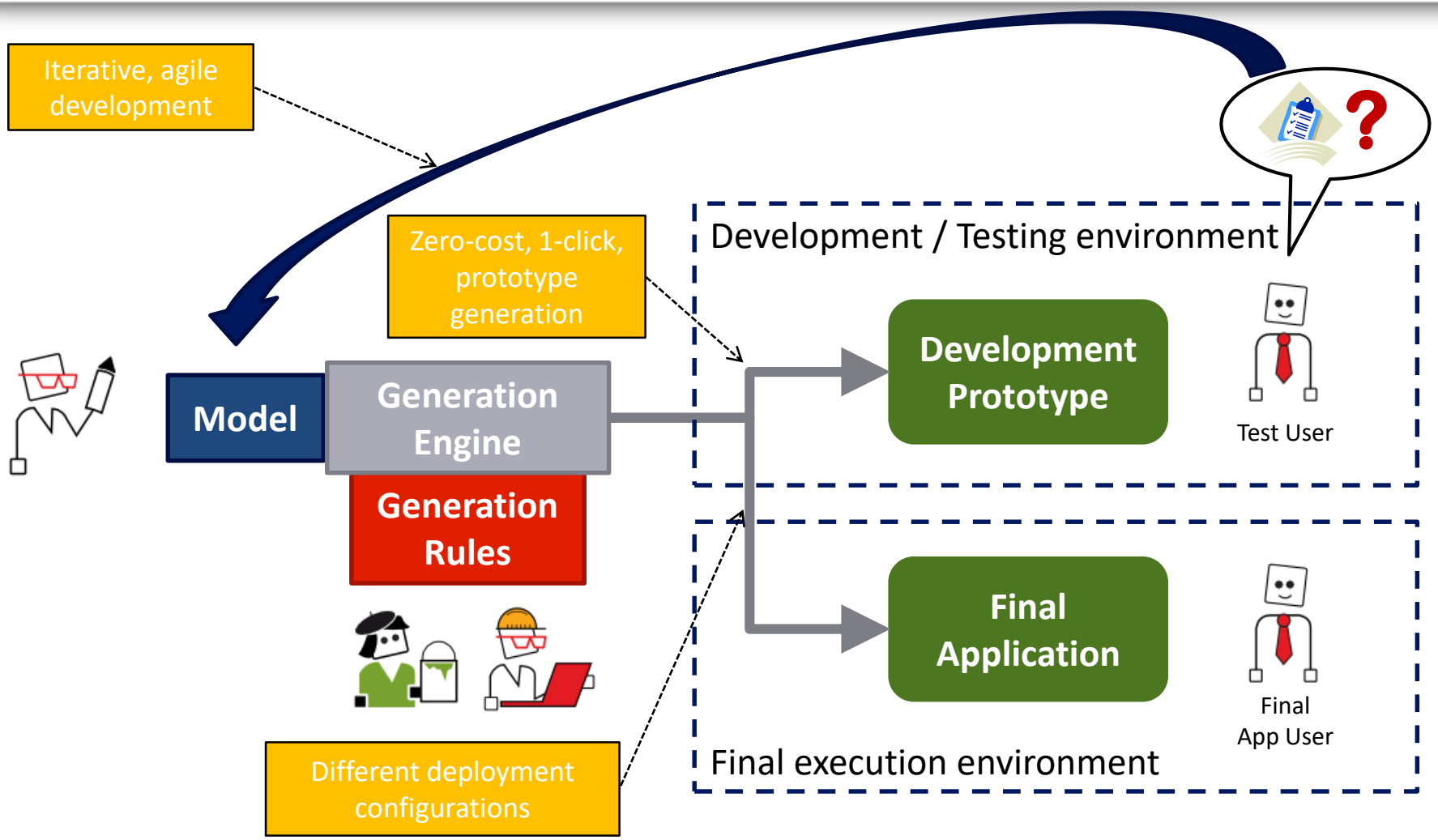
POLITECNICO MILANO

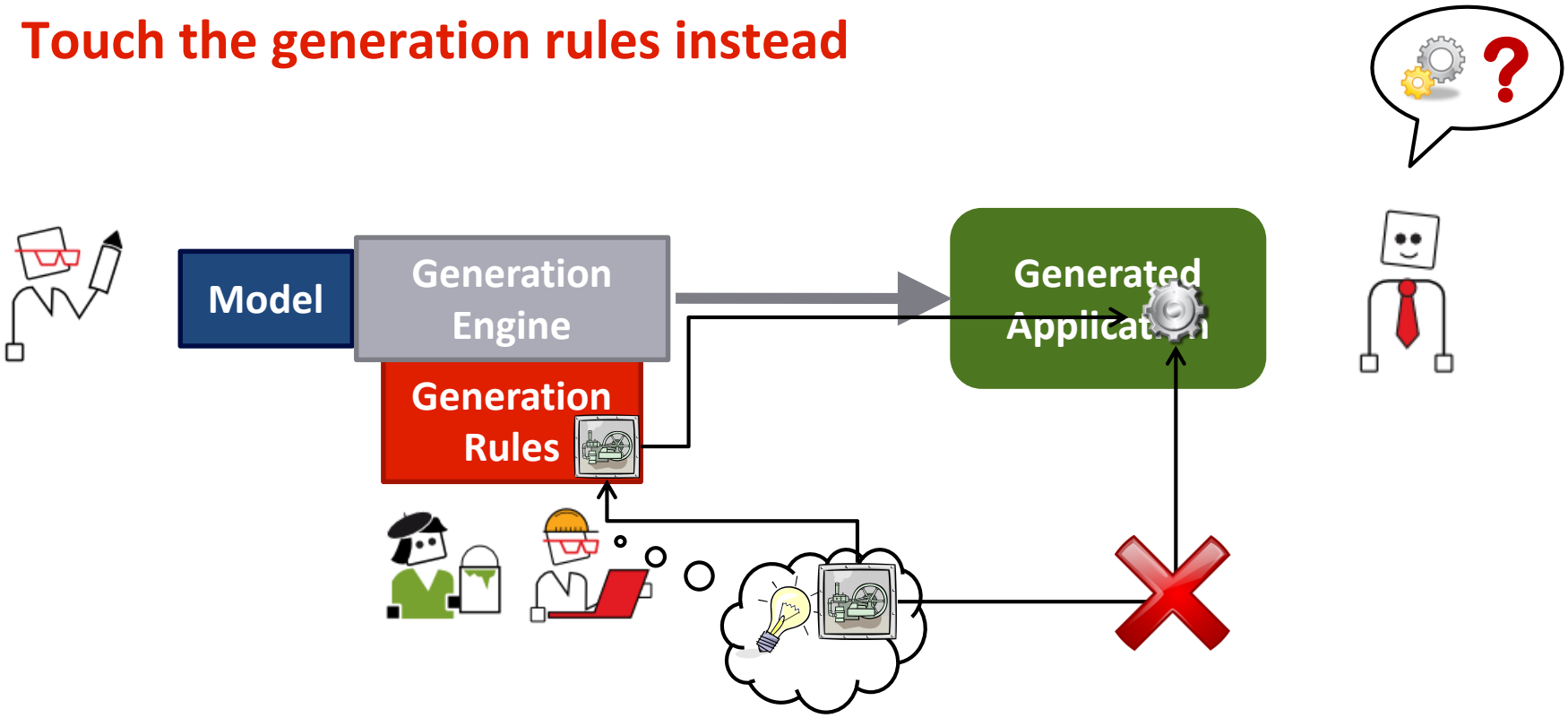
Agility + MDD


Iterative, agile development
Zero-cost, 1-click, prototype generation
Development / Testing environment
Development Prototype
Test User
Model
Generation Engine
Generation Rules
Final Application
Final App User
Final execution environment
Different deployment configurations

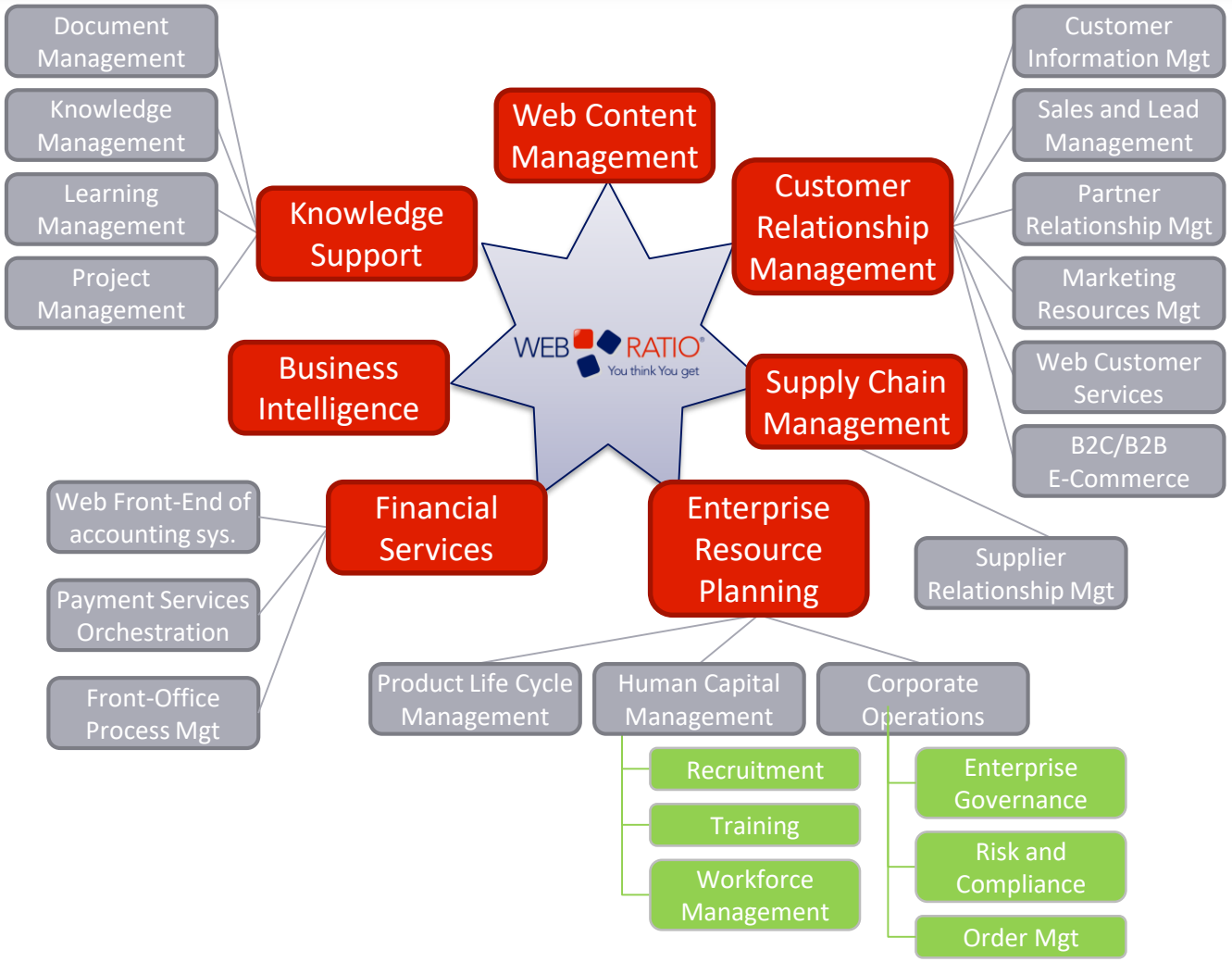
The MDE Virtuous Cycle

Do not change the generated application code

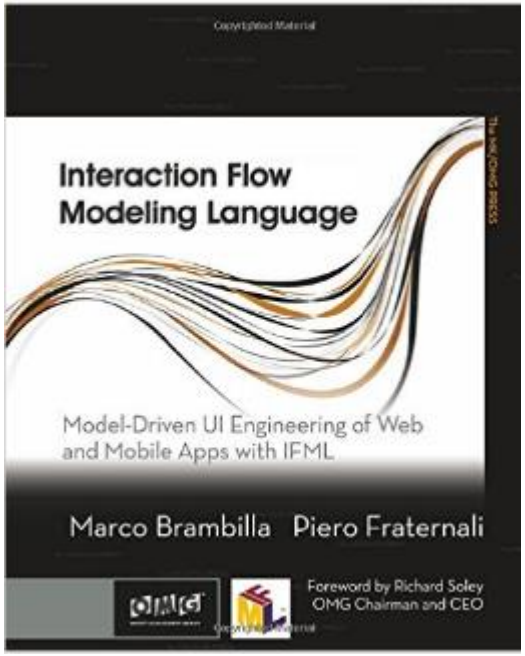
Touch the generation rules instead



Examples of application areas



Book references



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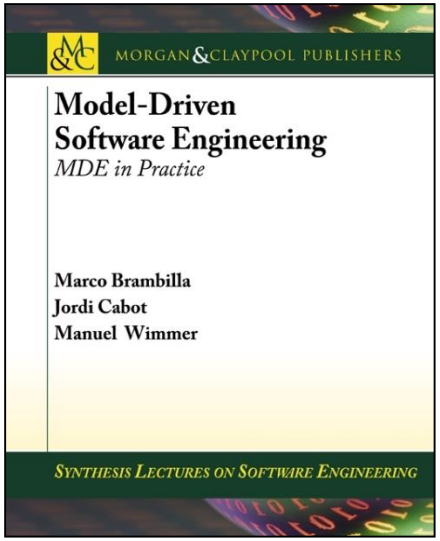
Brambilla, Fraternali,
Elsevier, 2015



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