

# INF5120

## ”Modellbasert Systemutvikling” ”Modelbased System development”

Lecture 15: 15.05.2017

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
- 27/2: Oblig 1: Smart Building – Business Architecture and App/Portal with IFML WebRatio UI for Smart Building
  
- March (8-11) (Modeling of IoT/CPS/Cloud, Services and Big Data – UML SM/SD/Collab, ThingML Server-Side):
- 8-6/3: Basis for DSL and ThingML -> UML State Machines and Sequence Diagrams
- 9-13/3: ThingML DSL - UML Composite structures, State Machines and Sequence Diagrams II
- 10-20/3: Guest lecture, "Experience with Modelling", Anton Landmark, SINTEF
- 11-27/3: ThingML part 2 and UML Service Modeling, Architectural models, SoaML. Role modeling and UML Collaboration diagrams
  
- April/May (12-14) (MDE – Creating Your own Domain Specific Language):
- 12-3/4: Model driven engineering – Metamodels, DSL, UML Profiles, EMF, Sirius Editors – intro to Oblig 3
  
- EASTER – 10/4 og 17/4
- 20/4: Oblig 2: Smart Building – Individual and group delivery - Internet of Things control with ThingML – Raspberry Pi, Wireless sensors (temperature, humidity), actuators (power control)
  
- 13-24/4: MDE transformations, Non Functional requirements – Discussion of Oblig2 and 3
- 1. Mai – Official holiday
- 4/5: Oblig 3 - Your own Domain Specific Language – (ArchiMate) (Delivery – Thursday May 4<sup>th</sup> )
- 14-8/5: Archimate 2.0/3.0 (Oblig 3) and Xtext (for ThingML) and NFR (Discussion of Oblig 2/ 3)
  
- May (15-17): (Bringing it together)
- 15-15/5: Summary of the course – Final demonstrations (ESITO and/or GENUS), <http://www.esito.no/> and <https://www.genus.no/>
- 16-22/5: Previous exams – group collaborations (Guest lecture – ThingML language development, with Xtext, Franck Flerey SINTEF)
- 17-29/5: Conclusions, Preparations for the Exam by old exams
- June (Exam)
- 13/6: Exam (4 hours), Tuesday June 13<sup>th</sup>, 0900-1300

# Content

- Part 1: Business Architecture, Information/Class-modeling and Client-side Modeling - User Interfaces with IFML and WebRatio - OBLIG 1 (Lecture 2-7)
- Part 2: Server-side Modeling – ThingML, UML 2.0, Service Modeling (SoaML) – OBLIG 2 (Lecture 8-11)
- Part 3: MDE – Model Driven Engineering (Meta models, Editors and model transformations) for Domain Specific Languages (Sirius, EMF and Xtext), (Examples: IFML, ThingML, UML, SoaML, Archimate, BPMN, ...), – OBLIG 3 (Lecture 12-16)

# INF5120 and INF9120

## ”Modelbased System development”

Lecture 2: 23.01.2017

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## Oblig 1 – “SmartBuilding - Business Architecture and Requirements Model and first WebApp”

*Individual project on creating a Web App for information about yourself.*

*Group project on SmartBuilding Lean Business Model Canvas and Requirements Modelling with user stories and use cases - and user interface with WebRatio Web platform.*

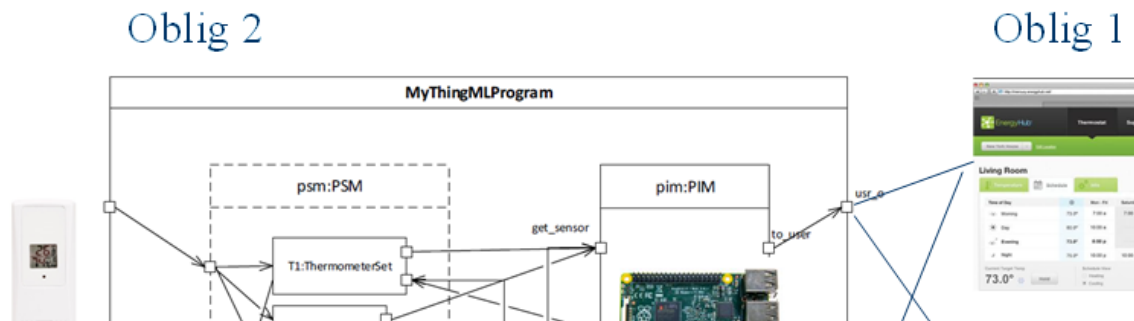
Groups of 1-2-3-4 persons - Group and individual report Submission date: March 6th, 2017

Group presentations (on parts of the Oblig):

- February 20<sup>th</sup>: Lean Business Model Canvas – VDMBee and User stories (3 groups)
- February 27<sup>th</sup>: User stories with some related Use cases w/template – and Individual App implementation (3 groups)
- March 6<sup>th</sup>: Oblig 1 Project presentations with WebRatio web app (3 groups)

### Description:

SmartBuilding is a new business idea for a possible startup company conceptualised for the INF5120 class at the University of Oslo for the fall of 2017.

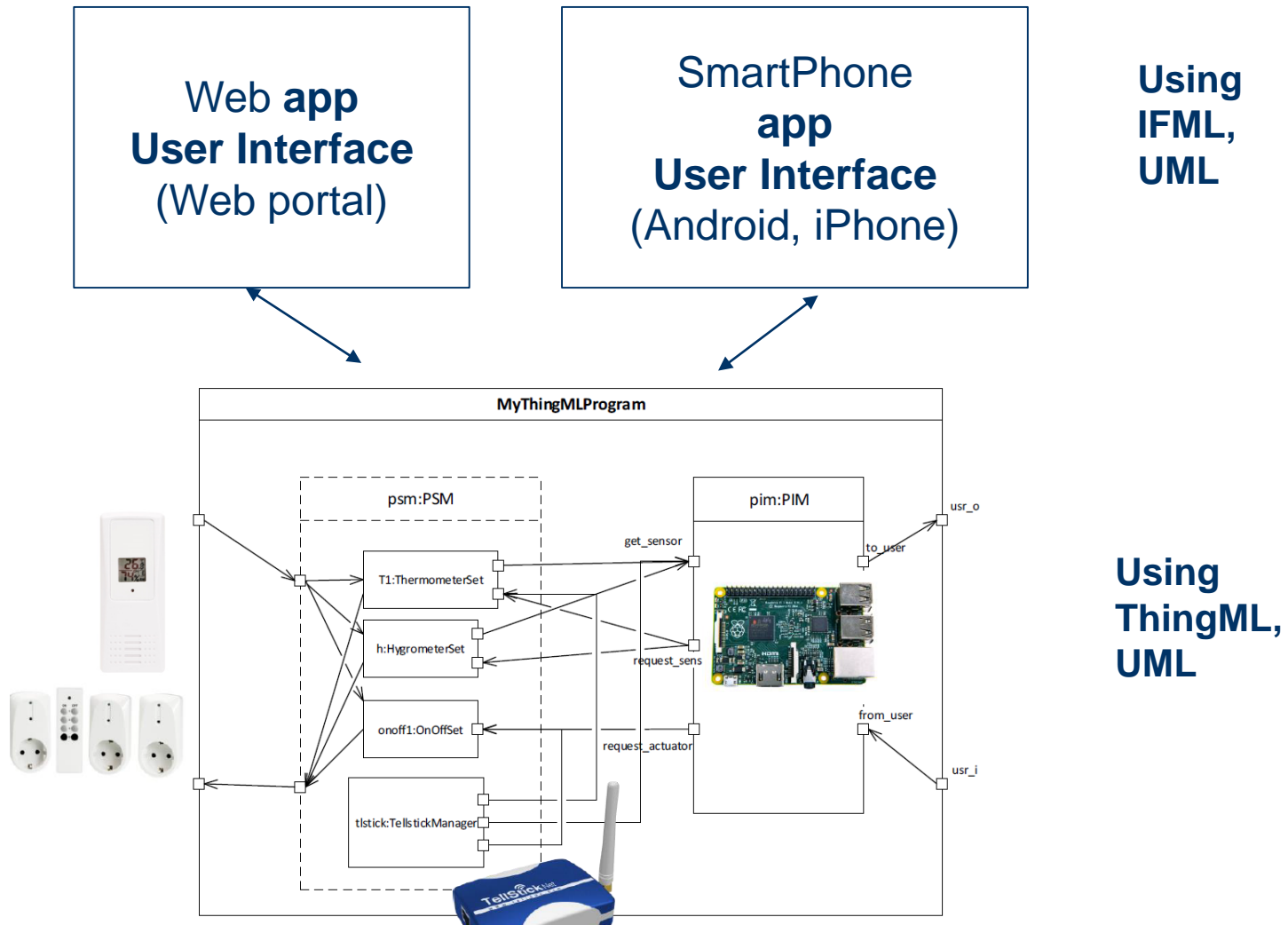


# This Lecture, January 23, 2017

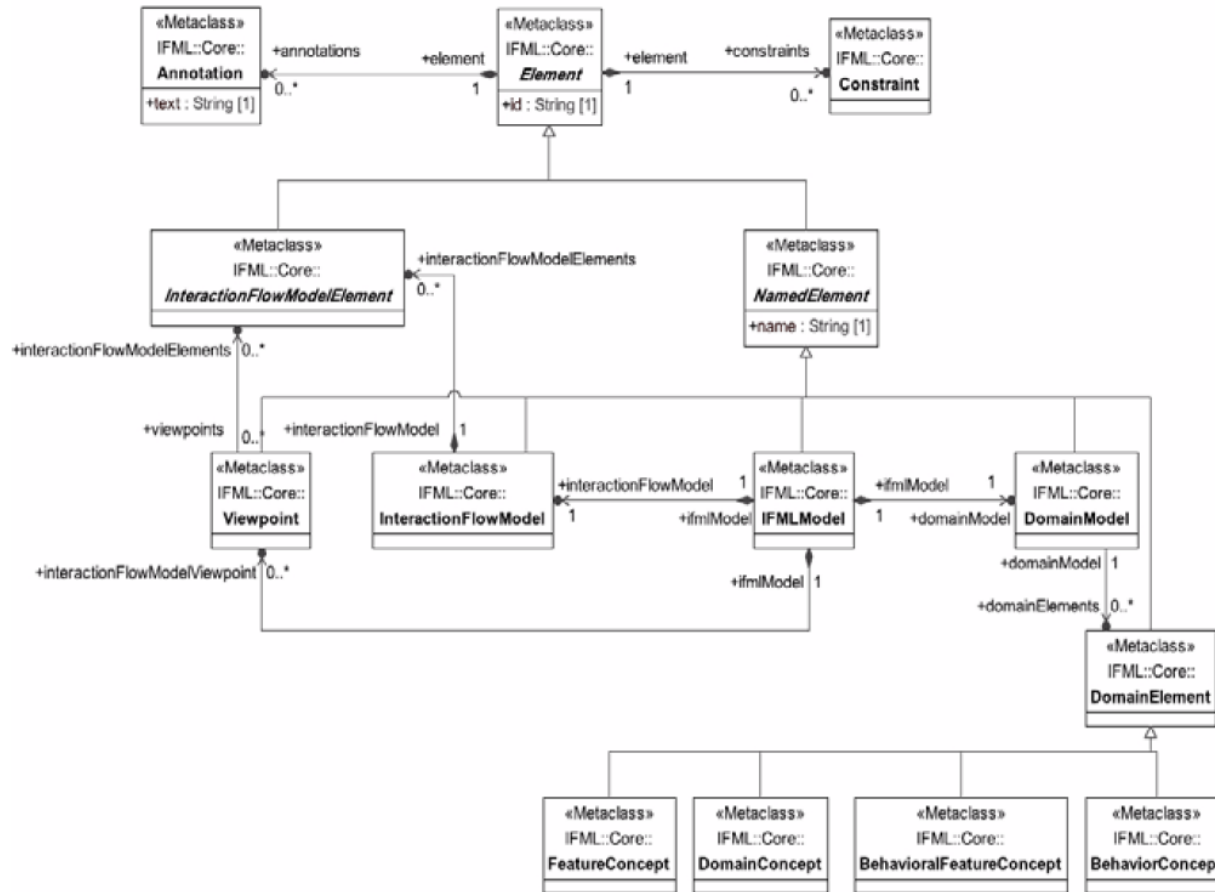
## Modeling structure and behaviour (UML and UML 2.0)

- Introduction to OBLIG, "Smart Building" with Web Portal and Mobile App development and control of Raspberry Pi with connected wireless sensors and actuators.

# "Smart Building" - Project for spring 2017



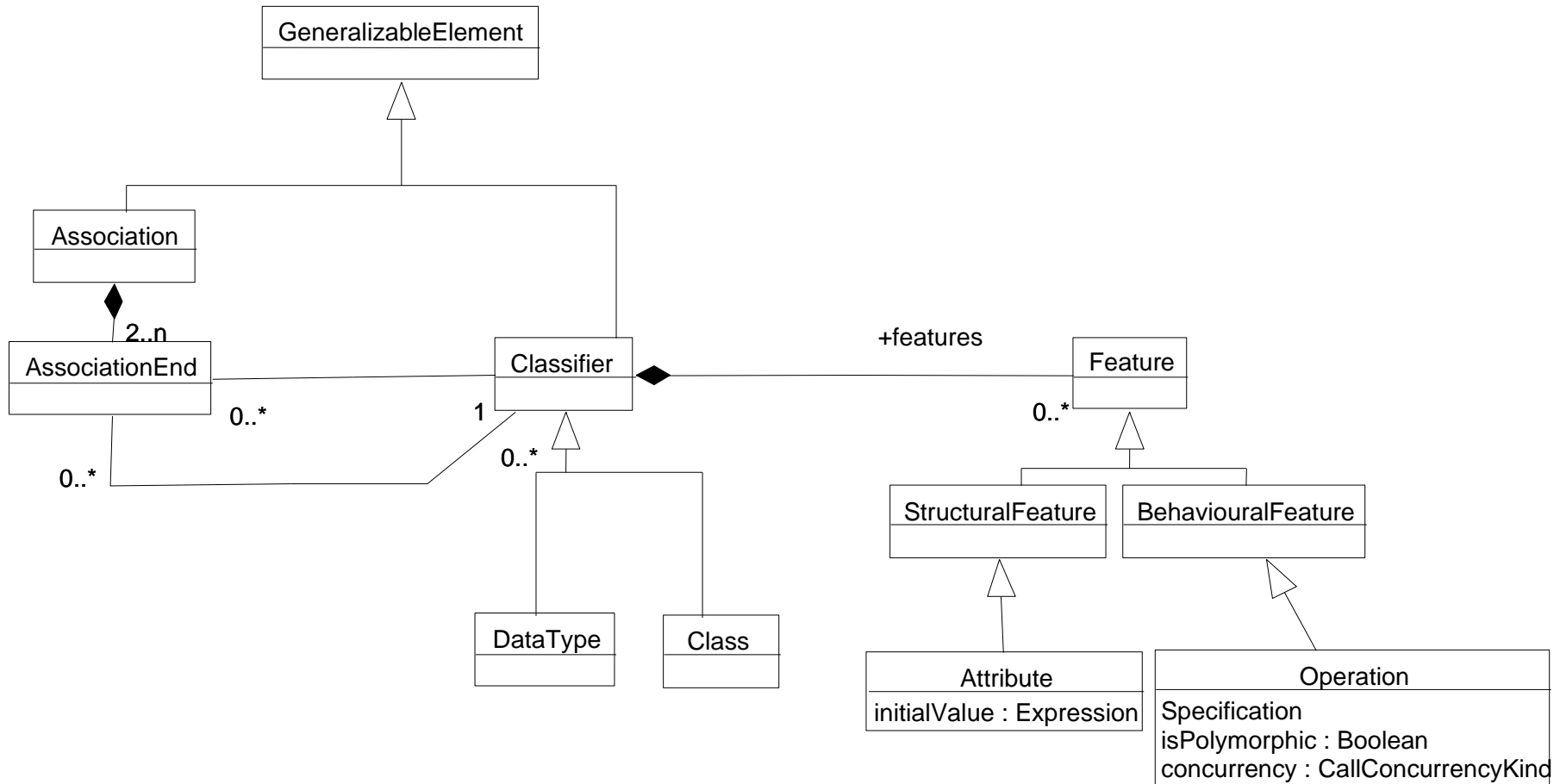
# Models and MetaModels



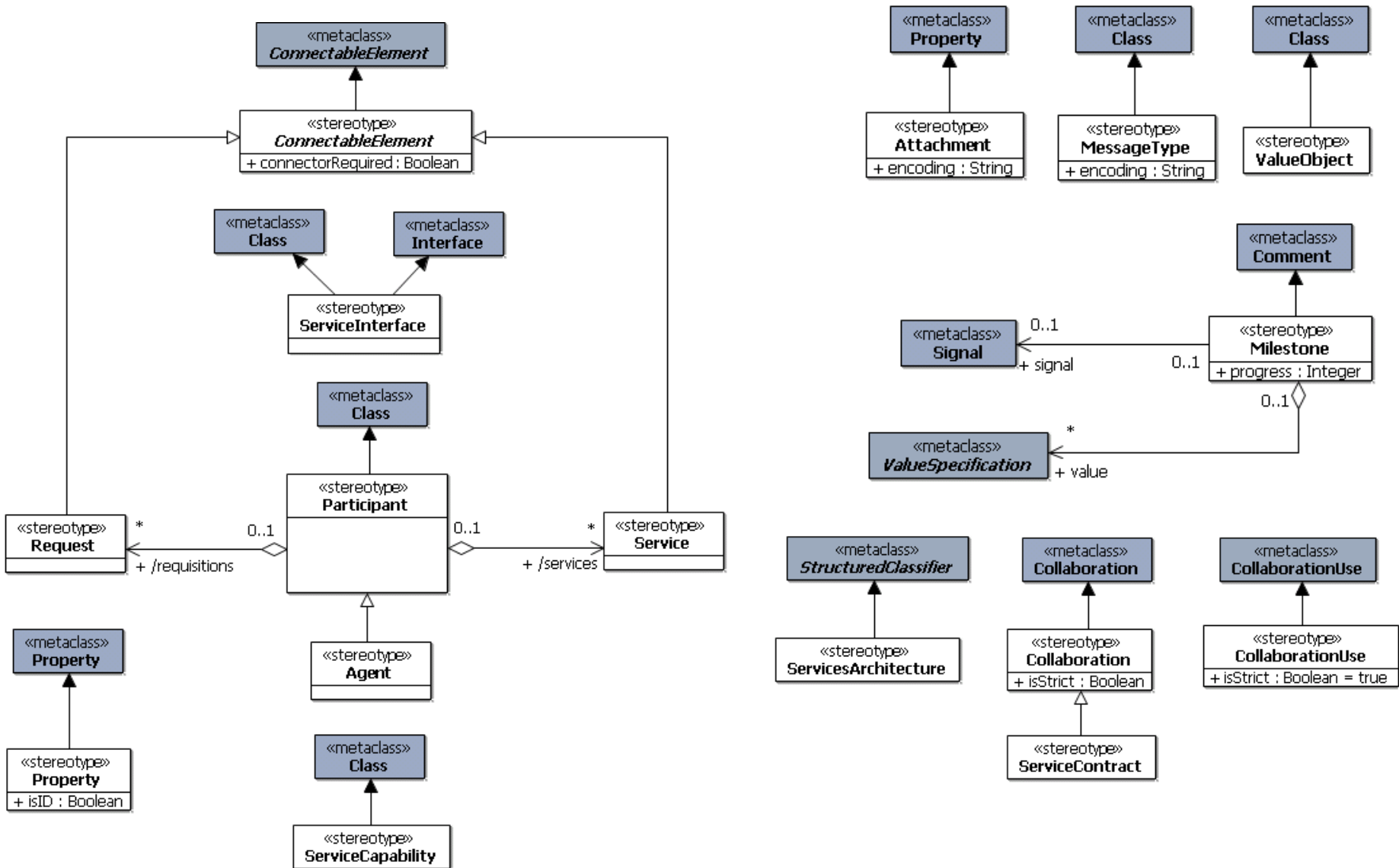
Parts of IFML Metamodel



# Parts of UML Metamodel



# SoaML UML Profile & Metamodel



# INF5120 and INF9120

## ”Modelbased System development”

Lecture 3: 30.01.2017

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**This Lecture, January 30, 2017**

**Introduction to Web and App UI development  
with WebRatio (with IFML)**

# WebRatio, [www.webratio.com](http://www.webratio.com)

80% MAINTENANCE COST CUT >

900% PRODUCTIVITY INCREASE >

50% TIME-TO-MARKET CUT >

CHOOSE YOUR WEBRATIO PLATFORM TO ENTER THE MARKET

**IFML**

**MOBILE PLATFORM**  
Build amazing mobile apps in days, not months, without writing a single line of code.  
[LEARN MORE](#)

**BPM PLATFORM**  
Build tailored BPM applications with a fine-grained user experience definition.  
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**WEB PLATFORM**  
Focus on creative tasks and build composite web applications in a fraction of the time.  
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**ENTERPRISE PLATFORM**  
Build omni-channel applications with a consistent user experience.  
[LEARN MORE](#)

The advertisement features a woman working at a desk in the background. The 'IFML' label is positioned above the platform cards, with two arrows pointing to the 'MOBILE PLATFORM' and 'WEB PLATFORM' cards.

# INF5120 and INF9120

## ”Modelbased System development”

Lecture 4: 06.02.2016

Arne-Jørgen Berre

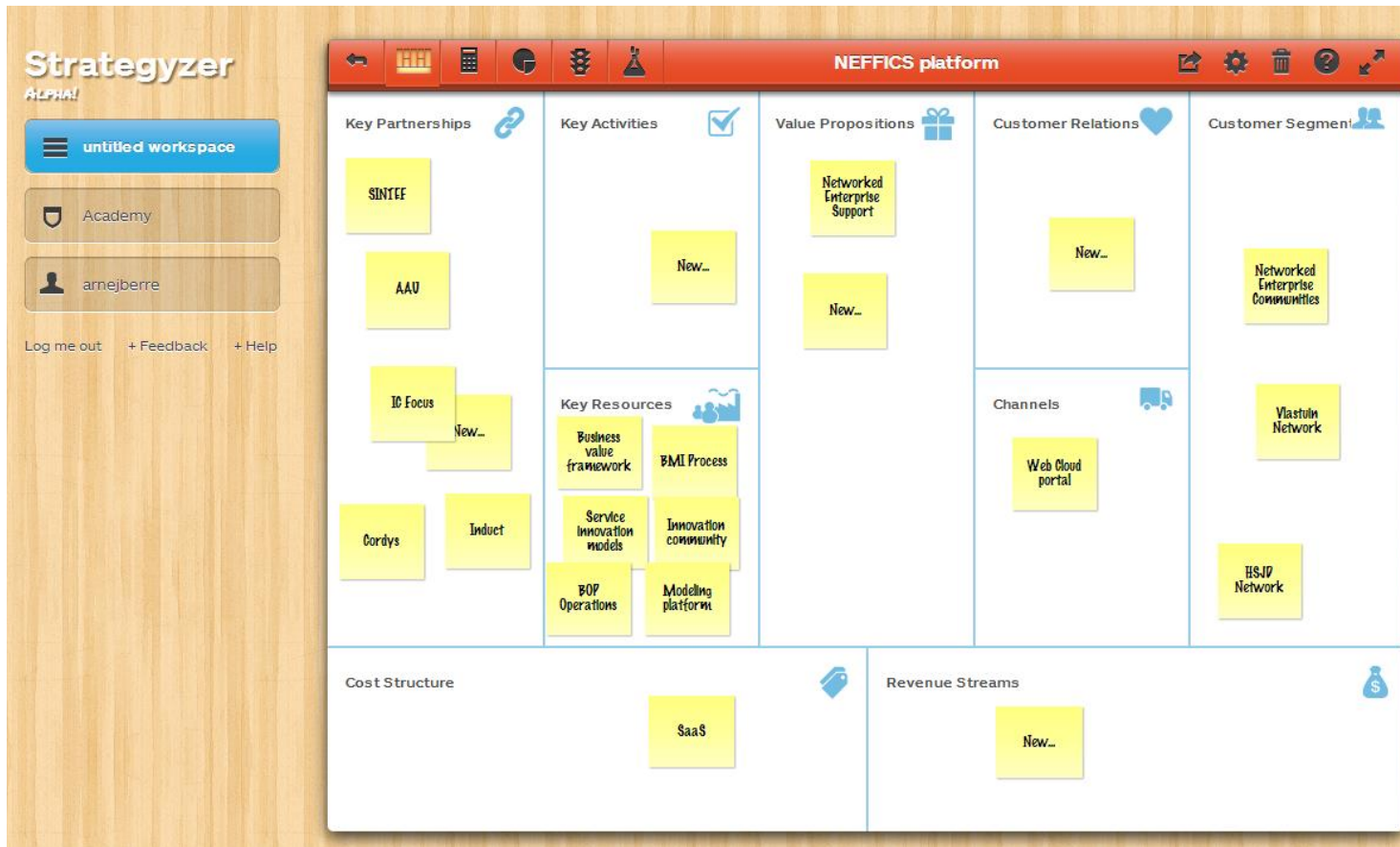
[arneb@ifi.uio.no](mailto:arneb@ifi.uio.no) and [Arne.J.Berre@sintef.no](mailto:Arne.J.Berre@sintef.no)

# This lecture, February 6, 2017

## Business Architecture, Business Engineering and Business Model Canvas

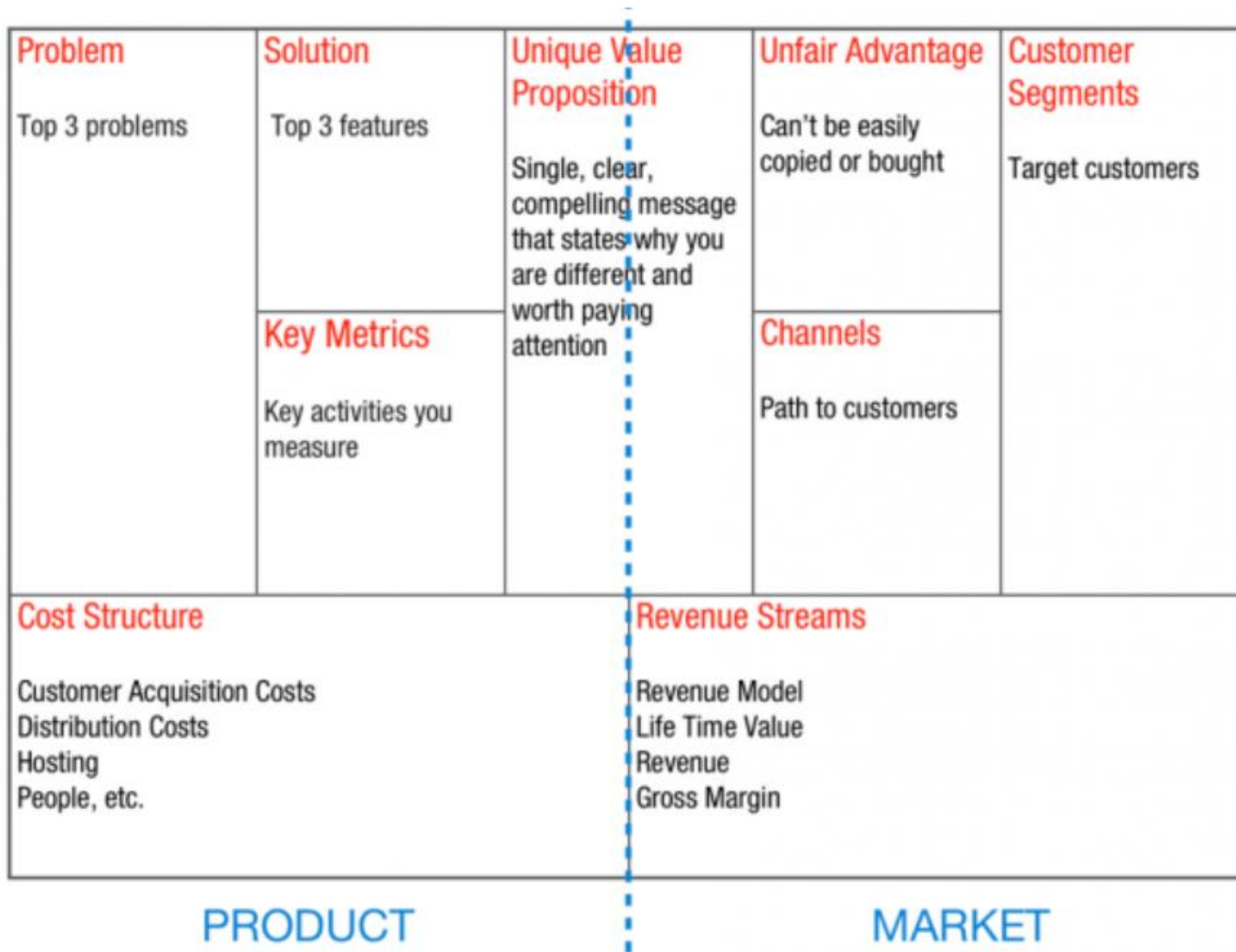
- Introduction to Agile development
- Introduction to Team management – using Upvawe.io – for Scrum and Kanban
- Business Modeling, Business Engineering
- Lean Startup – Lean Canvas

# Strategyzer (Osterwalder)

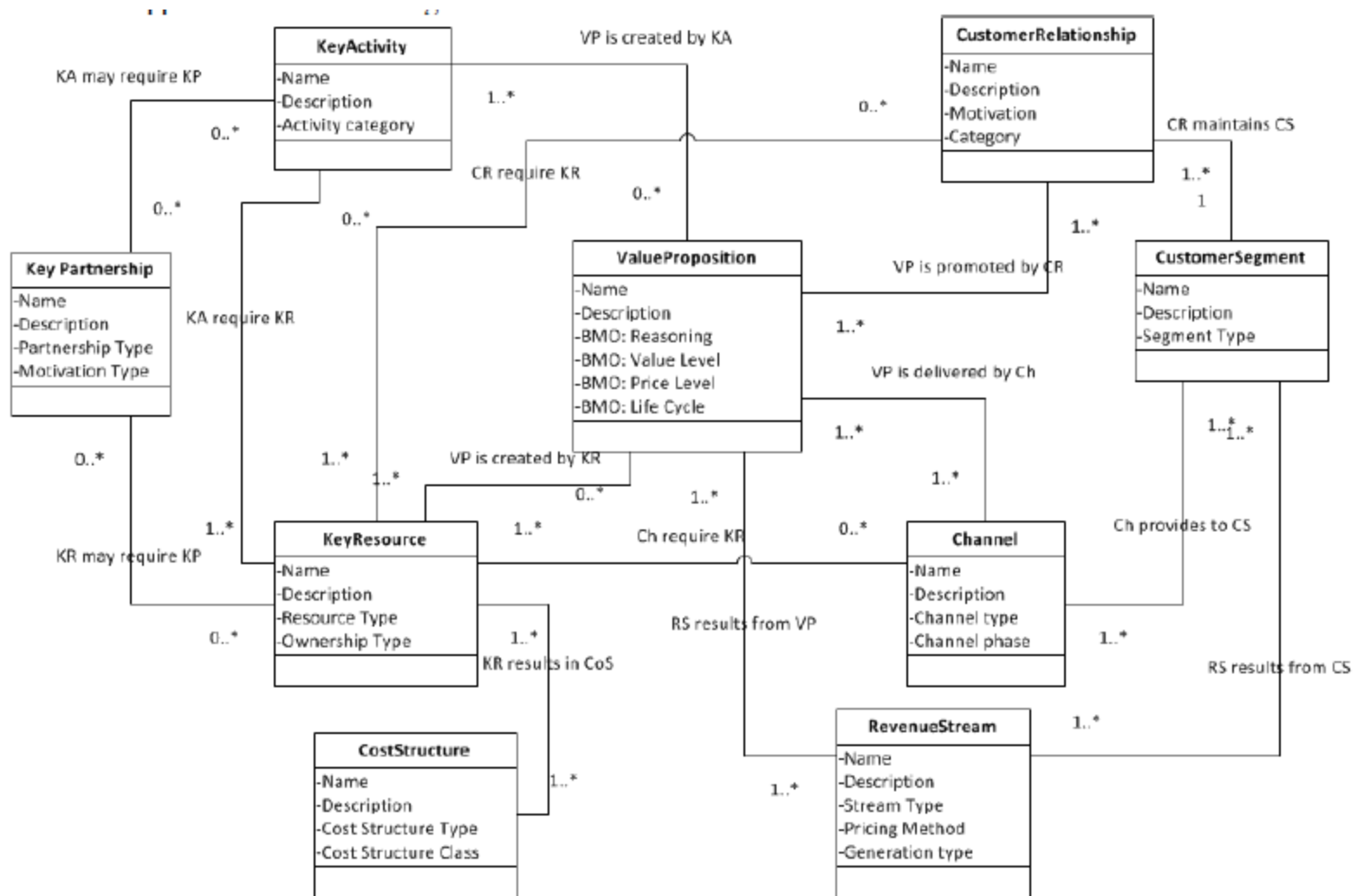




# Lean Canvas



# Business Model Canvas Metamodel



# INF5120 and INF9120

## ”Modelbased System development”

Lecture 5: 13.02.2016

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# This lecture, February 13, 2017

## IFML and WebRatio

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

# IFML Objectives



Content

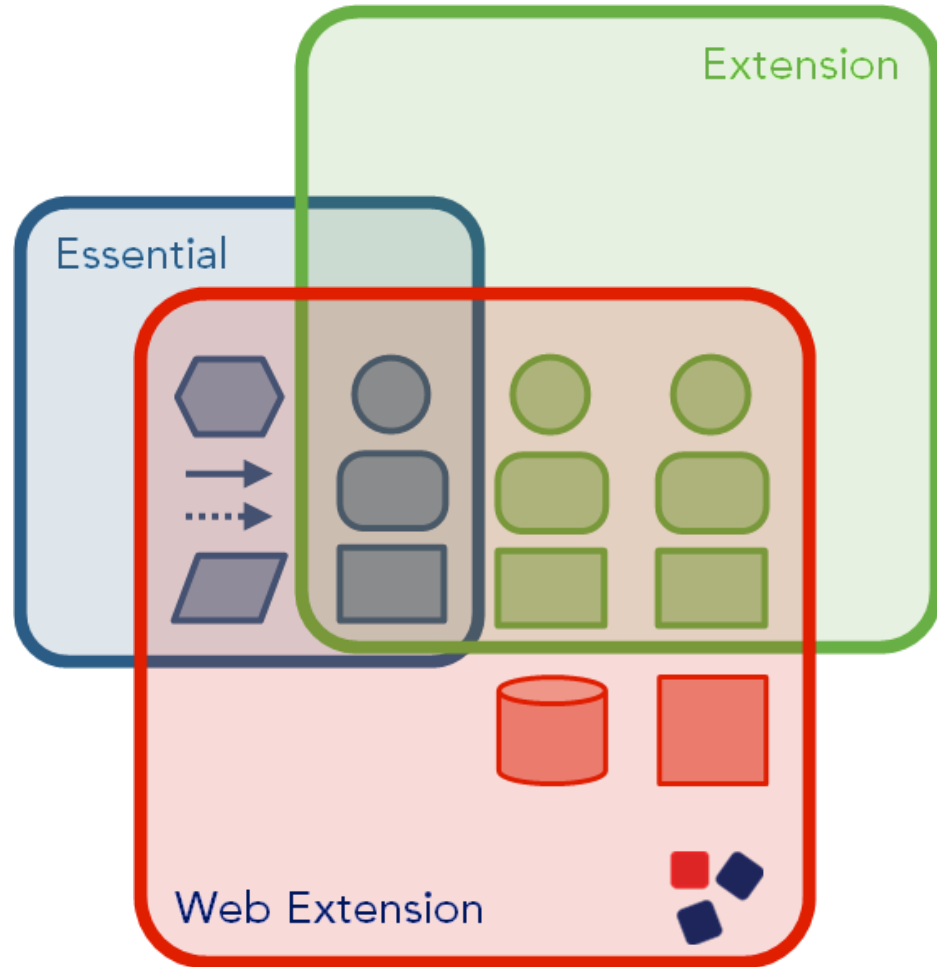
Navigation Path

Event

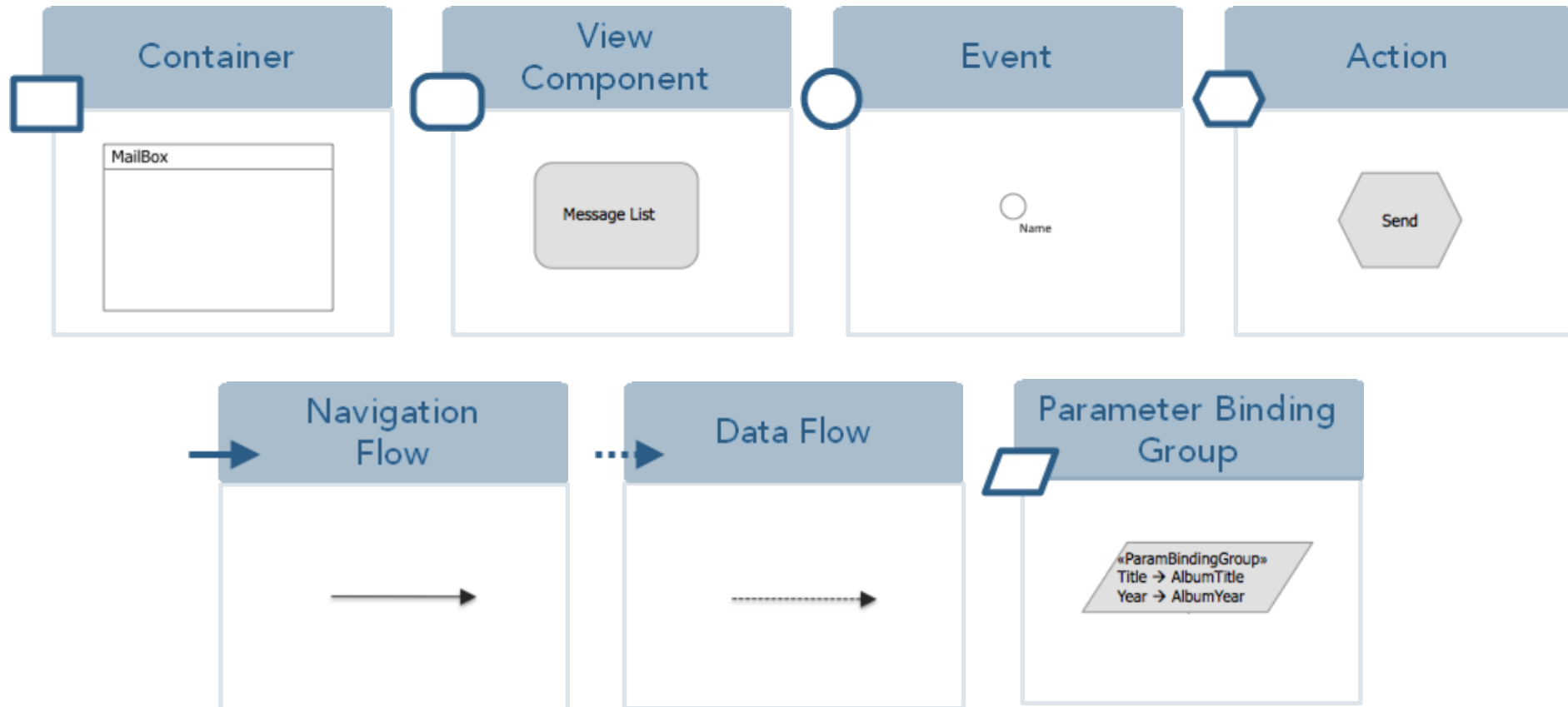
Binding to  
Business Logic

Binding to  
Persistence Layer

# IFML Overview

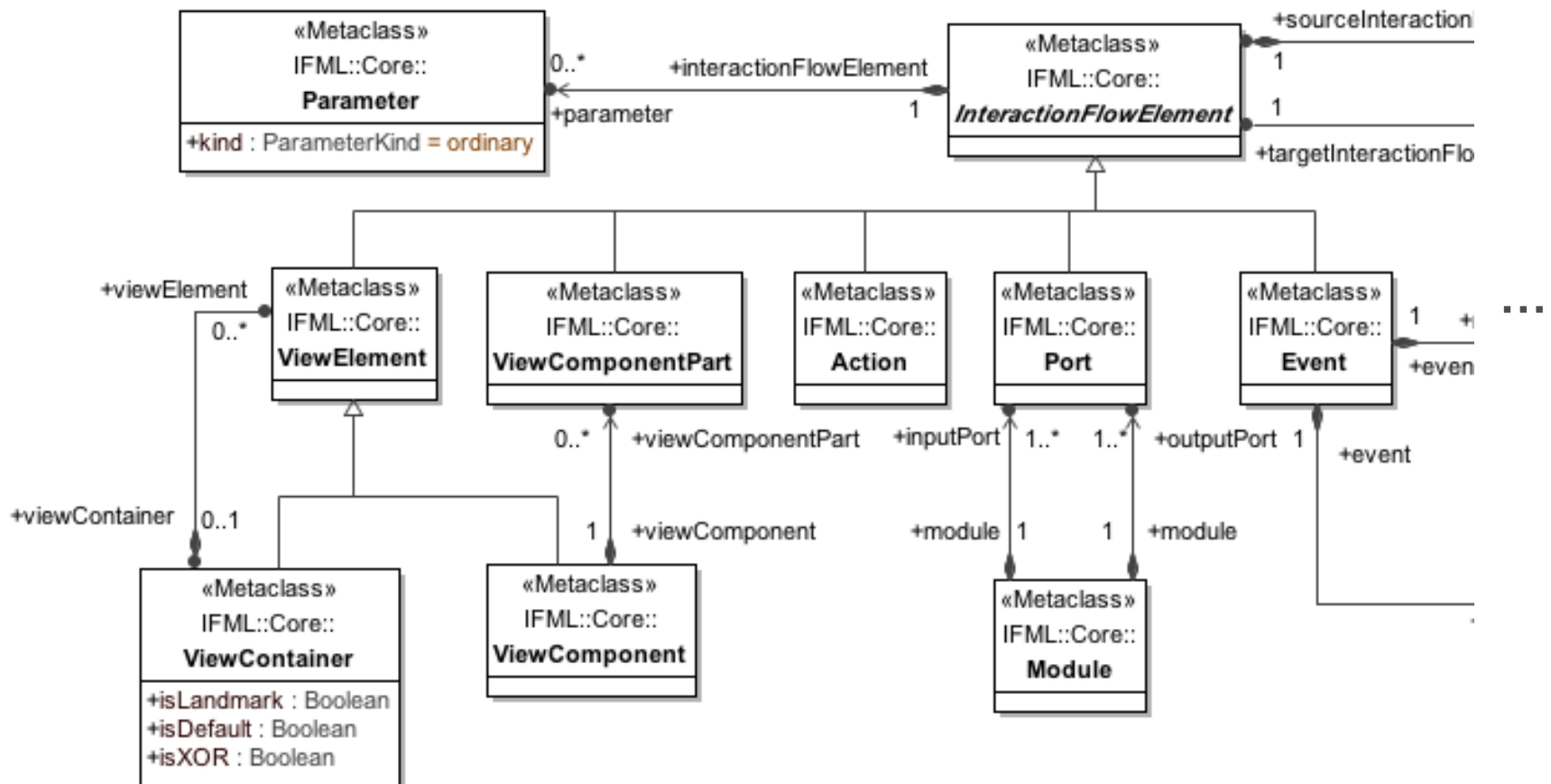


# IFML Essentials



# How does it work? IFML metamodel (1)

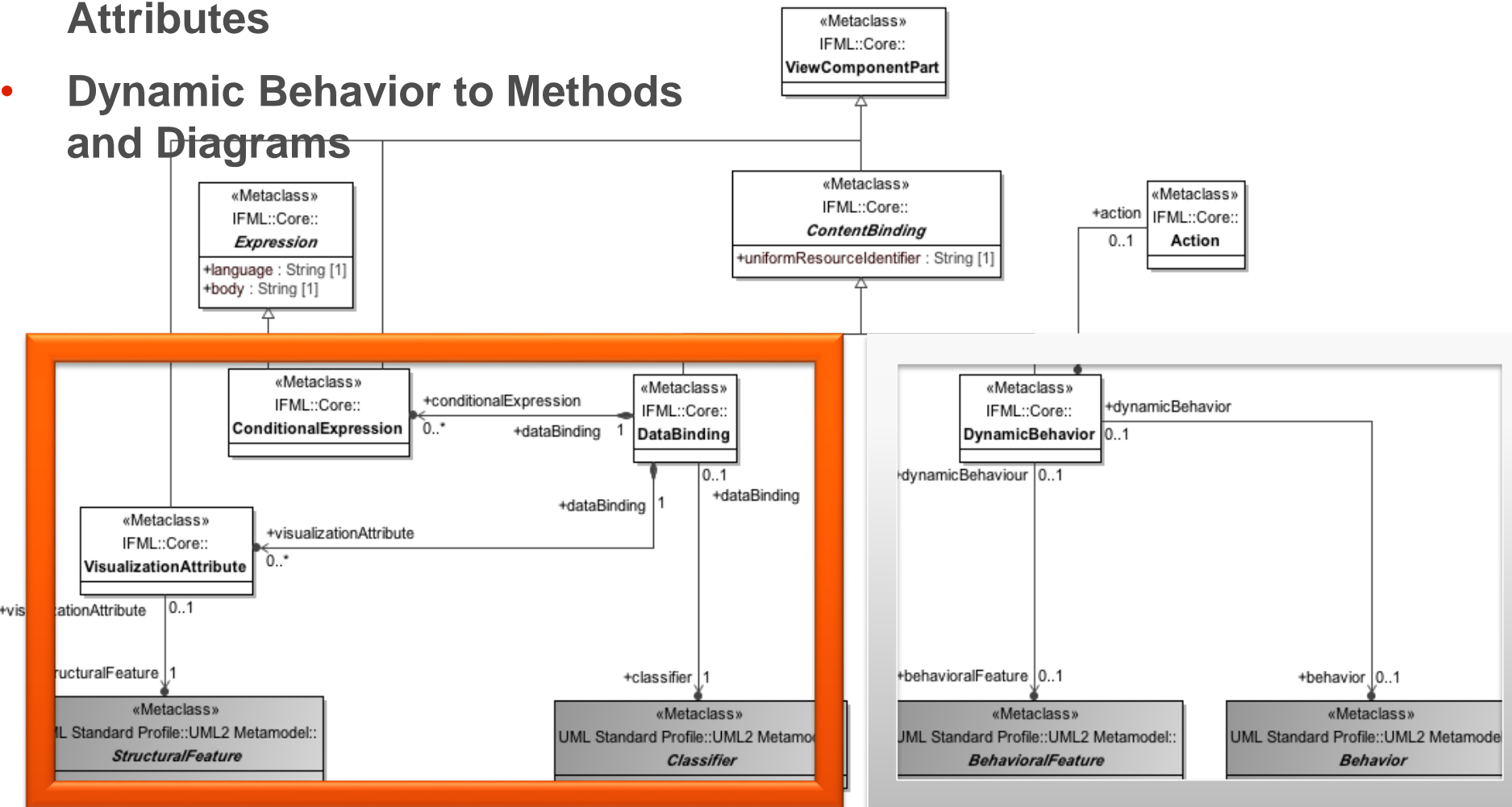
IFML is defined through a metamodel





# IFML metamodel (2): Content Binding

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



# INF5120 and INF9120

## ”Modelbased System development”

Lecture 6: 20.02.2016

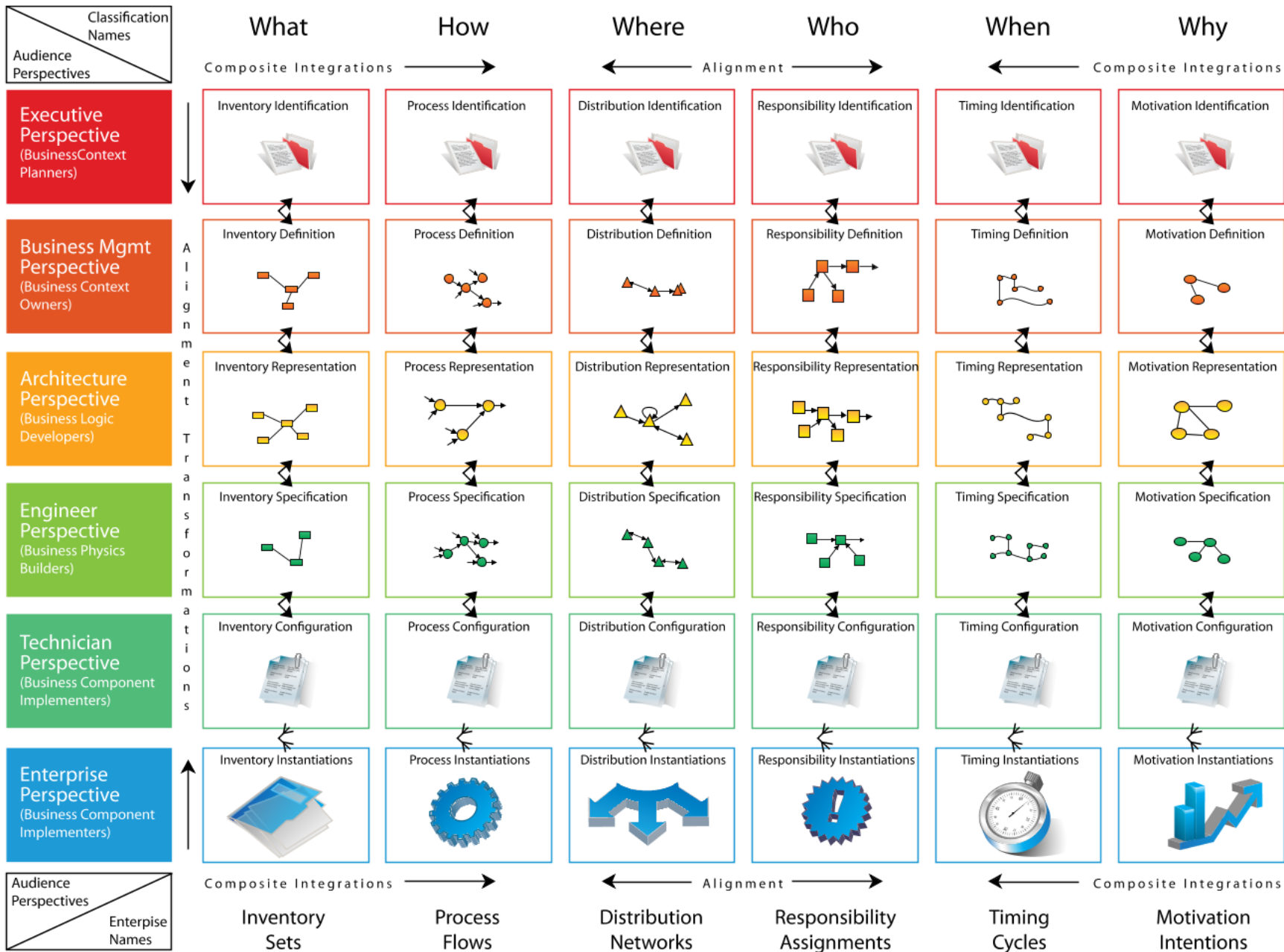
Arne-Jørgen Berre

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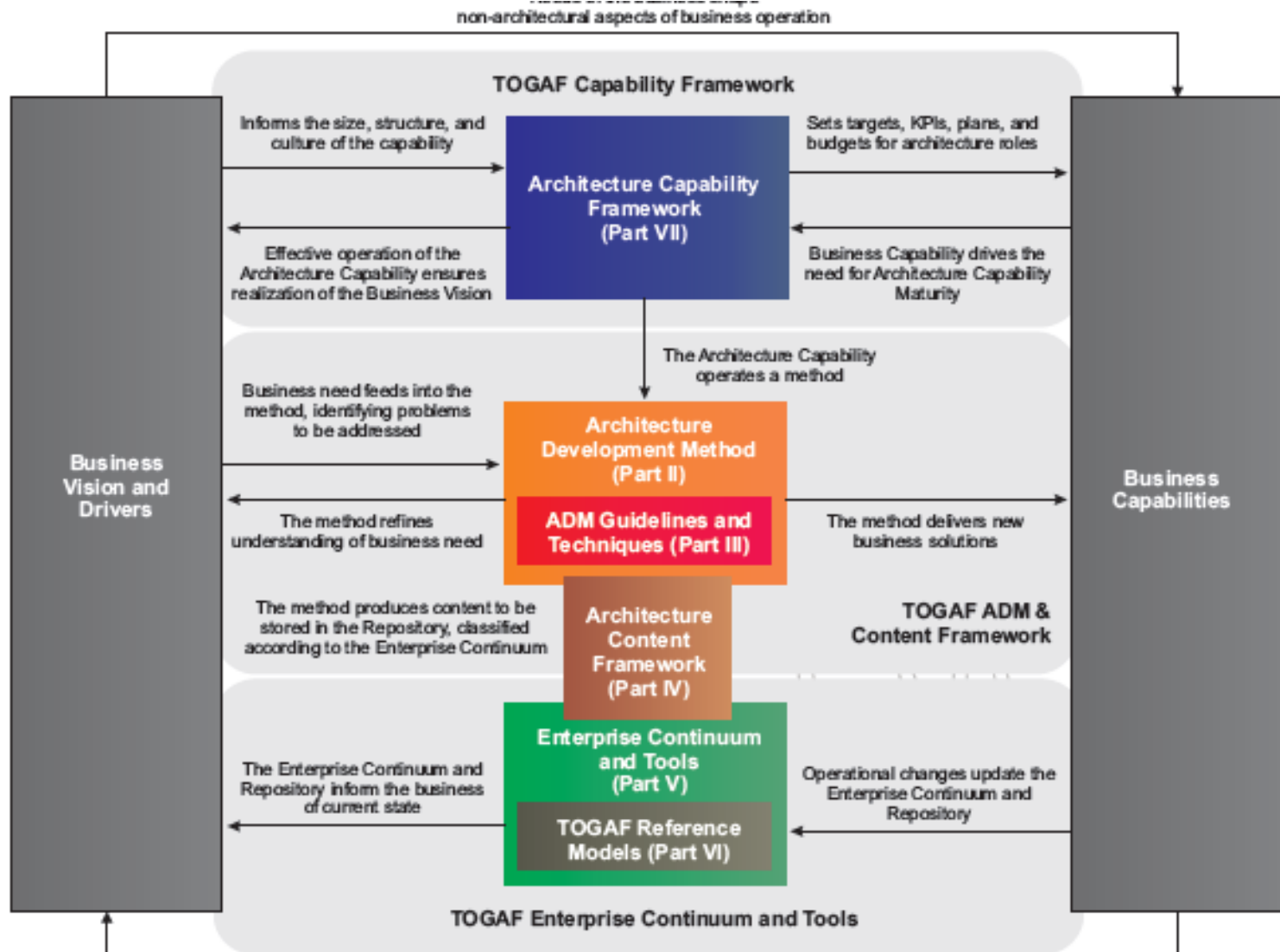
# This lecture, February 20, 2017

## BPMN and Process modeling

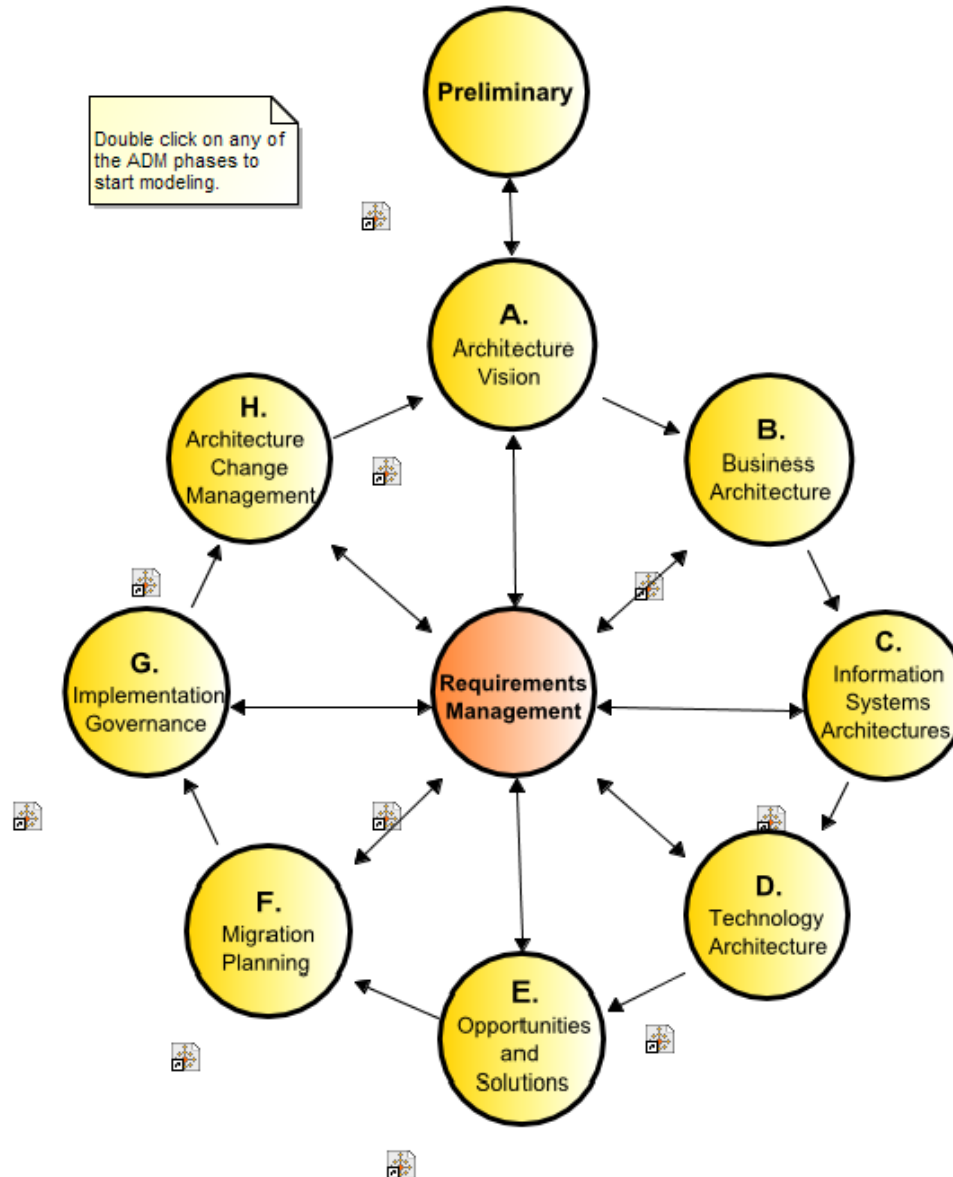
- Enterprise Architecture
- TOGAF
- ArchiMate
- Modelio Archimate, BPMN and UML modelling tool
- ArchiMate Business Process
- BPMN process modelling notation – part 1



# TOGAF 9 (The Open Group)



# The TOGAF Architecture Development Method (ADM)





## TOGAF

TOGAF is a framework for EA which provides a comprehensive approach to the design, planning, implementation, and governance of an enterprise information architecture. TOGAF is a registered trademark of The Open Group. TOGAF is a high level and holistic approach to design, which is typically modeled at four levels: Business, Application, Data, and Technology. As an open standard, TOGAF is widely adopted to support EA.

[READ MORE](#)



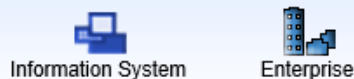
## Togaf Modeling

"**Togaf Modeling**" is a collaborative site designed to provide a guide and practical modeling solutions, by selecting different standards that provide an off-the-shelf solution. There is no universal solution, but our aim is to identify a practical solution, through your contributions.

### Enterprise Architecture is for ...



### Enterprise Architecture addresses ...



"**Togaf Modeling**" recommends one or several toolled solutions, using one or several modeling tools which have a complete and an open version, and by providing open-source extensions (**EAP extensions**, in the form of **UML profiles**).

<http://www.togaf-modeling.org/>

### Login

Username

Password

Remember Me

[LOG IN](#)

[Create an account](#)  
[Forgot your username?](#)  
[Forgot your password?](#)

Sign in to use the forum and be informed of the latest news.

### Latest comments

[Functional decomposition](#)



# ArchiMate

## ArchiMate®



### About ArchiMate

ArchiMate®, an Open Group Standard, is an open and independent modelling language for enterprise architecture that is supported by different tool vendors and consulting firms. ArchiMate provides instruments to enable enterprise architects to describe, analyze and visualize the relationships among business domains in an unambiguous way.

Just as an architectural drawing in classical building architecture describes the various aspects of the construction and use of a building, ArchiMate offers a common language for describing the construction and operation of business processes, organizational structures, information flows, IT systems, and technical infrastructure. This insight helps stakeholders to design, assess, and communicate the consequences of decisions and changes within and between these business domains.

### The ArchiMate 2.1 Specification

The ArchiMate 2.1 Specification is a maintenance update to ArchiMate 2.0, addressing comments raised since the introduction of ArchiMate 2.0 in 2012. The ArchiMate Specification is based on many years of practical experience of modeling and analysis of Enterprise Architecture (EA) by a world-wide user base. It enables the creation of fully integrated models of the organization's enterprise architecture, the motivation for it, and the programs, projects and migration paths to implement it.

The detailed changes between version 2.0 and 2.1 are available as [Document U132: ArchiMate 2.0 Specification Technical Corrigendum Number 1](#)

The ArchiMate modeling language has evolved to be fully aligned with the TOGAF® standard:

- By providing a vendor-independent set of concepts, that helps to create a consistent, integrated model “below the waterline”, which can be depicted in the form of TOGAF views
- The ArchiMate® language enables modeling throughout the TOGAF® Architecture Development Method
- The language structure of the ArchiMate Core corresponds with the three main architectures as addressed in phases B, C & D in the TOGAF® ADM
- The extensions to the Core closely correspond with the main aspects to be addressed in the Preliminary phase, Phase A and the Central Requirements management repository, as well as Phases E, F, G and H

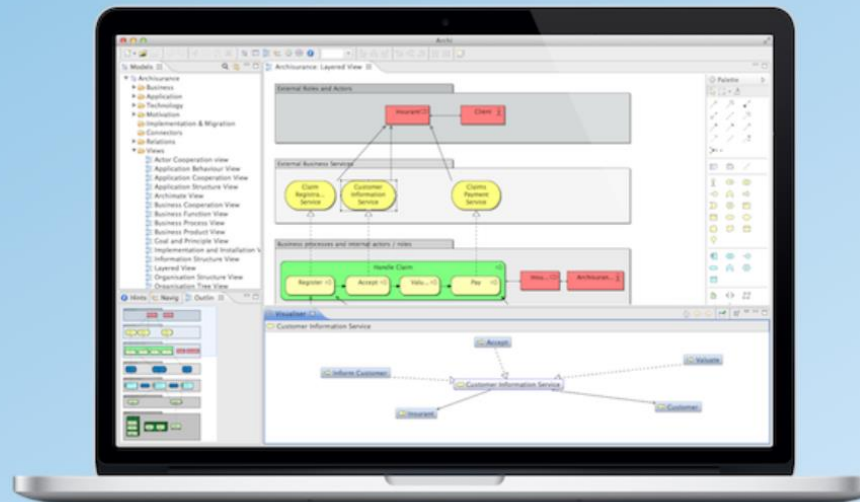






## The Free ArchiMate Modelling Tool

A free and open source modelling tool to create ArchiMate models and sketches. Used by hundreds of Enterprise Architects throughout the world.



Modelio 3.6

File Edit Configuration Views Help

Welcome



# MODELIO™

by Modeliosoft



## Welcome to Modelio

### The Open Source Modeling Environment



### Add ArchiMate 3.0 support for free

Download and install the Modelio ArchiMate plugin and **start modeling with the ArchiMate standard!**

[Download ArchiMate](#)



**New**



### Getting started

Quick tour of Modelio features... Worth a try!



### UML practical guides

A set of practical and pragmatic UML modeling guides...



### Migrating projects

How to migrate earlier Modelio projects...

ExistingProject - Modelio 3.6

File Edit Configuration Views Help

Model

- ExistingProject
  - ExistingProject
    - Model
      - business
        - Notification
        - Service
        - Business Proces
        - Business Proces
        - Object
      - strategy
      - motivation
      - application
      - technology
      - physical
      - implementation
    - ViewPoint
      - ArchimateView
      - ViewPointDiagram
  - ExistingProject
  - PredefinedTypes 3.6.04

ArchimateView

Select  
Marquee  
Smart links

Concepts  
Relationships  
Realization  
Serving  
Common  
Free drawings

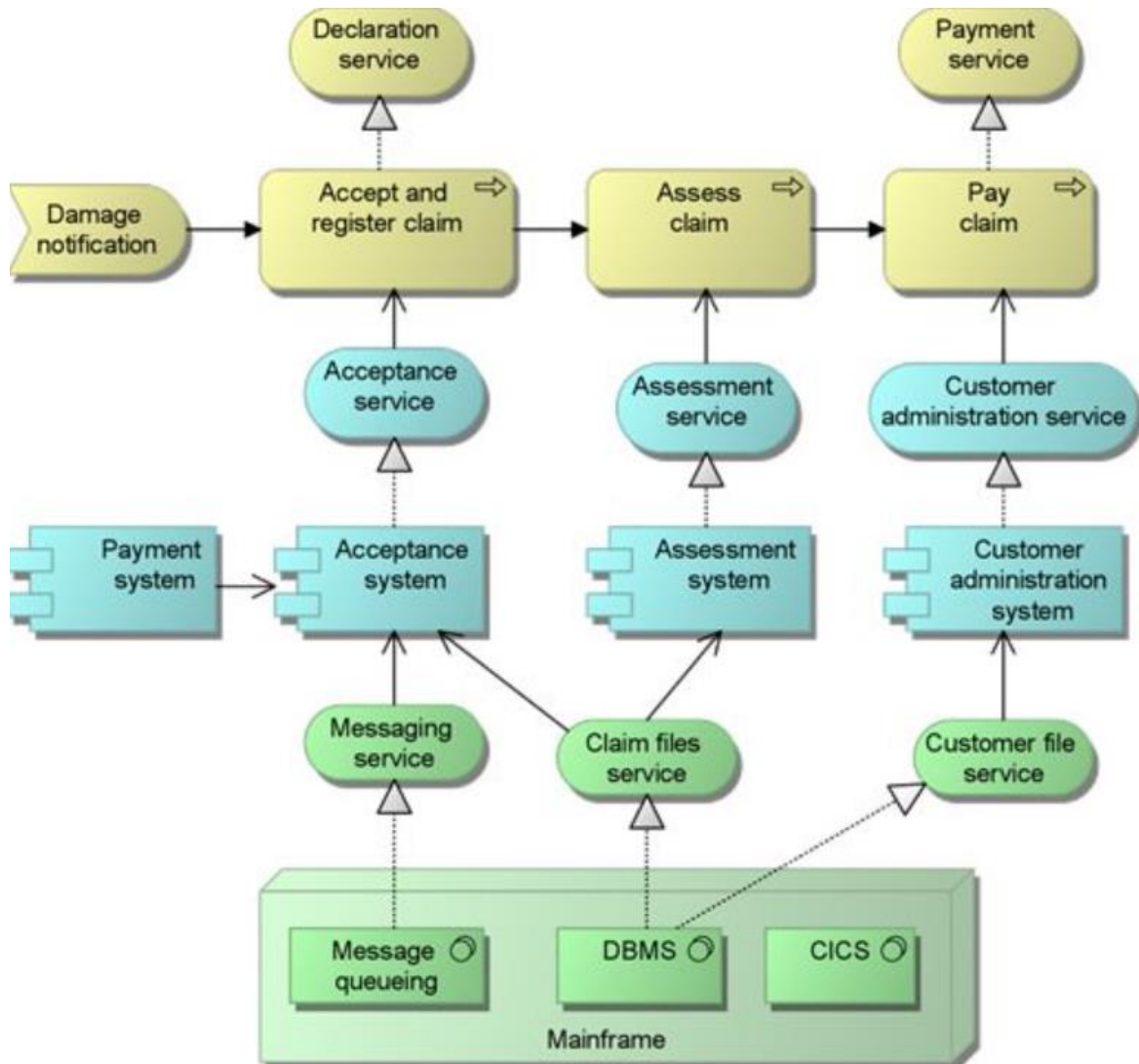
```

    graph TD
      Notification[Notification] --> BusinessProcess[Business Process]
      BusinessProcess --> BusinessProcess1[Business Process1]
      BusinessProcess -.-> Service[Service]
      Service -.-> Object[Object]
  
```

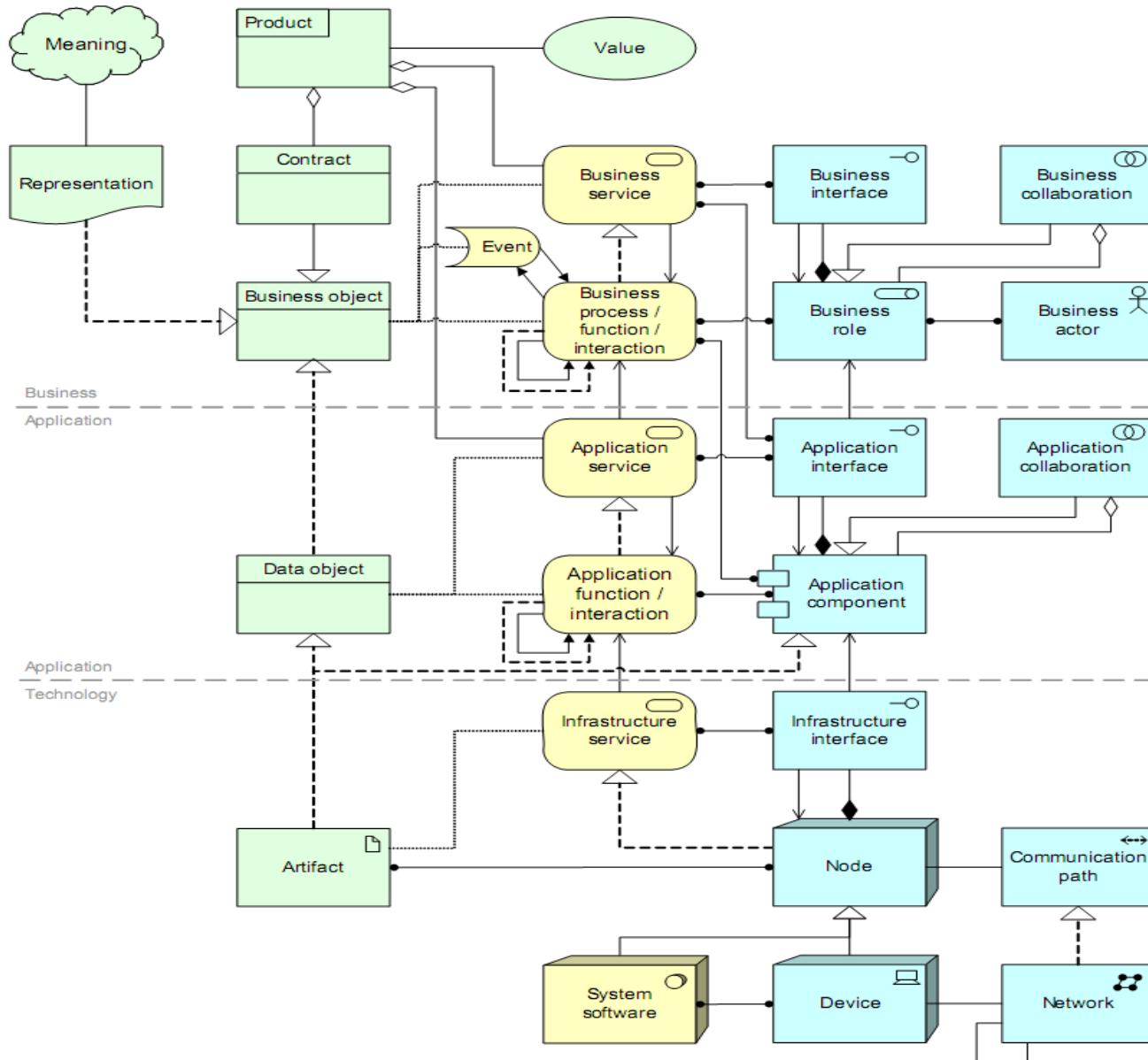
Outline Audit Link Editor Diagrams Script Properties

ArchimateView (ArchimateView)

Element	Property	Value
Notes & constraints	Property	
	Value	
	Value	
Symbol	Diagram	
	Snap to geometry	<input type="checkbox"/>
	Fill color	
Modify element representation:		



# Layered view



## Overview of the ArchiMate concepts and main relationships



# INF5120

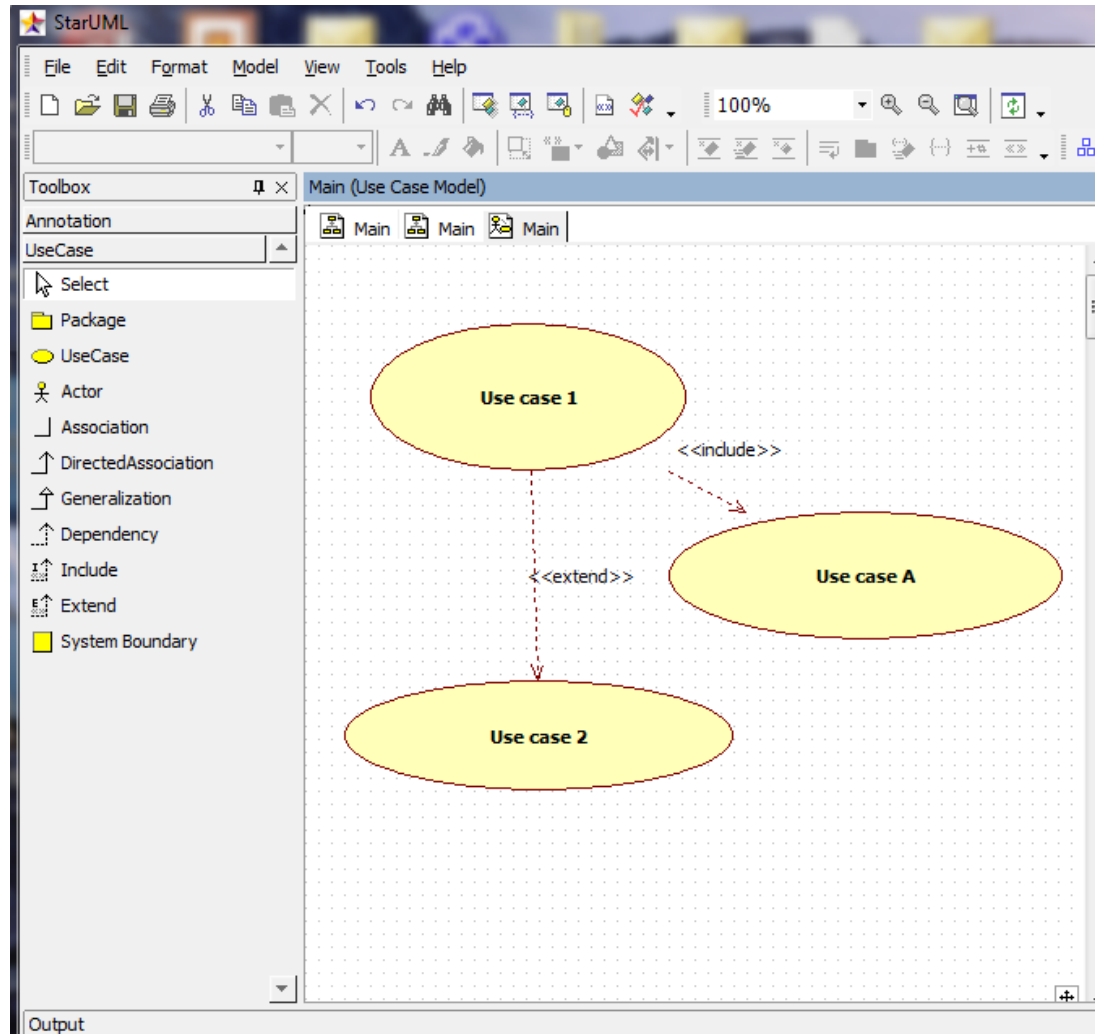
## ”Modellbasert Systemutvikling” ”Modelbased System development”

Lecture 7: 27.02.2017

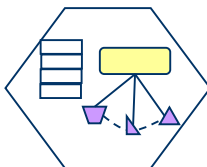
Arne-Jørgen Berre

[arneb@ifi.uio.no](mailto:arneb@ifi.uio.no) or [Arne.J.Berre@sintef.no](mailto:Arne.J.Berre@sintef.no)

# Use case modeling



# Template of a Use Case Description

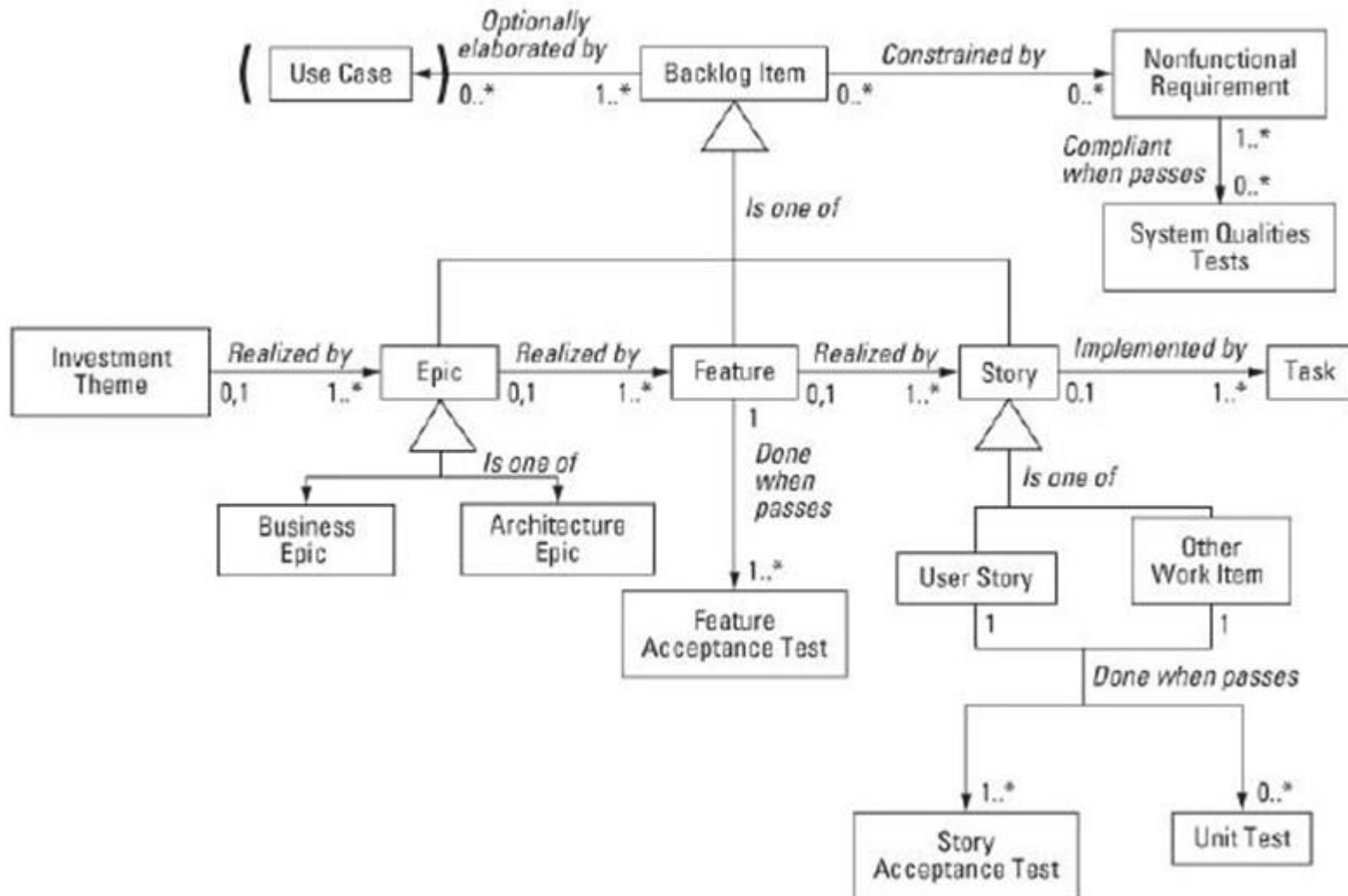
Use Case Template		Examples
Use Case Name		Visualise proposed water height after the tsunami event
Use Case ID		CS1-UC01
Revision		CS1-UC01-01
Status		Active
Goal		To get a map of the affected area with the proposed water height after the tsunami event
Summary		The user opens the browser which shows map-window with the water height after the tsunami event in the affected area
Category		primary
Actor		Employee in a local tsunami warning centre
Primary Actor		Employee in a local tsunami warning centre
Stakeholder		
 Requested Information Resources	Data input	satellite scene with near infra-red and visible spectrum (e.g. Landsat); bounding box with spatial extent (e.g. WGS84); temporal extent (ttmmjjjj, hh:mm), calculated forecast of the water height
	Data access control	no special access control
	Data format	digital raster dataset image in the browser
Preconditions		The user has opened the portal successfully.



# User Story template

- I <in the role of XX> needs functionality <zzz> to achieve the goal of <YYY>

# Backlog metamodel



# INF5120 – Modellbasert Systemutvikling

## ■ F07-2: Architectural Patterns, Design Patterns and Refactoring

Lecture 27.02.2017

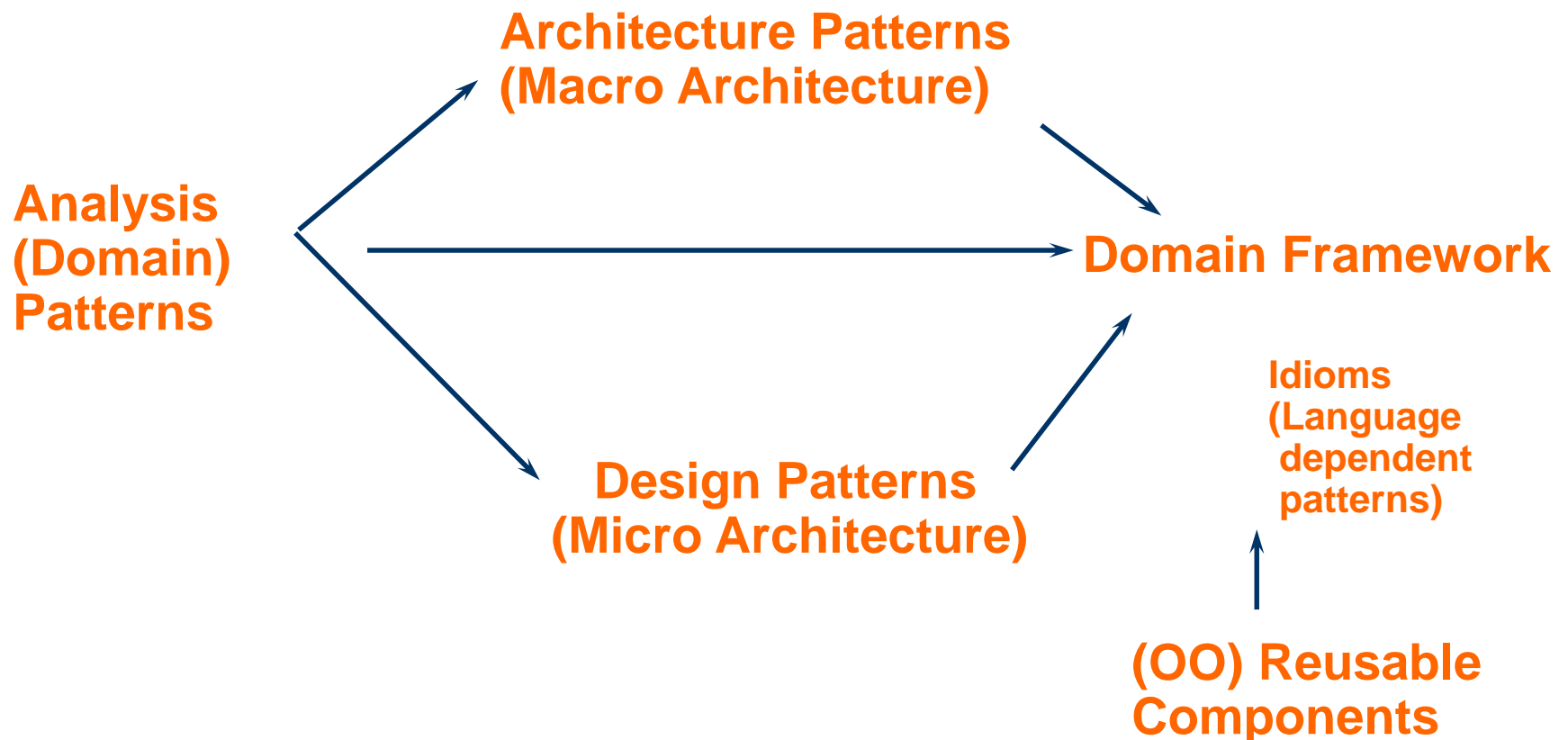
Arne-Jørgen Berre

# Patterns: From Analysis to Implementation

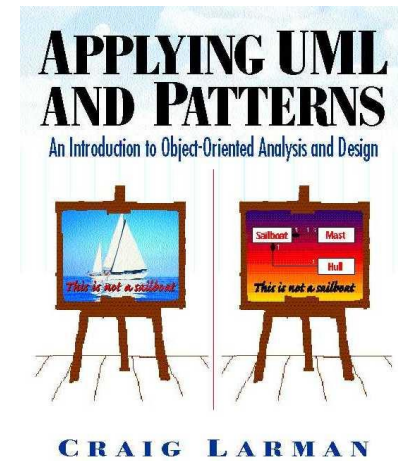
Analysis

Design

Implementation



# GRASP



General Responsibility Assignment  
Software Patterns.

Responsibility assignment.

1. knowing (answering)
2. or, doing

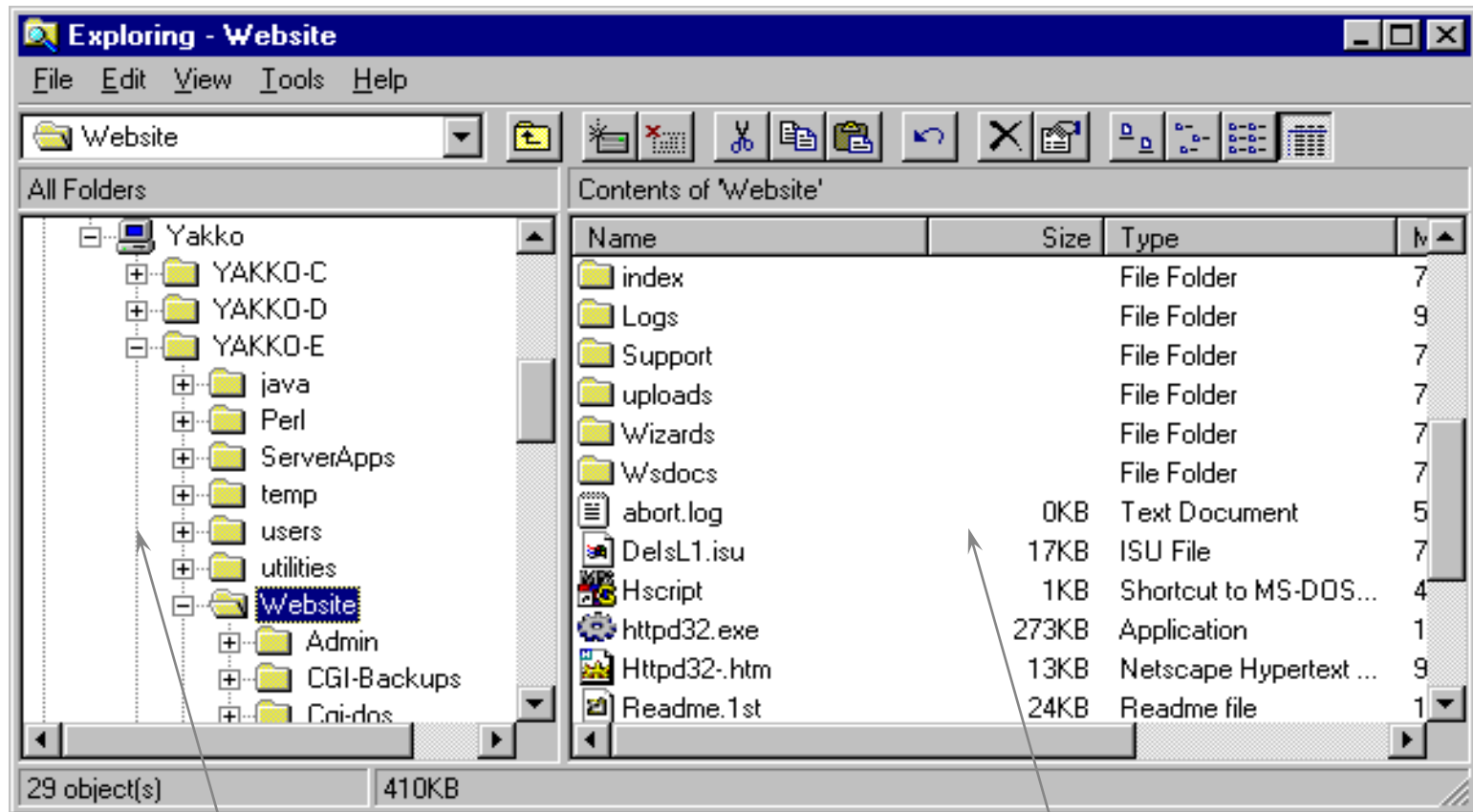
Guidance and evaluation in  
mechanistic design.

1. Expert
2. Creator
3. Controller
4. Low Coupling
5. High Cohesion
6. Polymorphism
7. Pure Fabrication
8. Indirection
9. Don't Talk to Strangers

# GOF (Gang of Four) 23 Patterns

- Creational Patterns (5)
- *Abstract Factory, Builder, Factory Method, Prototype, Singleton*
- Structural Patterns (7)
- *Adapter, Bridge, Composite, Decorator, Façade, Flyweight, Proxy*
- Behavioural Patterns (11)
- *Chain of responsibility, Command, Interpreter, Iterator, Mediator, Memento, Observer, State, Strategy, Template method, Visitor*

# Windows Explorer Screen Shot



FolderView

ContentsView

**INF5120**  
**”Modellbasert Systemutvikling”**  
**”Modelbased System development”**

Lecture 8: 06.03.2017

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# INF5120 – Spring 2017

## Oblig 2 – “SmartBuilding – Server side with ThingML”

*Individual project on ThingML tutorial.*

*Group project on SmartBuilding Server Side ThingML model.*

Continued groups from Oblig 1

Individual report submission date: Monday April 3rd, 2017

(Easter dates, April 10<sup>th</sup>, April 17<sup>th</sup>)

Group report submission date: Friday April 21<sup>st</sup>, 2017 (After Easter)

Group presentations (on parts of the Oblig):

Oblig 3 on MDE Domain specific language editor will be provided on April 3<sup>rd</sup> with delivery deadline on May 8<sup>th</sup>. The objective in Oblig 3 is to make a Graphical editor in SIRIUS – supporting (parts of) the Archimate notation.

Demonstrate the tool showing the respective Archimate diagrams in your tool with models describing the SmartBuilding system from Oblig 1 and Oblig 2.

## Group Oblig 2-1: The Managed Room based on X3B (or on the Stabilized room)

The Managed Room shall have more advanced management options, like more thermometers and more switches, as well as time schedules.

### More Thermometers

During the construction phase of the program, first any number of thermometers can be entered (up to 10). They shall have the following properties:

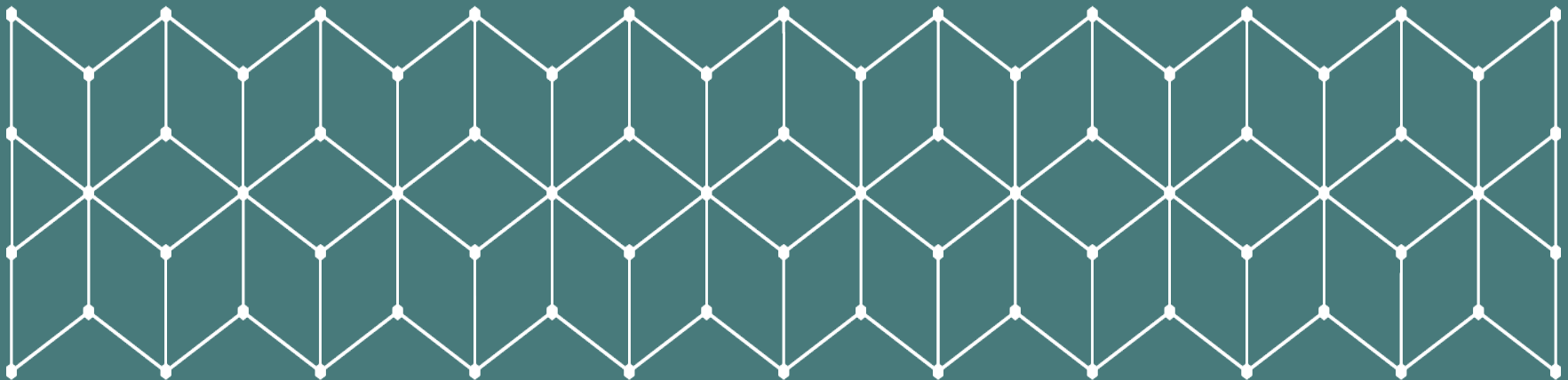
- ☑ Sensor id – a unique number found when observing the thermometer
- ☑ Name – choose one
- ☑ Weight – the relative weight of this thermometer in the calculation of the combined temperature (a Double number)

The combined temperature shall be calculated by the weighted sum of the temperatures. Assume that the thermometers will deliver temperatures. This means you do not need to guard the thermometers' delivery of temperatures individually. X3B already has a timer that covers that if no thermometer delivers within some duration, a message is sent to the human interface.

### More Actuators of different kinds

In X3B we had only one actuator (switch) that controlled a heater. In the Managed Room we shall introduce any number of actuators up to 10. The actuators shall be categorized into 3 different categories.

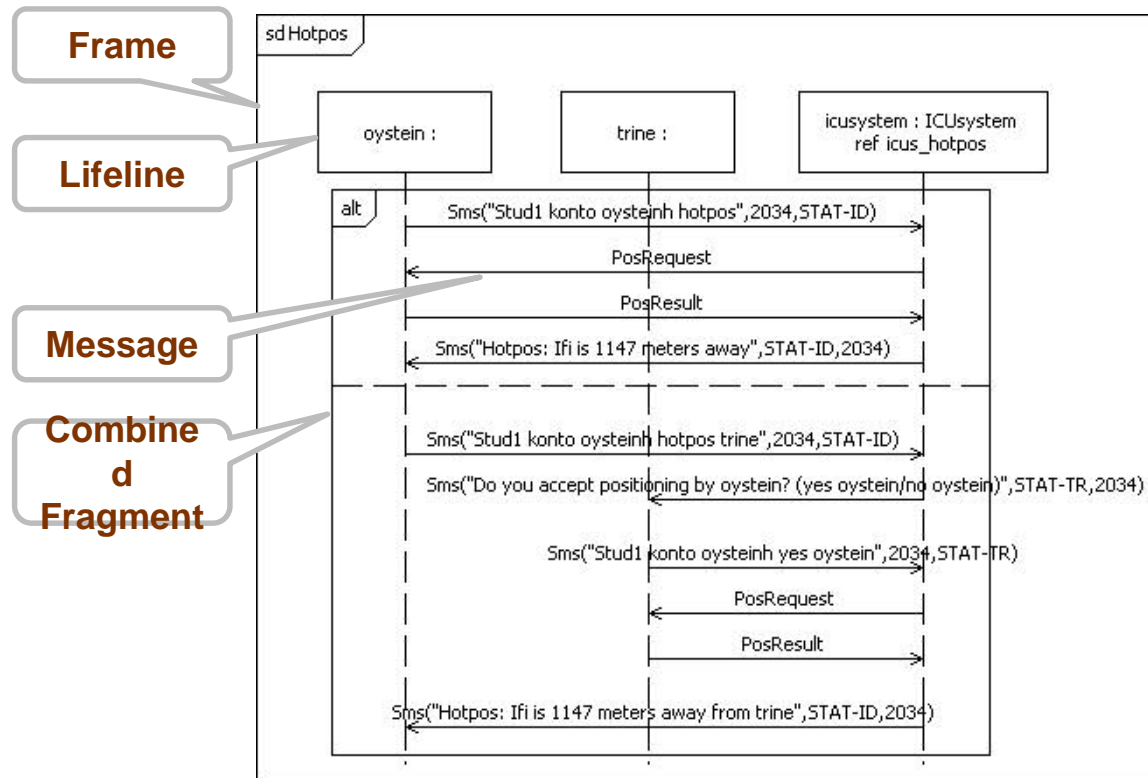
# UML Interactions (Sequence Diagrams)



# Overview of lecture

- Sequence Diagrams
  - What are they intended for?
  - Where in the software engineering process are they used?
- The History Lesson
  - a very short history this time
- Basic sequence diagrams
- Interaction Fragments – structuring mechanisms
- Tooling
  - Sequence Diagrams in Papyrus
  - Interactions or Sequence Diagrams?
  - Experiences and challenges
- Interaction Metamodel

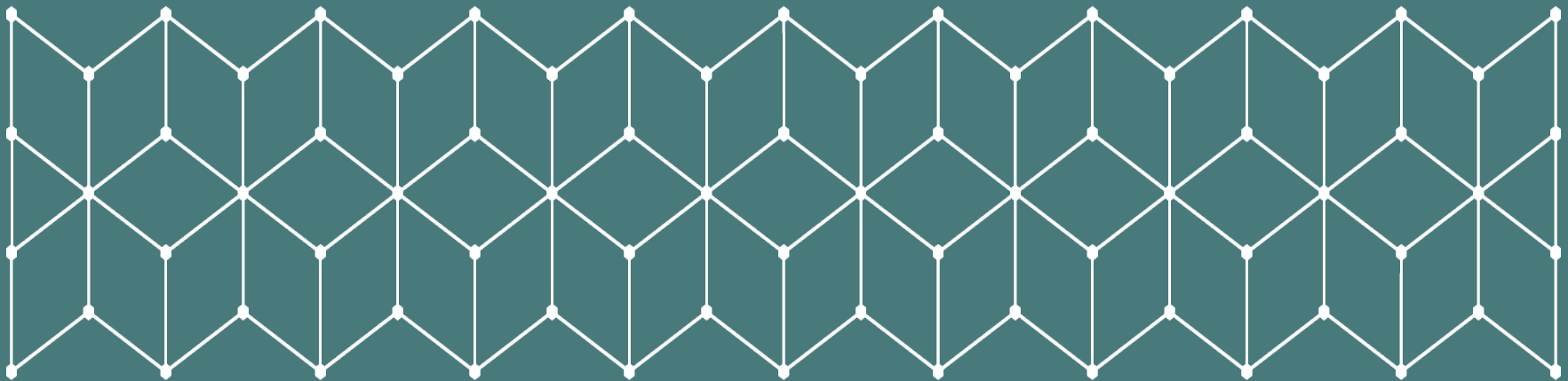
# This is a Sequence Diagram



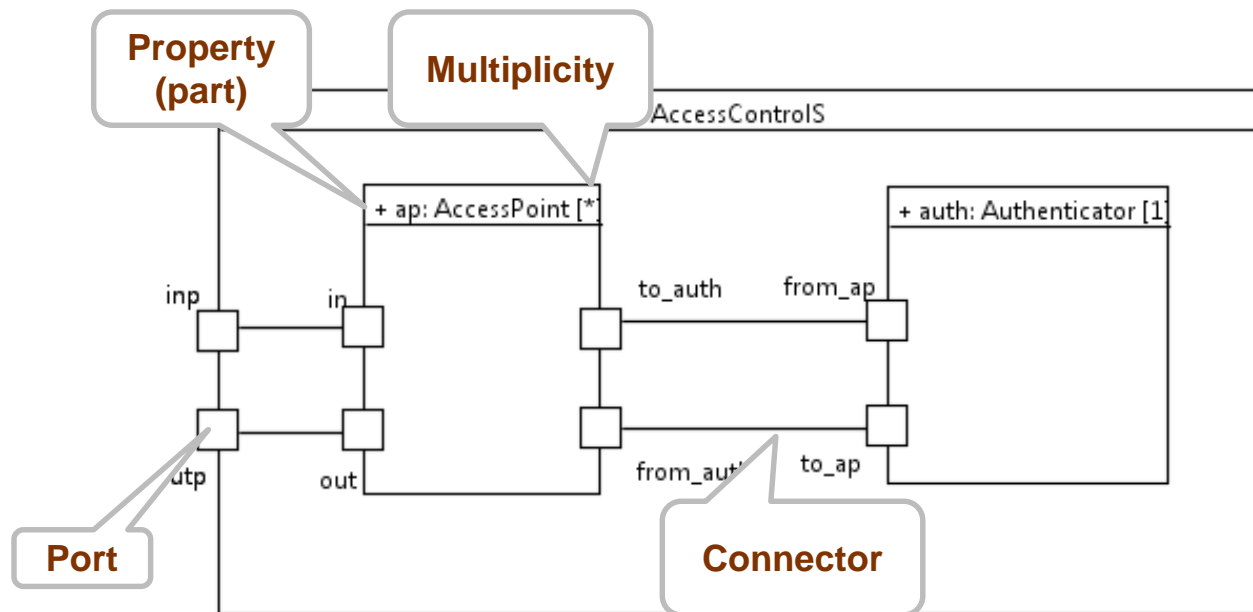
Professor Øystein Haugen | Faculty of Computer Science

53

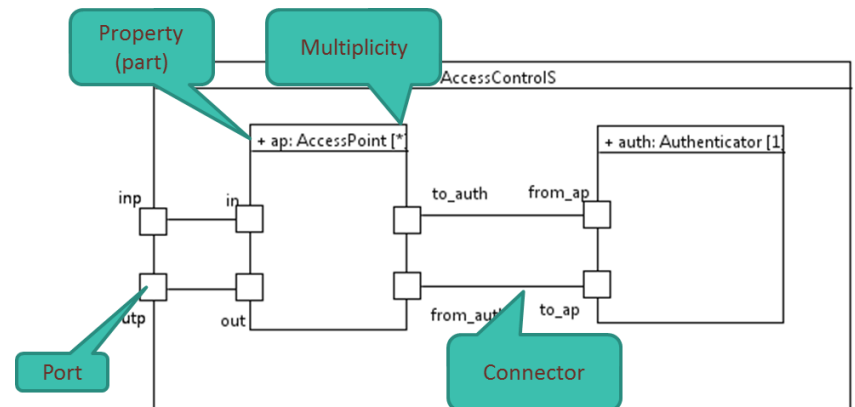
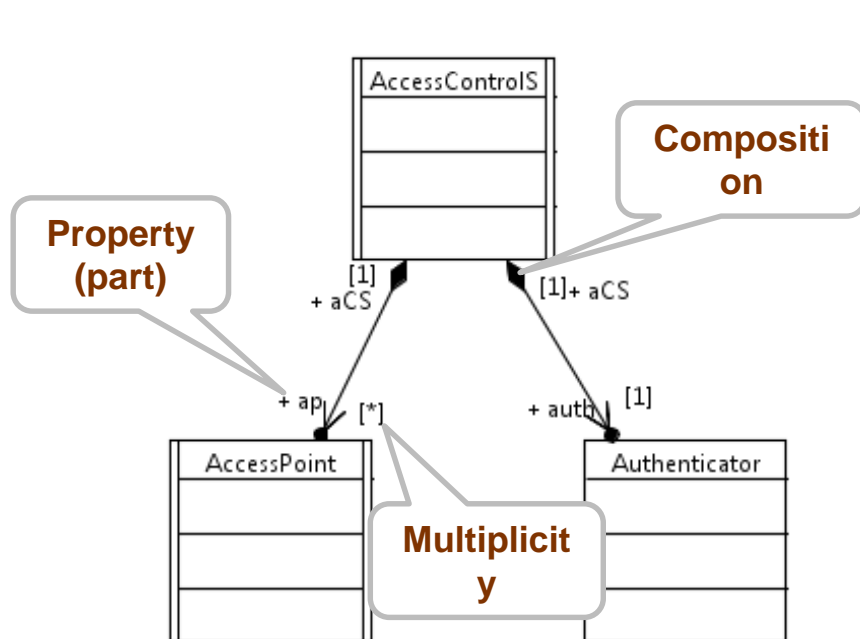
# State Machines and Model consistency



# The architecture in a composite structure

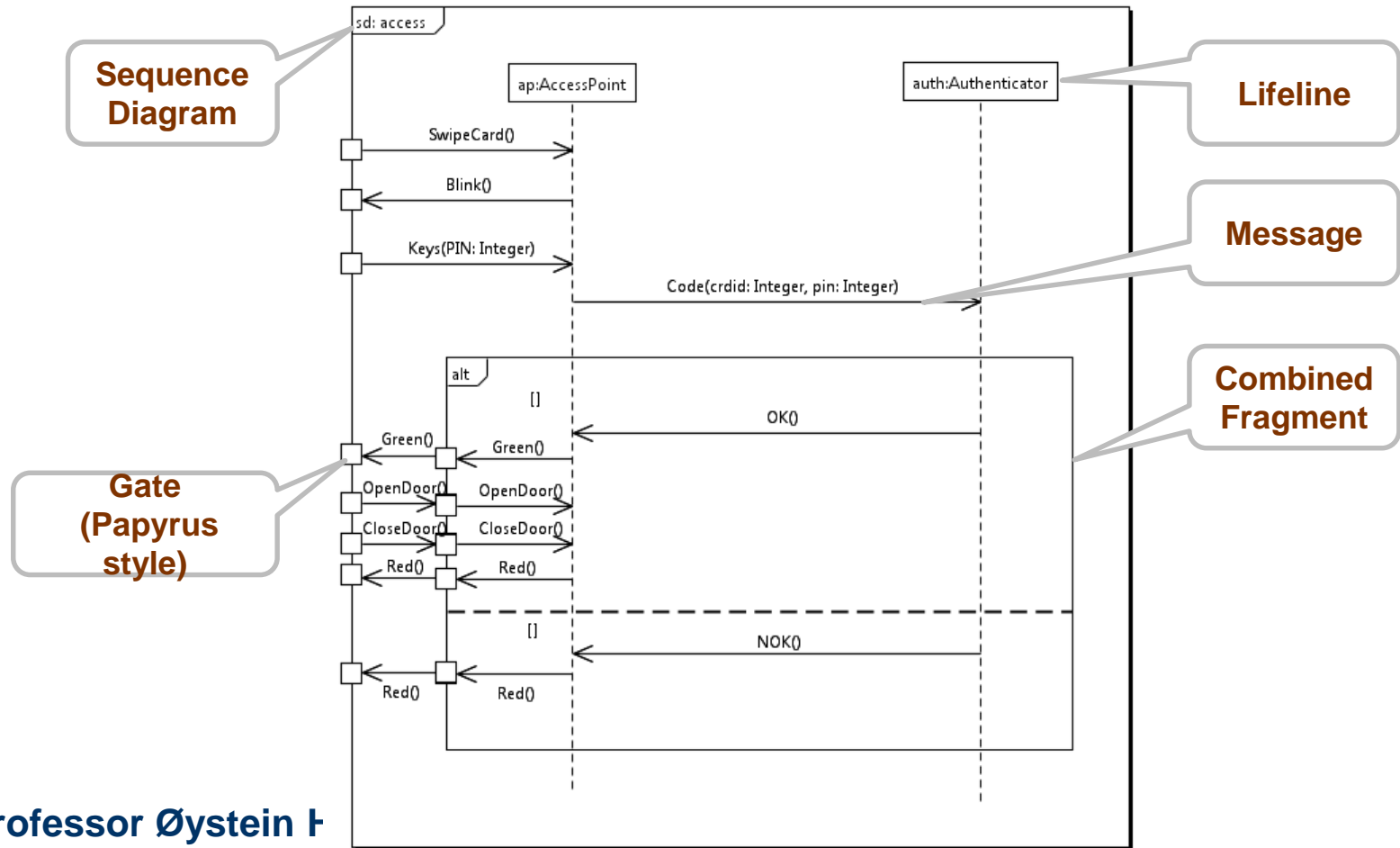


# The concepts in a class diagram

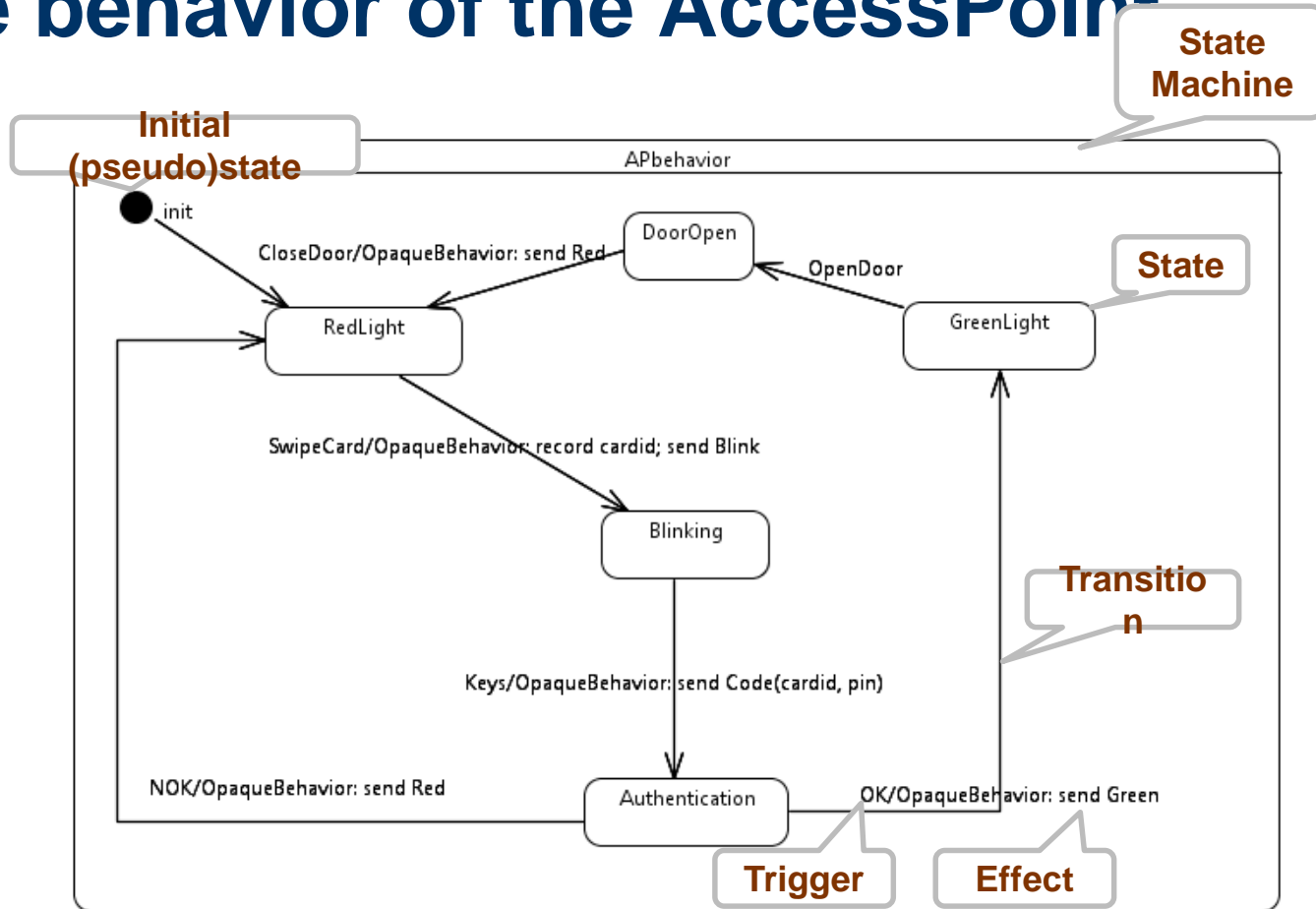




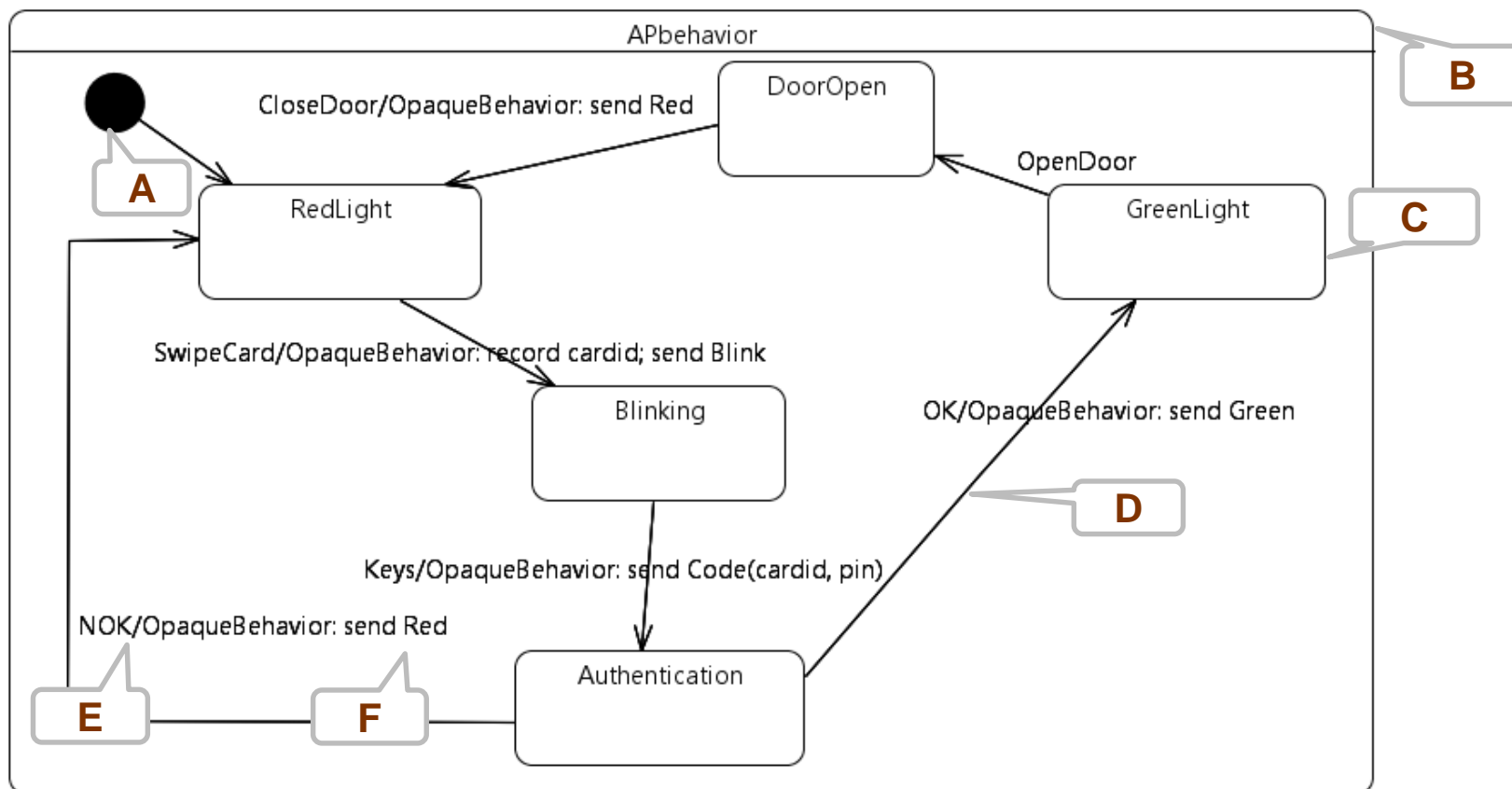
# Happy Day Scenario



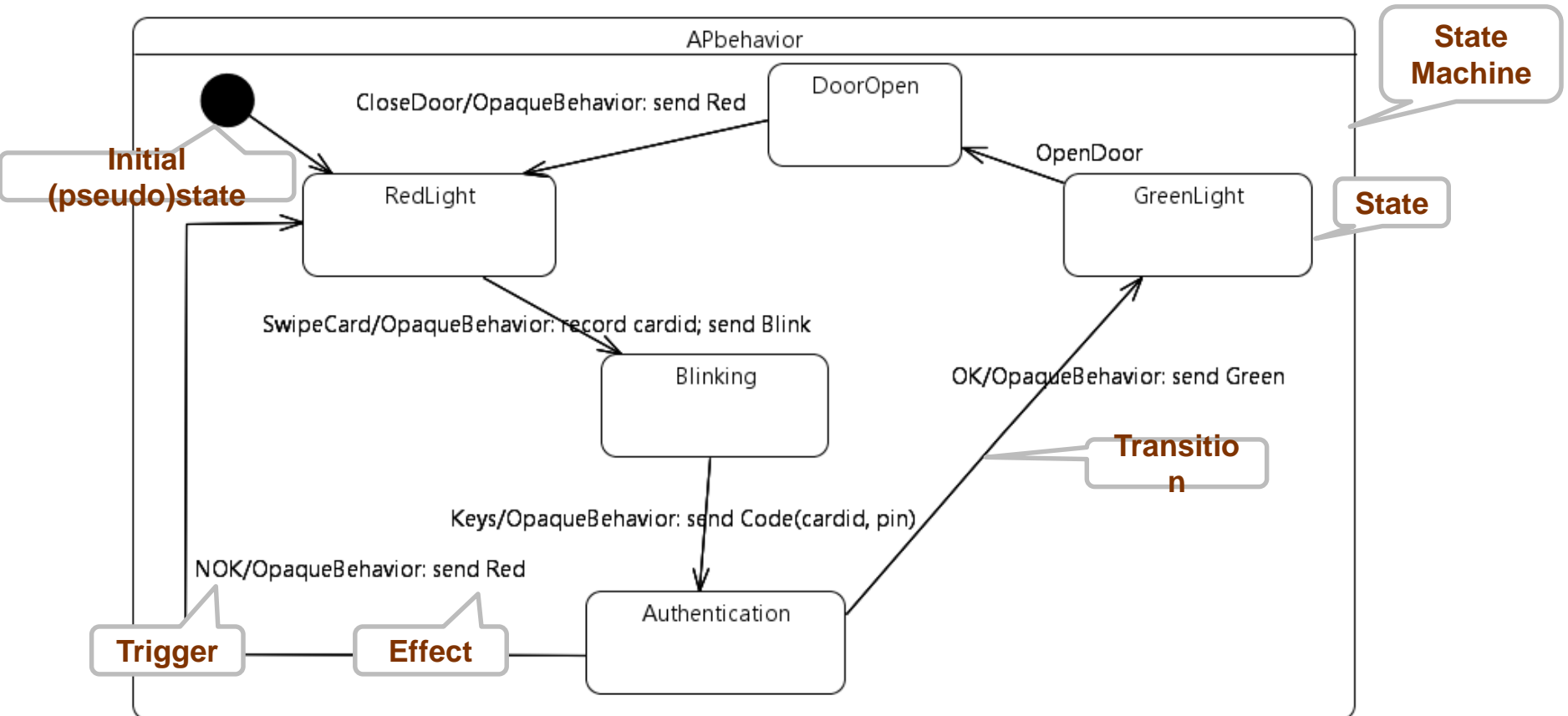
# The behavior of the AccessPoint



# The behavior of the AccessPoint



# The behavior of the AccessPoint



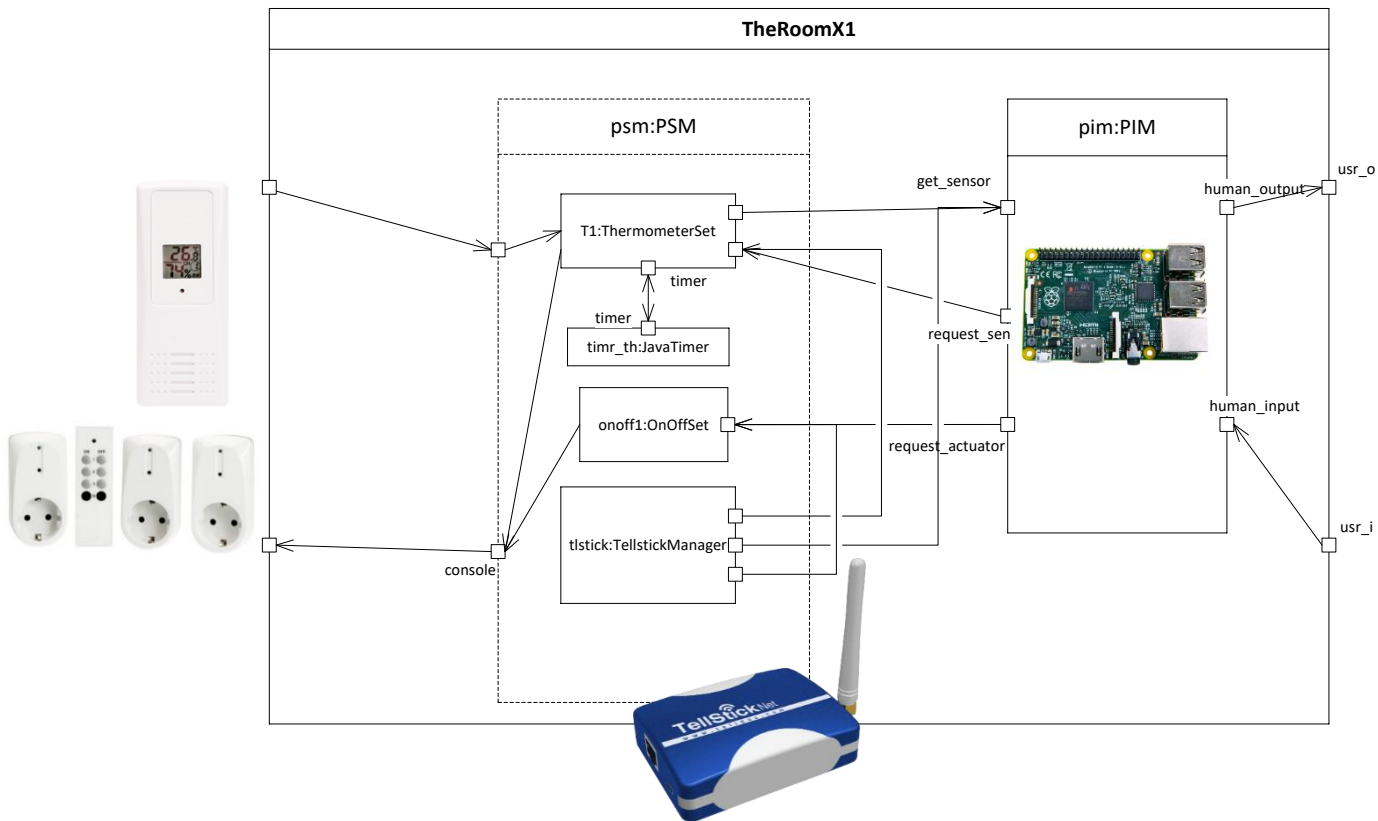
**INF5120**  
**”Modellbasert Systemutvikling”**  
**”Modelbased System development”**

Lecture 9: 13.03.2017

Arne-Jørgen Berre

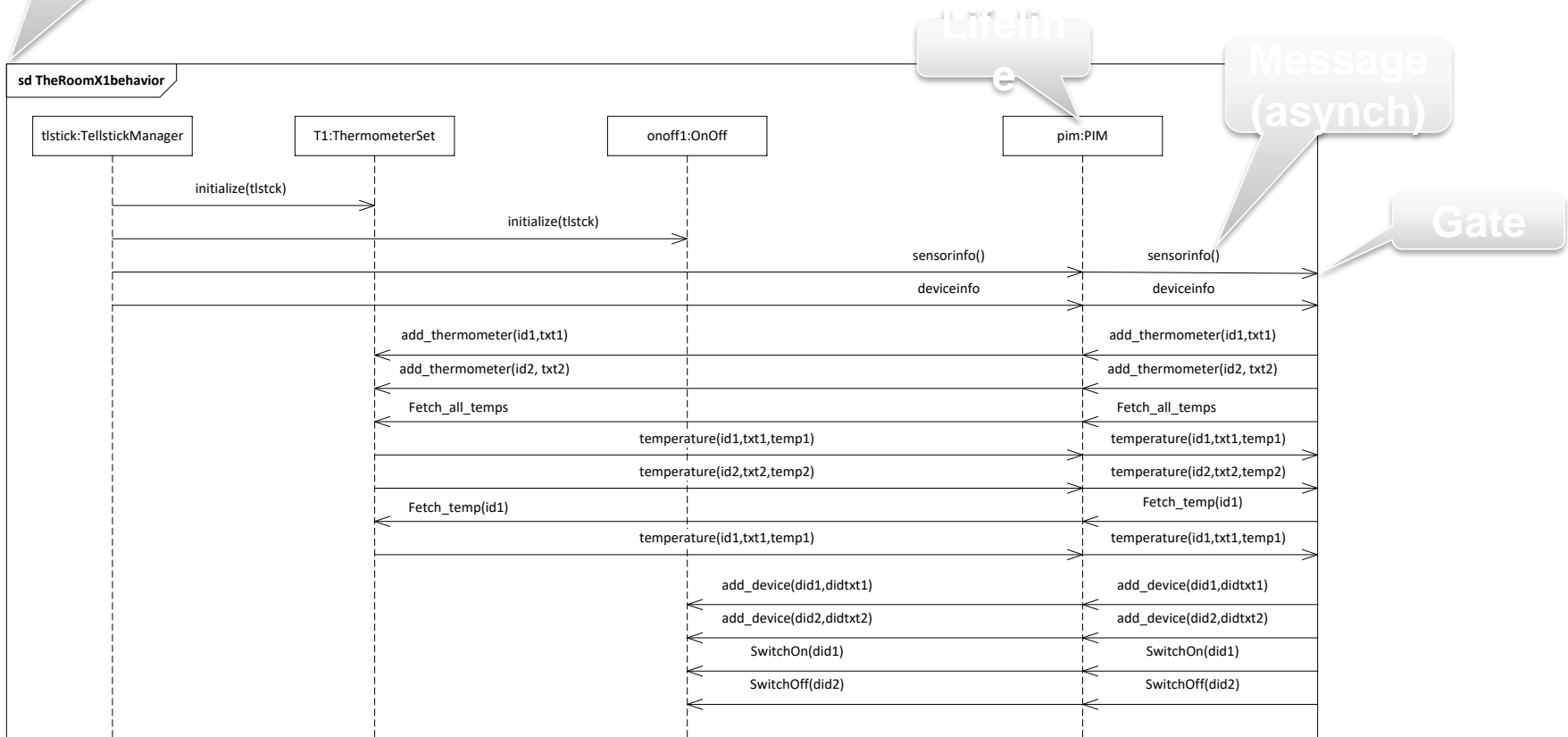
[arneb@ifi.uio.no](mailto:arneb@ifi.uio.no) or [Arne.J.Berre@sintef.no](mailto:Arne.J.Berre@sintef.no)

# In one picture

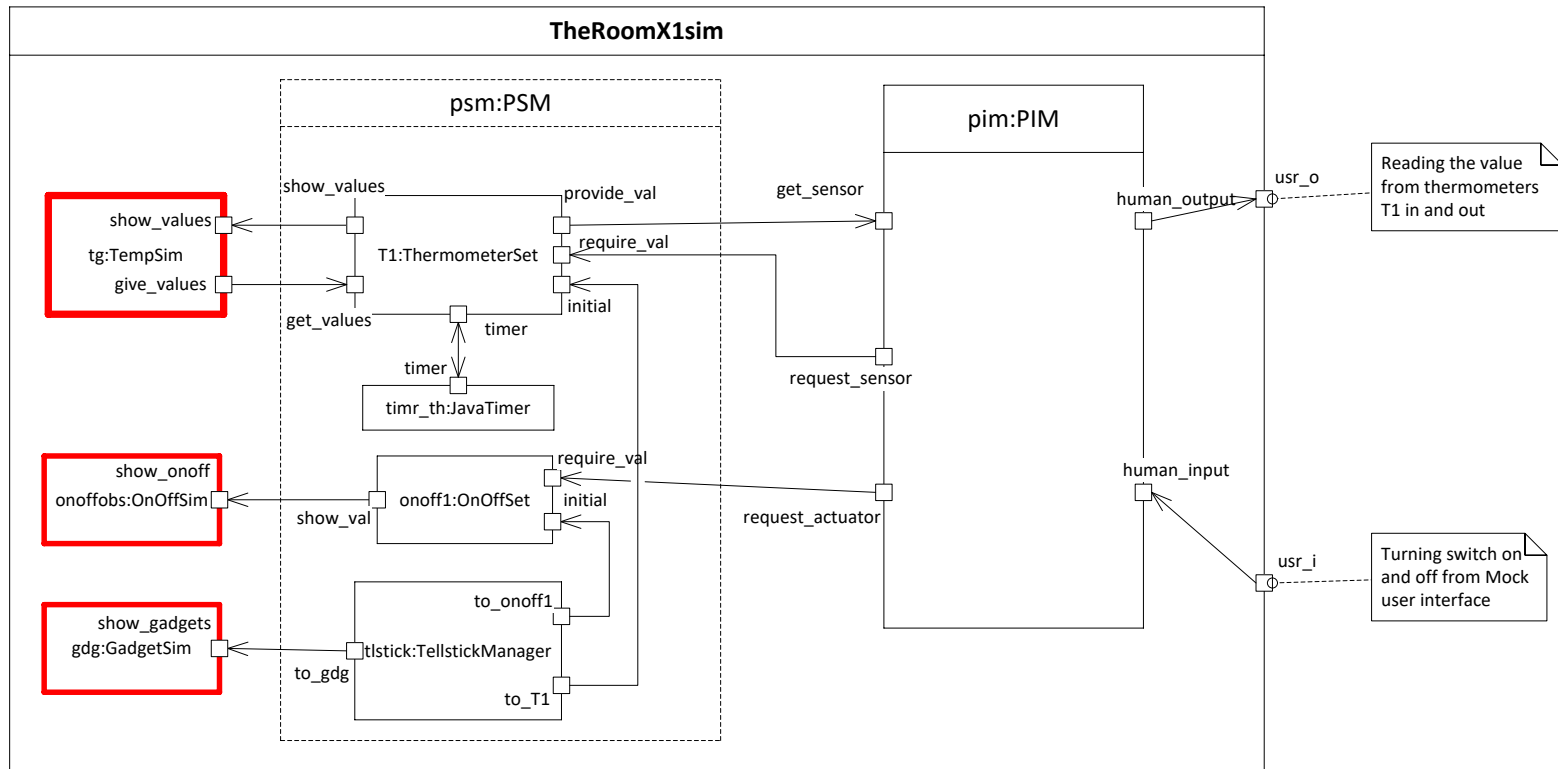


# The Room X1 Behavior

Sequence  
Diagram



# The Room X1 – Simulation architecture





# The Room X1 in ThingML – the configuration

```
import "psm_sim.thingml"
import "pim.thingml"
import "io.thingml"
import "javatimer.thingml"

configuration CPS {
instance tlstick:TellstickManager
instance T1:ThermometerSet
instance onoff1:OnOffSet
instance pim:PIM
instance myself:Human
instance timer : TimerJava

// SIMULATION
instance tg:TempSim
instance onoffobs:OnOffSim
instance gdg:GadgetSim

// PSM
connector tlstick.to_T1 => T1.initial
connector tlstick.to_gdg => gdg.show_gadgets
connector tlstick.to_onoff1 => onoff1.initial

connector T1.provide_val => pim.get_sensor
connector T1.timer => timer.timer
connector T1.show_values => tg.show_values

connector onoff1.show_val => onoffobs.show_onoff

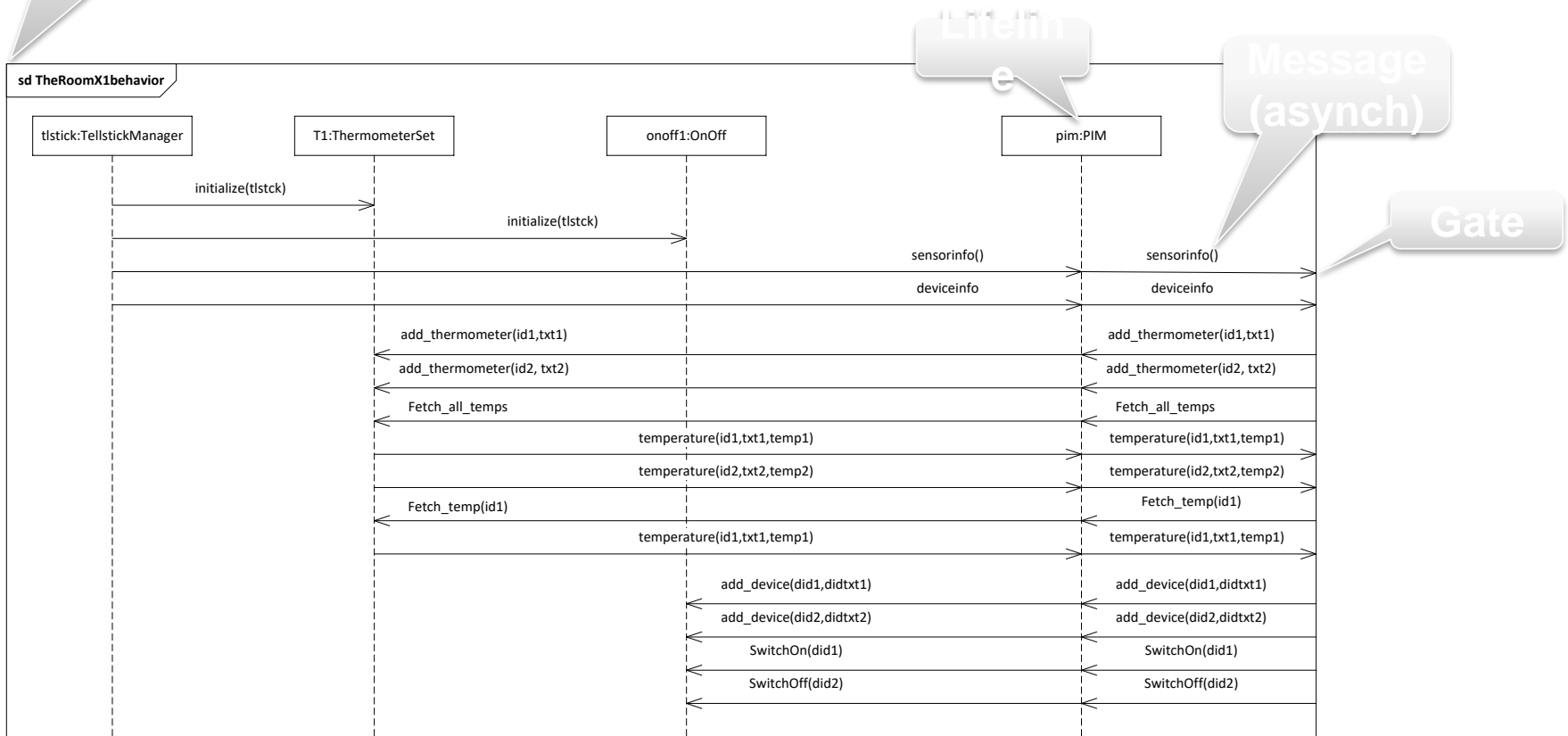
// HMI
connector myself.send_cmd => pim.human_input

// PIM outwards
connector pim.request_sensor => T1.require_val
connector pim.request_actuator => onoff1.require_val
connector pim.human_output => myself.get_values

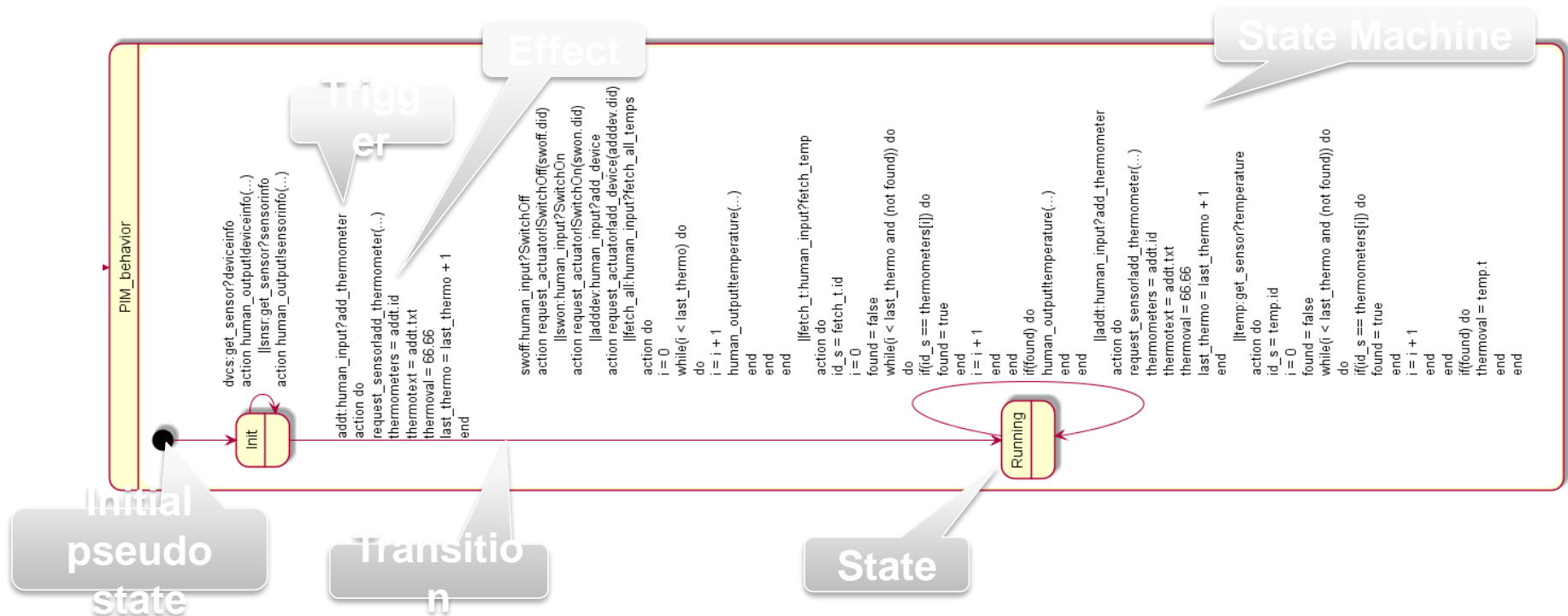
// SIMULATION
connector tg.give_values => T1.get_values
}
```

# The Room X1 Behavior

Sequence Diagram



# The Room X1 – PIM state machine visualized



# The Room X1 – A simulated execution

The TempSim\_tg window features a form with fields for 'id' (value: 2), 'txt' (value: cc), and 't' (value: 30). Below the form is a 'send' button and a 'Command line' field containing 'port:message(param1, param2, param3)'. The log area displays a series of 'show\_values?temperature' requests with timestamps every 10 seconds, alternating between 't=20.0' and 't=30.0'. A callout bubble points to the log with the text: 'Shows temperatures every 10 seconds when PSM is sending PIM'.

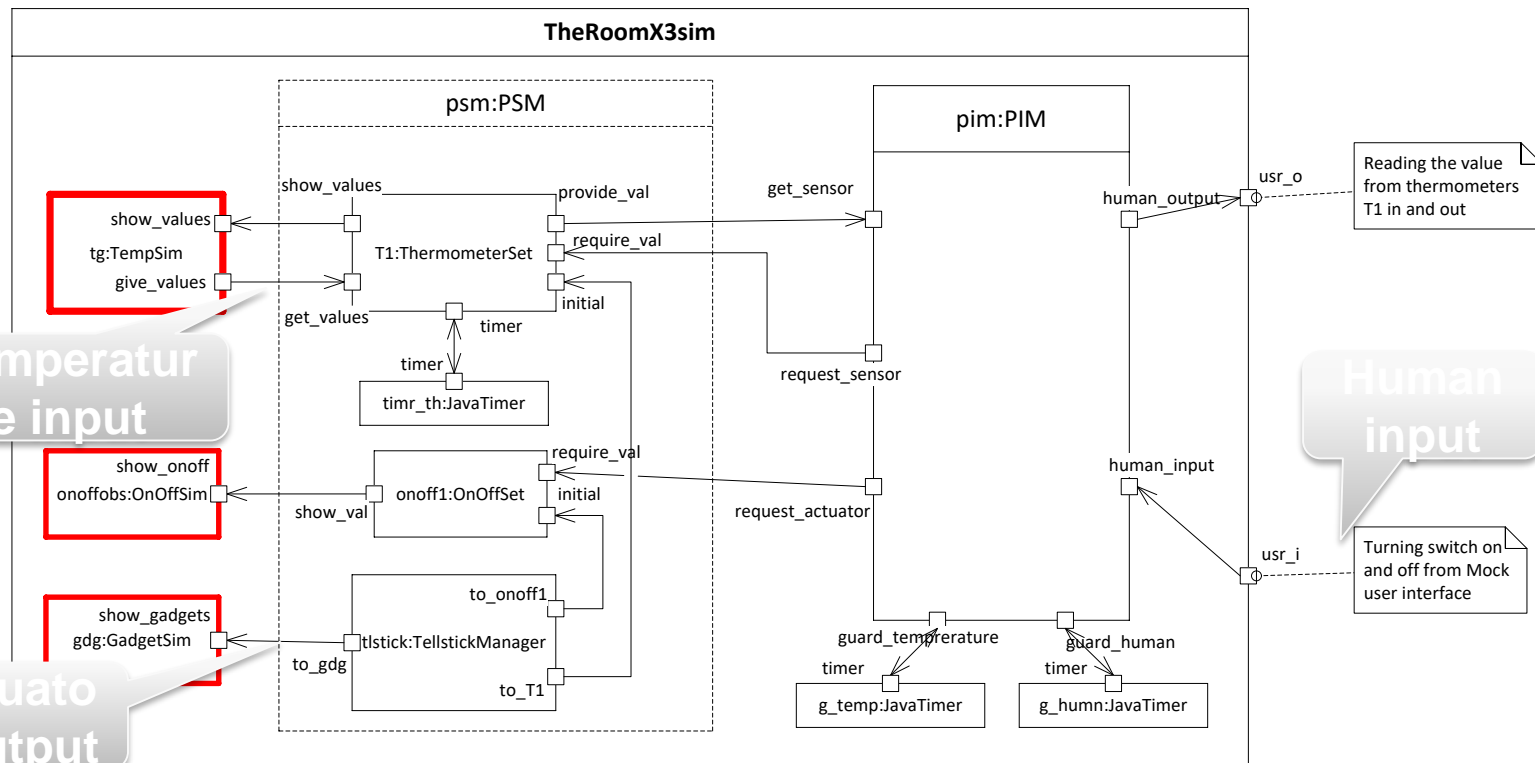
The Human\_myself window has a 'send\_cmd' section with buttons for 'add\_thermometer', 'add\_device', 'fetch\_temp', 'fetch\_all\_temps', 'SwitchOn', and 'SwitchOff'. Each button has associated input fields for 'id', 'did', and 't'. A 'send' button is located below the command line. The log shows 'get\_values?temperature' requests with timestamps. A callout bubble points to the log with the text: 'System response to user'. Another callout bubble points to the right side of the window with the text: 'User input command'.

The GadgetSim\_gdg window shows a 'Command line' field with 'port:message(param1, param2, param3)' and a 'Send' button. The log contains two entries: 'show\_gadgets?sensorinfo' and 'show\_gadgets?deviceinfo'. A callout bubble points to the log with the text: 'Fake gadget hardware observation'.

The OnOffSim\_onoffobs window has a 'Command line' field with 'port:message(param1, param2, param3)' and a 'Send' button. The log shows 'show\_onoff?SwitchOn' and 'show\_onoff?SwitchOff' requests with timestamps. A callout bubble points to the log with the text: 'Simulates switch – on or off'.



# The Room X3 – Simulated Environment



# Timers in ThingML (1)

```
configuration CPS {  
  ...  
  instance g_temp:TimerJava  
  instance g_humn:TimerJava  
  instance timer : TimerJava  
  
  // PSM  
  ...  
  connector T1.timer => timer.timer  
  
  // PIM  
  ...  
  connector pim.guard_temperature =>g_temp.timer  
  connector pim.guard_human => g_humn.timer  
}
```

- Soft timers in ThingML are instances of a Timer thing
- With Java object code there is a TimerJava specialization
- The timer object
  - sends timer\_timeout
  - receives timer\_start, timer\_cancel
- The timer client (here PIM)
  - receives timer\_timeout
  - sends timer\_start, timer\_cancel

# Timers in ThingML (2)

```
thing fragment TimerMsgs {
    // Start the Timer
    message timer_start(delay : Integer);
    // Cancel the Timer
    message timer_cancel()@debug "false";
    // Notification that the timer has expired
    message timer_timeout();
}
thing fragment Timer includes TimerMsgs {
    provided port timer {
        sends timer_timeout
        receives timer_start,
timer_cancel
    }
}
thing fragment TimerClient includes TimerMsgs {
    required port timer {
        receives timer_timeout
        sends timer_start, timer_cancel
    }
}
```

# INF5120

## ”Modelbased System development”

Lecture 10: 20.03.2017  
Anton Landmark

[Anton.Landmark@sintef.no](mailto:Anton.Landmark@sintef.no)

(Guest lecture – no questions for the Exam)



# INF5120

## ”Modellbasert Systemutvikling” ”Modelbased System development”

Lecture 11: 27.03.2017

Arne-Jørgen Berre

[arneb@ifi.uio.no](mailto:arneb@ifi.uio.no) or [Arne.J.Berre@sintef.no](mailto:Arne.J.Berre@sintef.no)

# Content

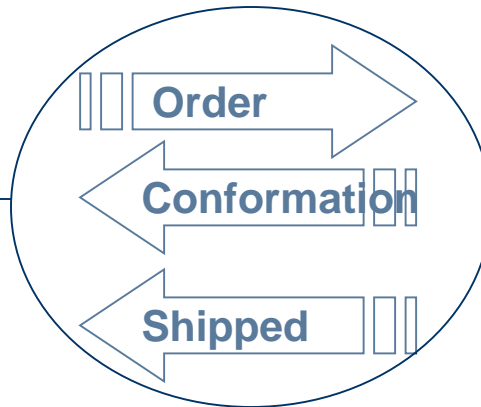
- Service Modeling
- SoaML introduction
- UML 2.0 Collaboration models
- SoaML – Service Architecture
- UML 2.0 Composite models
- SoaML – Port/connector models

# Marketplace Services – Example

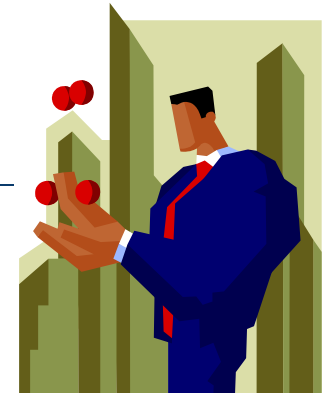


**Mechanics Are Us Dealer**

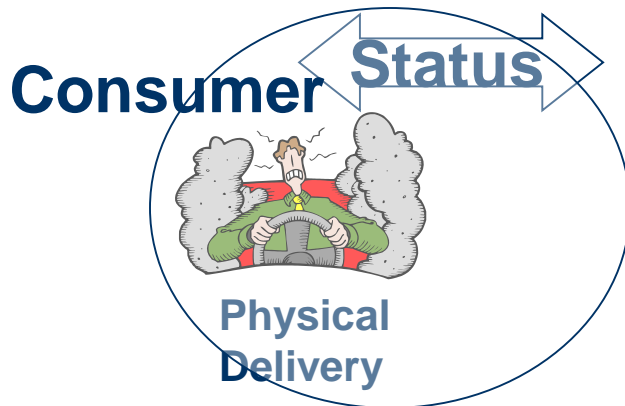
**Consumer**



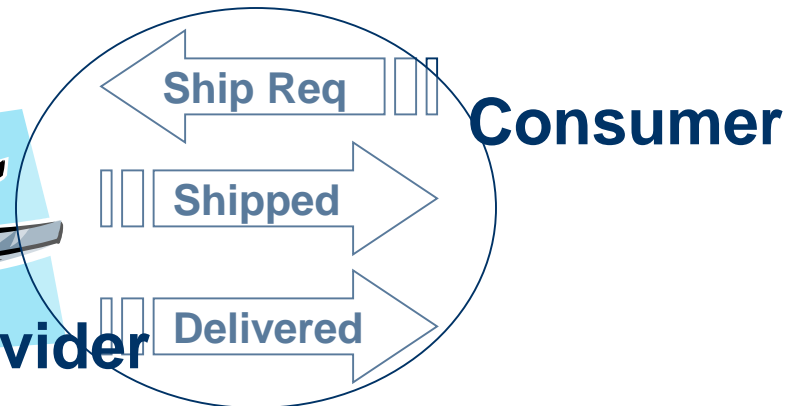
**Provider**



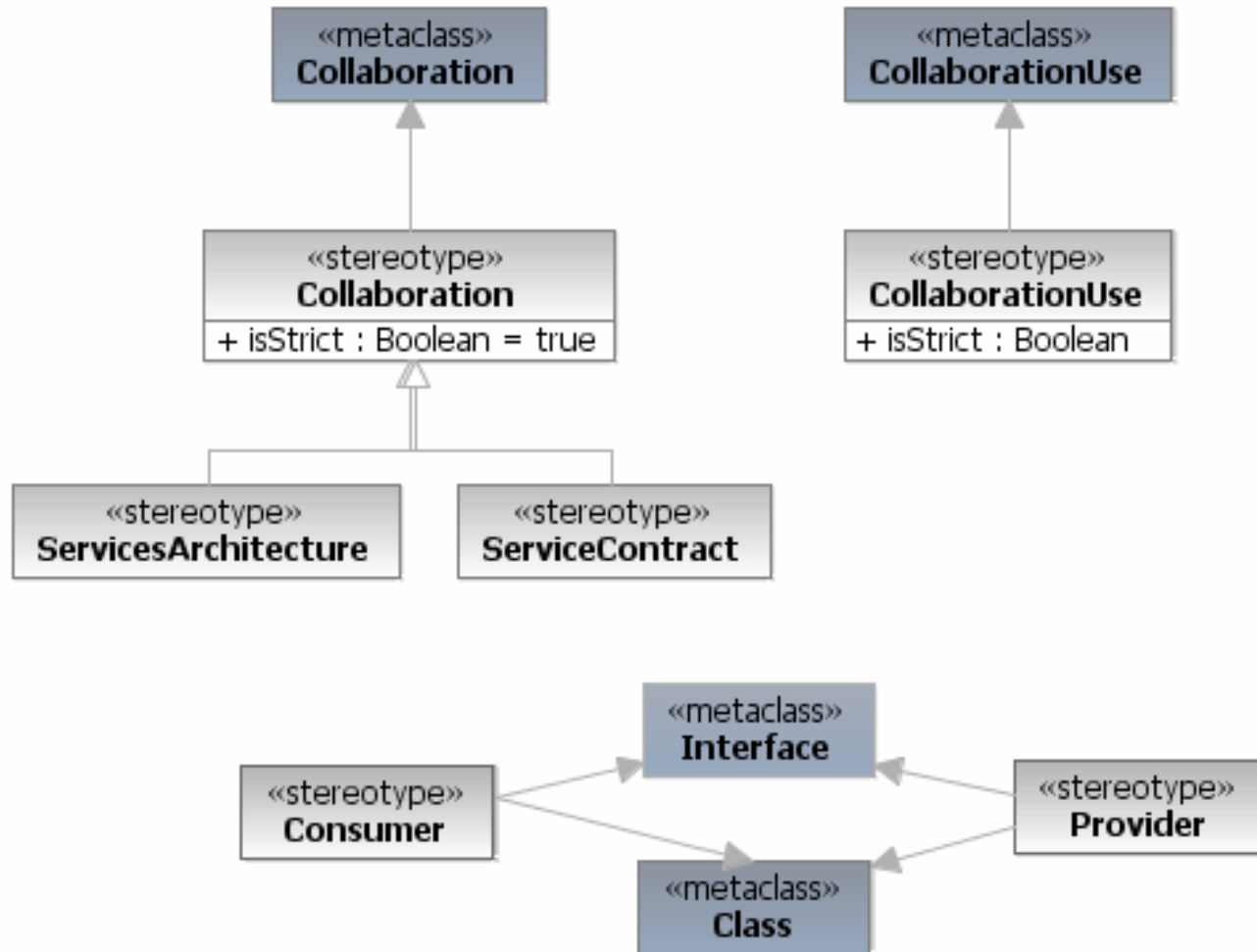
**Acme Industries Manufacturer**



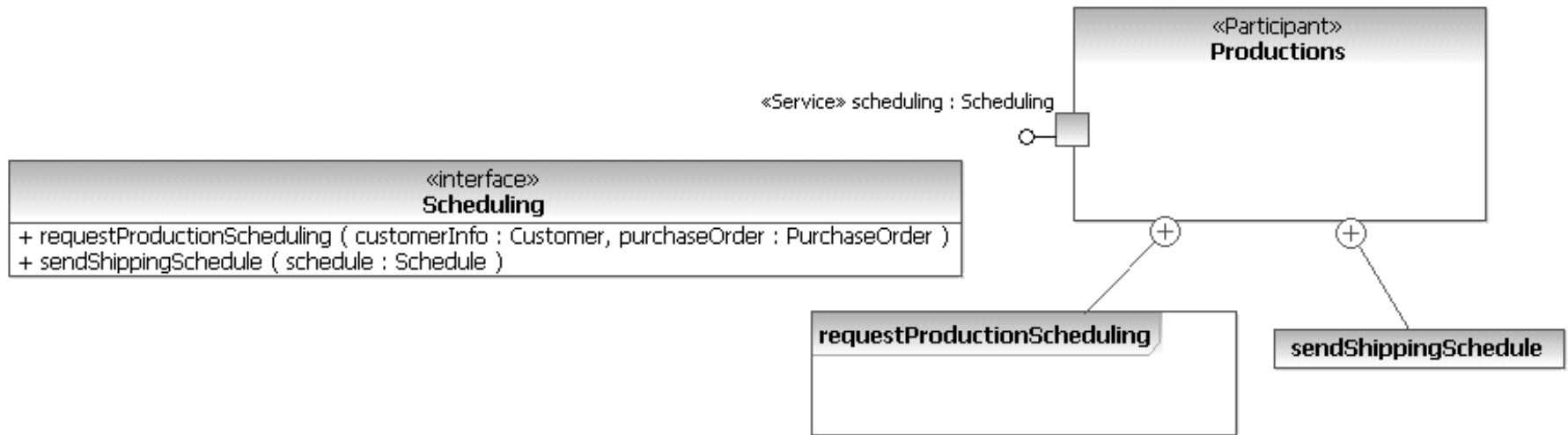
**GetItThere Freight Shipper**



# ServiceContracts and ServiceArchitectures Profile

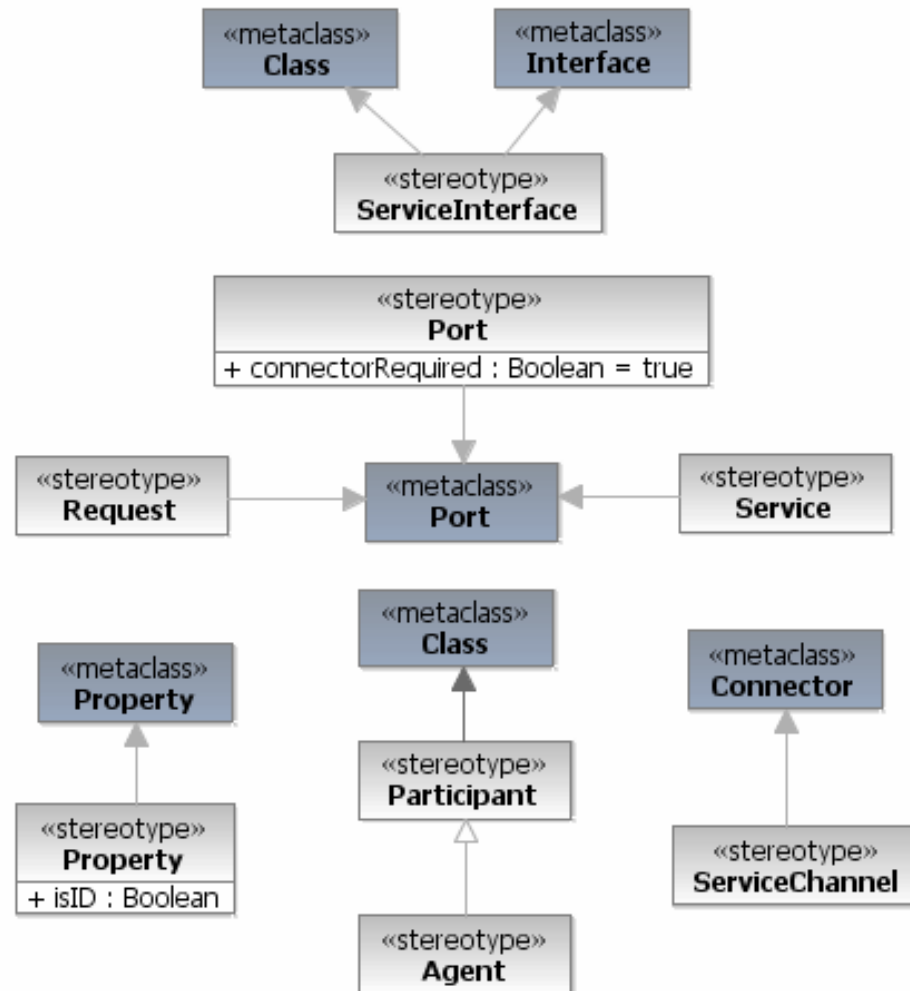


# Service ports and service participants



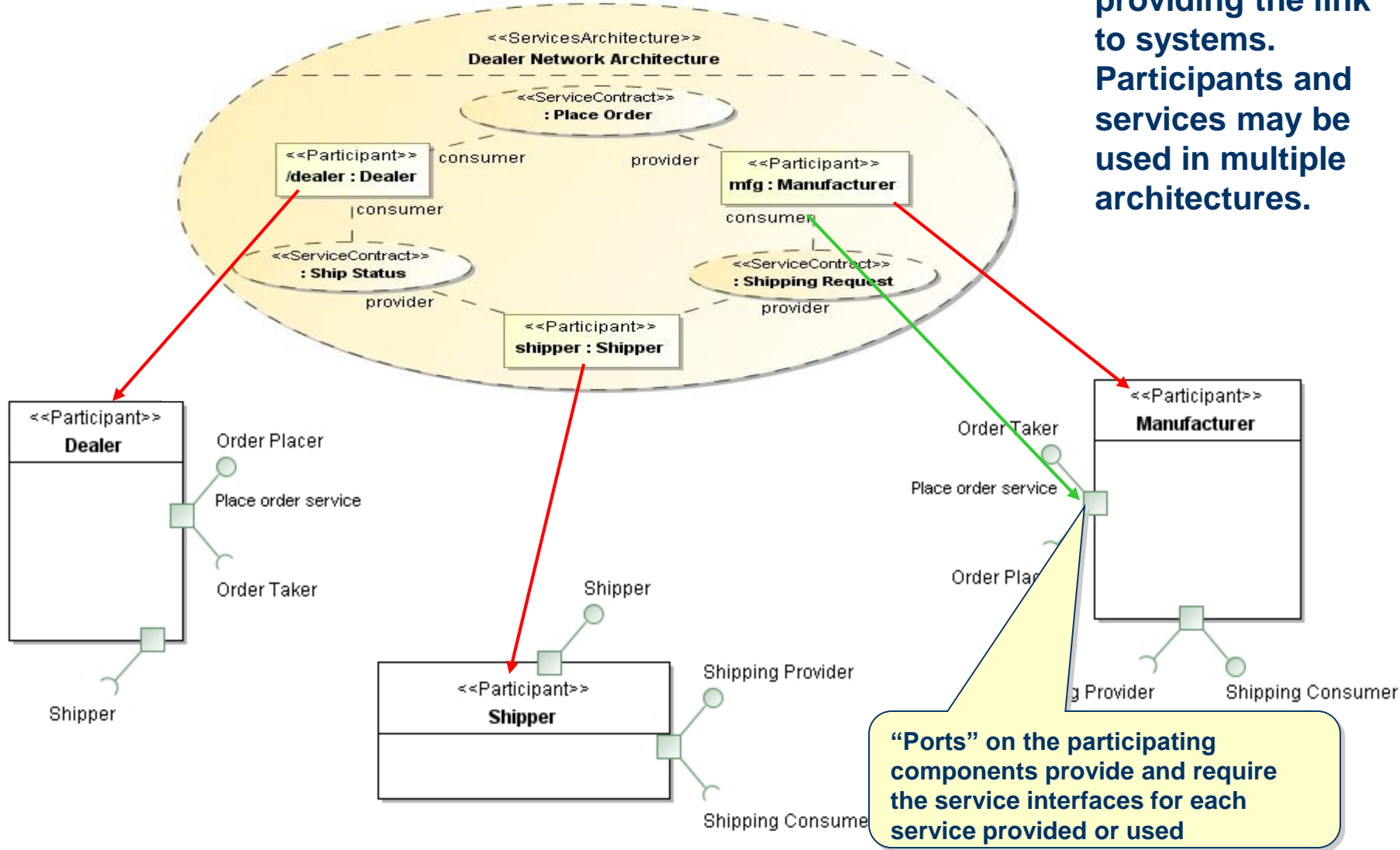
- A Service port:
  - is the offer of a service by one participant to others using well defined terms, conditions and interfaces
  - defines the connection point through which a Participant offers its capabilities and provides a service to clients.
  - It is defined using a UML Port on a Participant, and stereotyped as a `<<Service>>`
- A Service port is a mechanism by which a provider Participant makes available services that meet the needs of consumer requests as defined by ServiceInterfaces, Interfaces and ServiceContracts.

# ServiceInterfaces and Participants Profile



# Logical System Components

Components implement the service interfaces providing the link to systems. Participants and services may be used in multiple architectures.



# INF5120

## ”Modellbasert Systemutvikling” ”Modelbased System development”

Lecture 12: 03.04.2017

Arne-Jørgen Berre

[arneb@ifi.uio.no](mailto:arneb@ifi.uio.no) or [Arne.J.Berre@sintef.no](mailto:Arne.J.Berre@sintef.no)



# Oblig 3 – Use of Eclipse EMF and SIRIUS for the creation of an Archimate graphical editor

<https://eclipse.org/sirius/>

**Sirius** OVERVIEW FEATURES GALLERY GET STARTED COMMUNITY DOWNLOAD

## DOWNLOAD

**Install Sirius with Eclipse Marketplace**

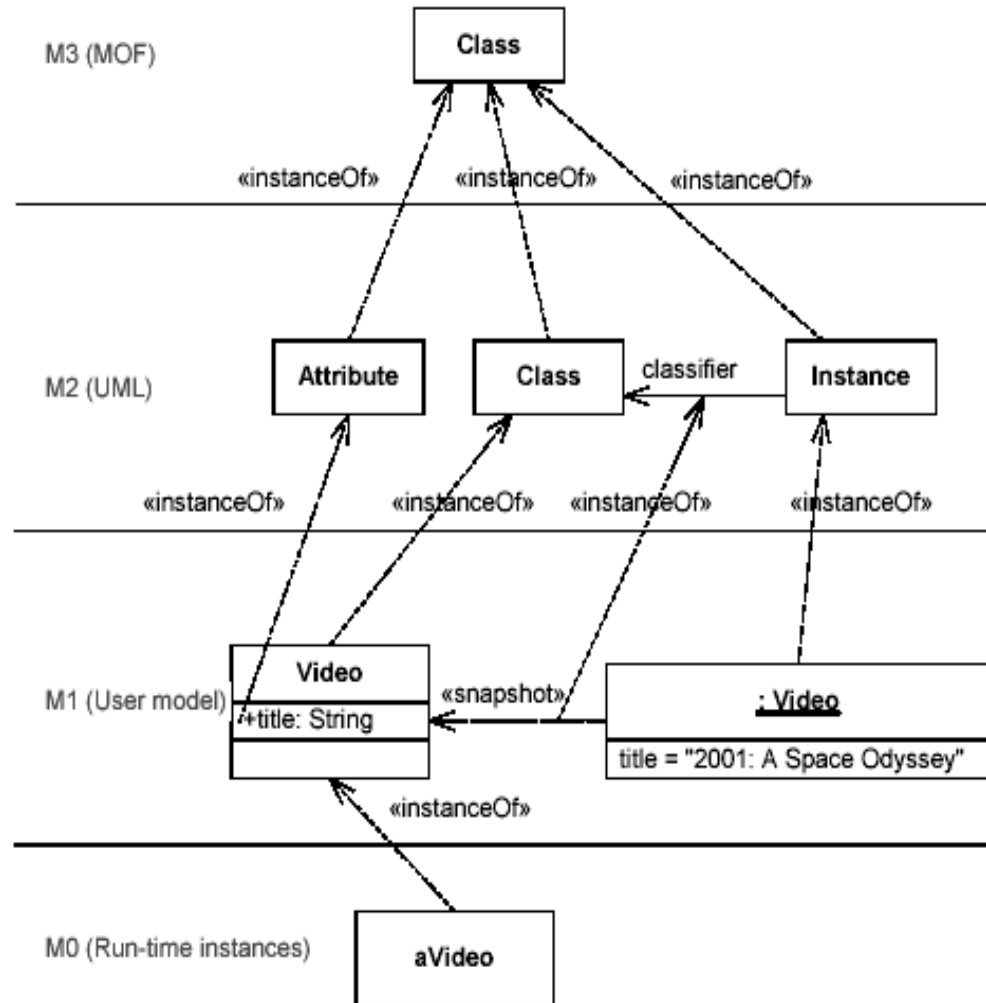
Browse the Marketplace, choose Sirius and just click on the install button.

**Requirement:** Please make sure that Marketplace is already installed in your Eclipse, otherwise these installation instructions won't work as expected.  
For more details, please refer to [Introducing the Eclipse Marketplace Client](#) installation guide.

# Content

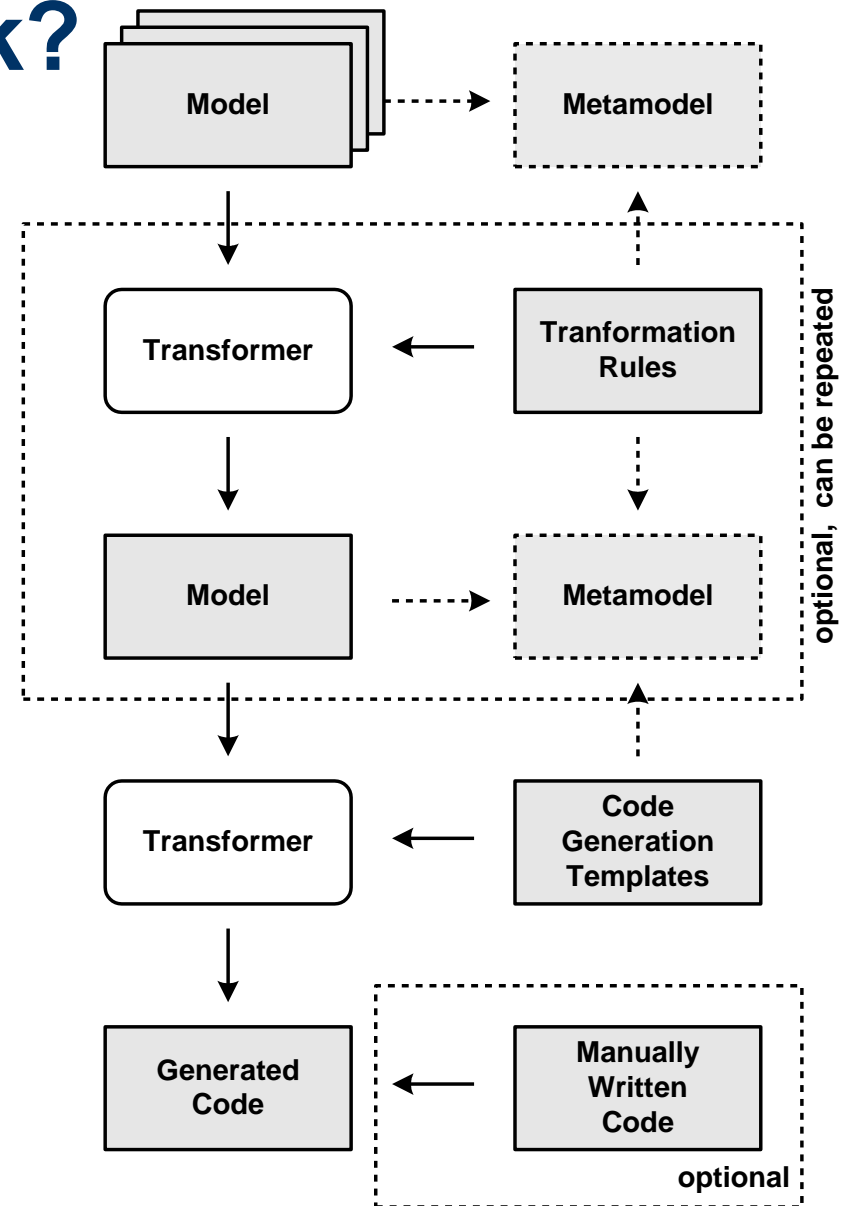
- Introduction to Metamodels and UML Profiles
- Introduction to Eclipse, EMF and Sirius
- Introduction to Oblig 3 – for May 4th

# The 4 layers in practice

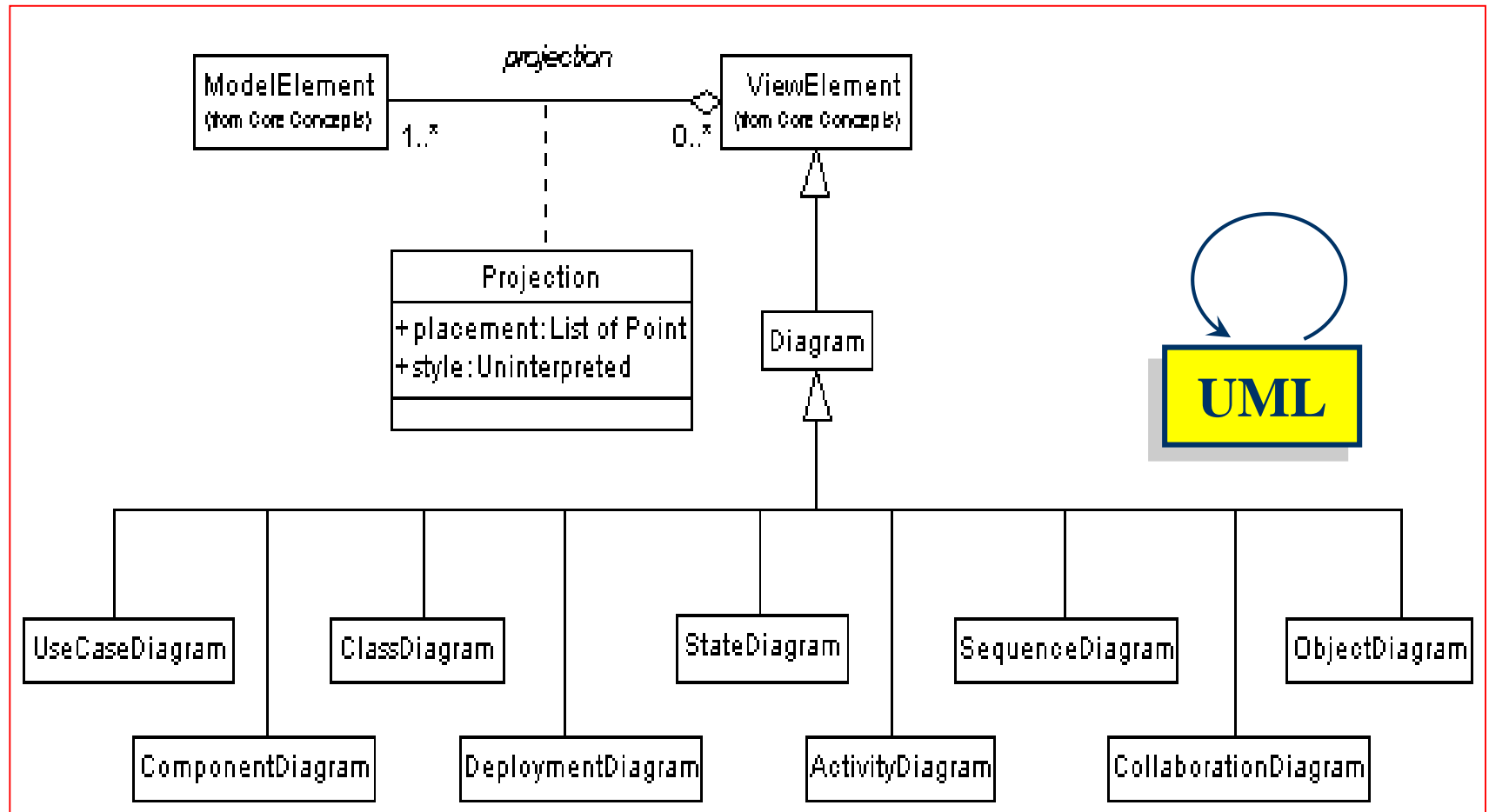


# How does MDD work?

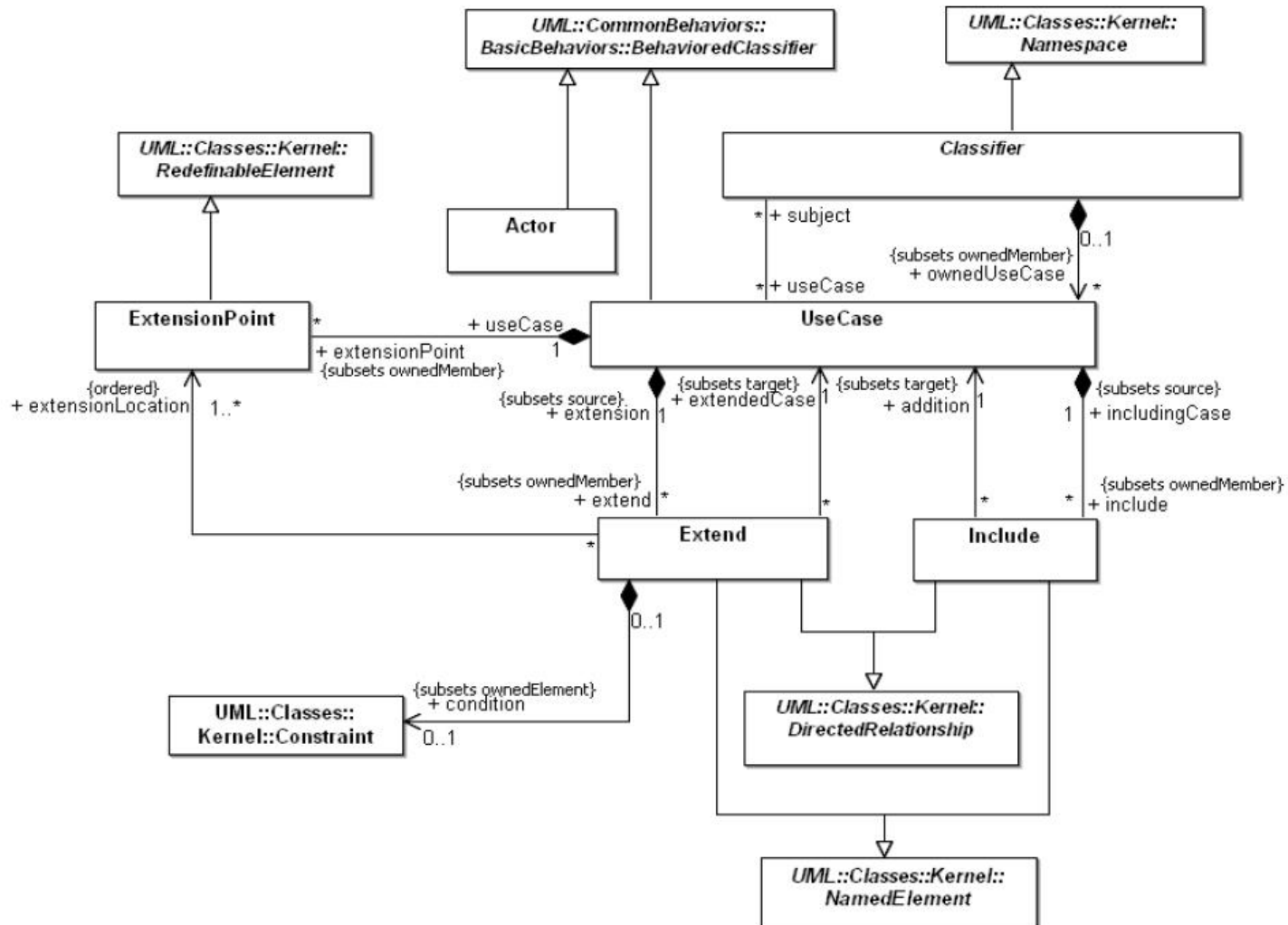
- Developer develops **model(s)** based on certain **metamodel(s)**.
- Using **code generation templates**, the model is transformed to executable code.
- Optionally, the **generated code is merged** with manually written code.
- One or more **model-to-model transformation steps** may precede code generation.



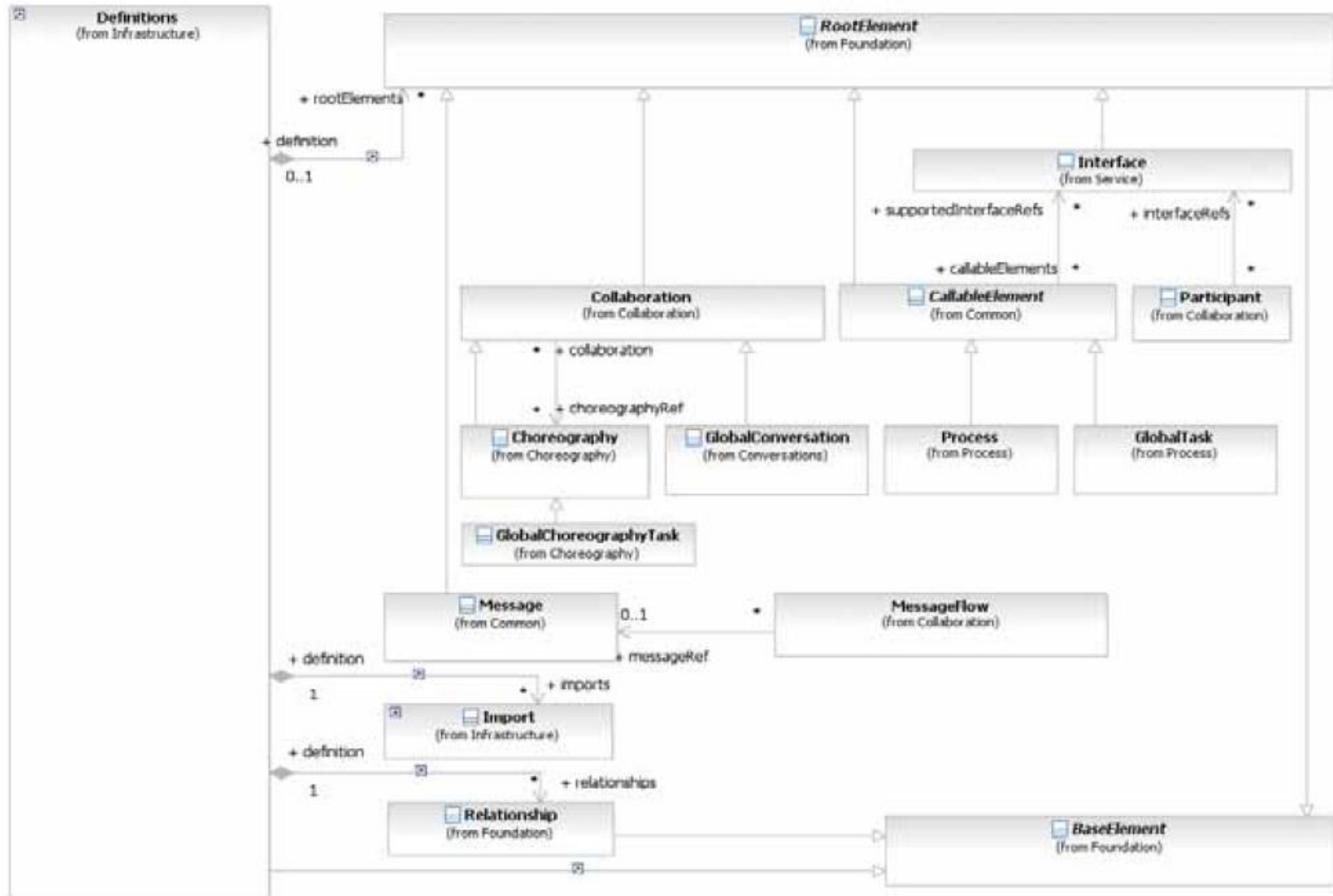
# Fragments of a UML metamodel



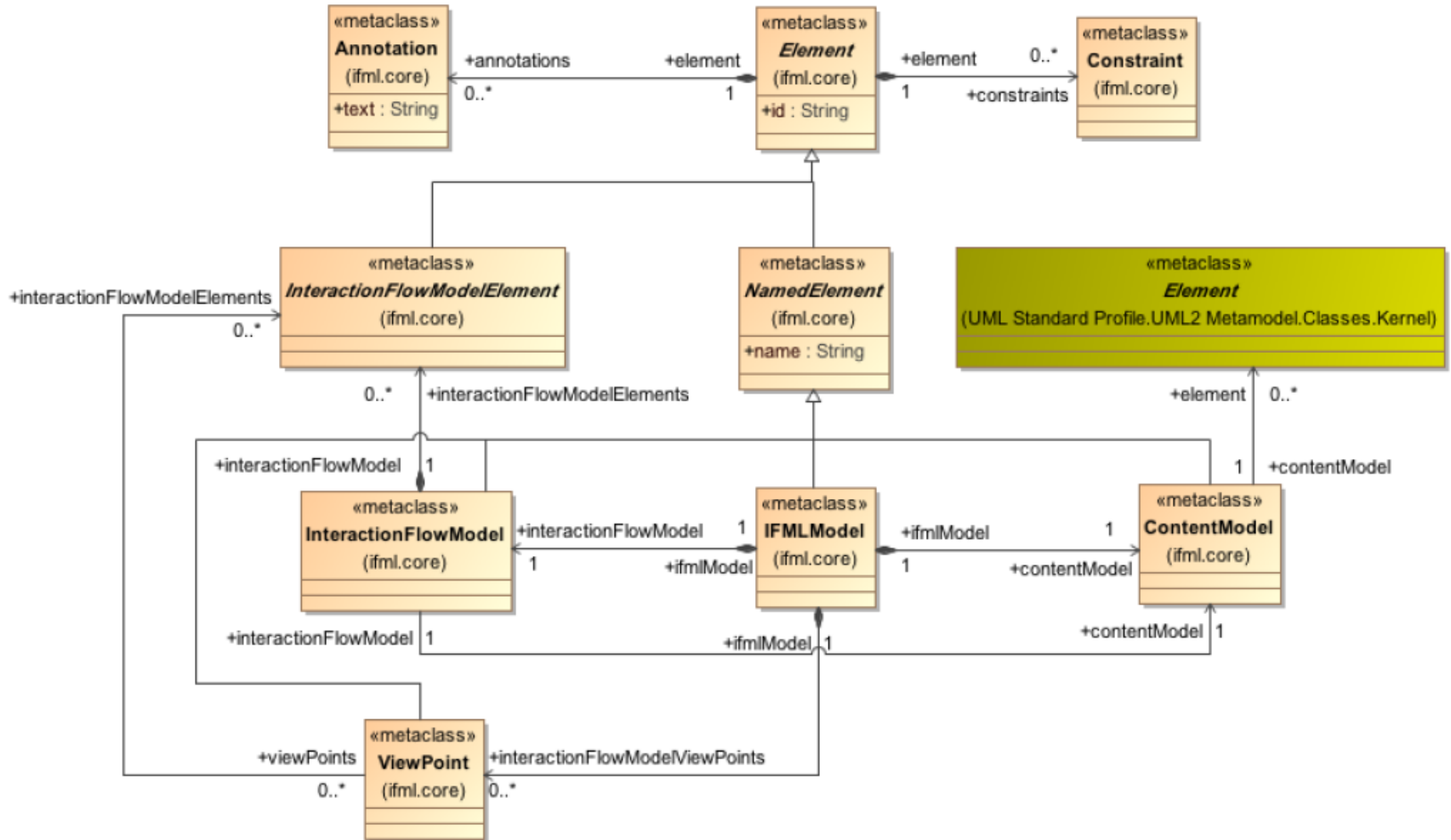
# UML Use Case Metamodel



# BPMN Metamodel



# IFML Metamodel





# INF5120

## ”Modellbasert Systemutvikling” ”Modelbased System development”

Lecture 13: 24.04.2017

Arne-Jørgen Berre

[arneb@ifi.uio.no](mailto:arneb@ifi.uio.no) or [Arne.J.Berre@sintef.no](mailto:Arne.J.Berre@sintef.no)

# Content

- MOF and EMF
  - Model transformations
  - MOFScript
  - ATL
  - Acceleo
- 
- OCL – UML Object Constraint Language

# Introduction

## ATHENA Model-Driven Interoperability (MDI) Framework

MDA & Interoperability

Metamodelling

UML Profiles & DSLs

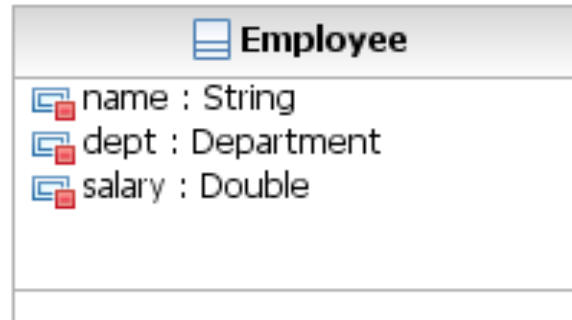
Model Transformations

Method Engineering

### Reusable MDI Assets

- Method chunks
- Tools and services
- Models and metamodels
- Model transformations
- DSLs and UML profiles
- Reference examples

# MOF to Text Example



```
[template public classToJava(c : Class)]
class [c.name/] {
    // Attribute declarations
    [attributeToJava(c.attribute)]
    // Constructor
    [c.name/] () {
    }
}
[/template]
```

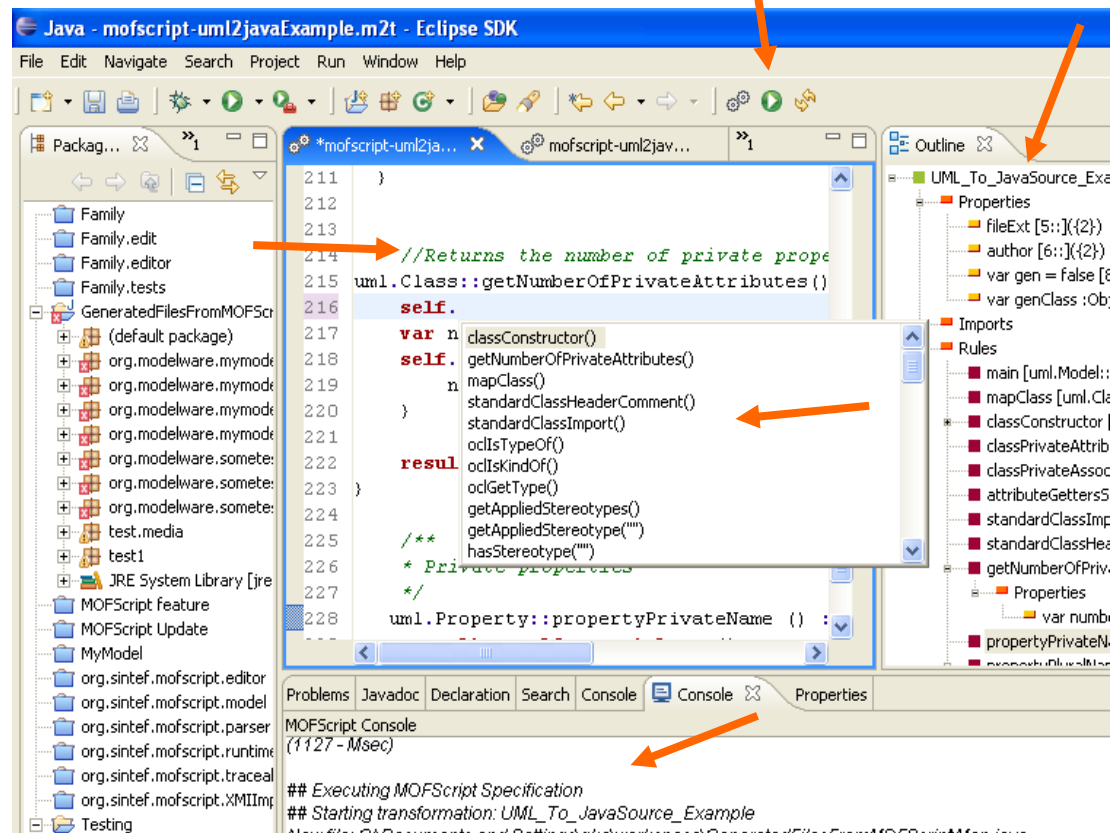
```
[template public attributeToJava(a : Attribute)]
[a.type.name/] [a.name/];
[/template]
```

```
class Employee
{
    // Attribute declarations
    String name;
    Department dept;
    Double salary;

    // Constructor
    Employee()
    {
    }
}
```

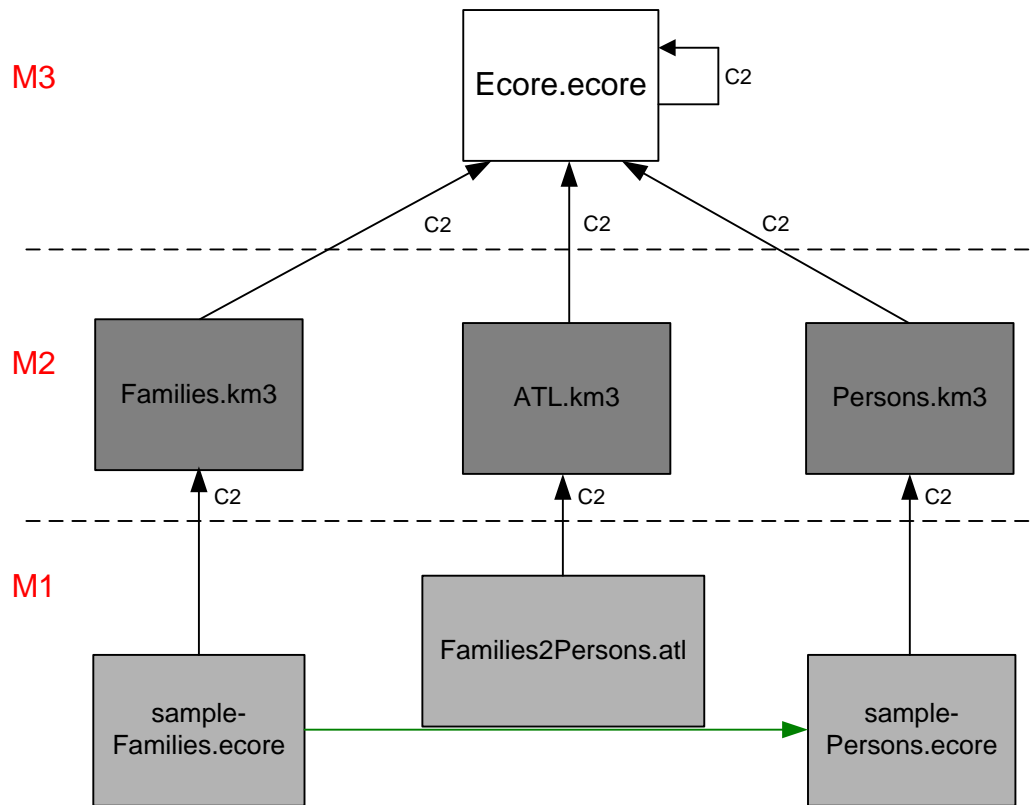
# MOFScript a model to text tool

- Provides the means of:
  - Editing, compiling and executing
- Syntax high-lightning
- Content assist
- Outline
- MOFScript Console



# The big picture

Eclipse Modeling Framework (EMF)

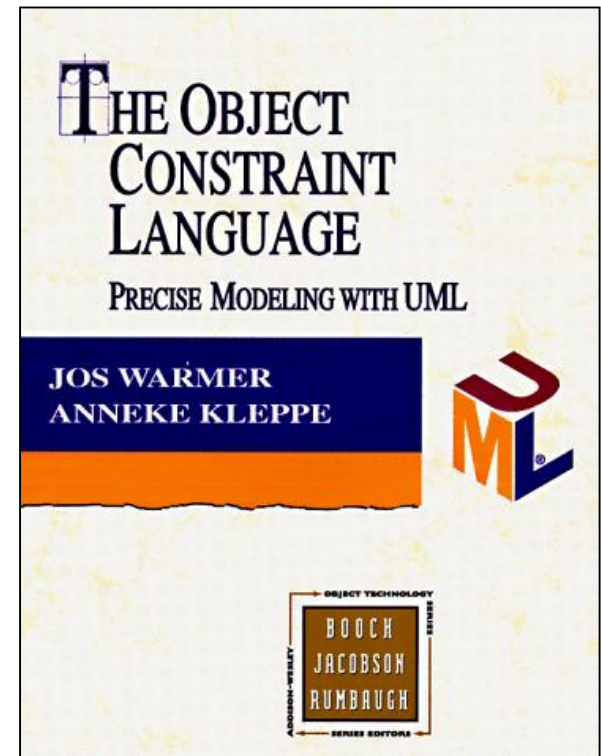


1. Our goal in this mini-tutorial is to write the ATL transformation, stored in the "Families2Persons" file.
2. Prior to the execution of this transformation the resulting file "sample-Persons.ecore" does not exist. It is created by the transformation.
3. Before defining the transformation itself, we need to define the source and target metamodels ("Families.km3" and "Person.KM3").
4. We take for granted that the definition of the ATL language is available (supposedly in the "ATL.km3" file).
5. Similarly we take for granted that the environment provides the recursive definition of the metamodel (supposedly in the "Ecore.ecore" file).

# UML OCL

## Object Constraint Language

- The Object Constraint Language
  - ISBN 0-201-37940-6
- OCL home page
  - [www.klasse.nl/ocl/index.htm](http://www.klasse.nl/ocl/index.htm)



# INF5120

## ”Modellbasert Systemutvikling” ”Modelbased System development”

Lecture 14: 08.05.2017

Arne-Jørgen Berre

[arneb@ifi.uio.no](mailto:arneb@ifi.uio.no) or [Arne.J.Berre@sintef.no](mailto:Arne.J.Berre@sintef.no)



# Content

- Archimate 2.0 and 3.0
- Metamodels for Archimate
  
- Xtext
- Xtext tutorial
- Xtext for ThingML
  
- NFR – Non Functional Requirements

# Archimate 3.0

- What is new:
- <http://www.opengroup.org/subjectareas/enterprise/archimate/3.0-whats-new>
- Introduction to Archimate 3.0 – part 1 to 7 (vode=
- <https://www.youtube.com/watch?v=ULI9lf0OZco&list=PLB8F2ECDADDEE616AA>
- Archimate 3.0 in Practice – part 1 to 5
- [https://www.youtube.com/watch?v=\\_kmYkxKb\\_o&list=PLB8F2ECDADDEE616AA&index=8](https://www.youtube.com/watch?v=_kmYkxKb_o&list=PLB8F2ECDADDEE616AA&index=8)

# Xtext

- <https://eclipse.org/Xtext/documentation/index.html>
- [https://eclipse.org/Xtext/documentation/102\\_domainmodel\\_walkthrough.html](https://eclipse.org/Xtext/documentation/102_domainmodel_walkthrough.html)
- <https://www.eclipsecon.org/france2015/sites/default/files/slides/presentation.pdf>

# Tom and Kai Gilb

[www.Gilb.com](http://www.Gilb.com)



# INF5120

## ”Modellbasert Systemutvikling” ”Modelbased System development”

Lecture 15: 15.05.2017

Arne-Jørgen Berre

[arneb@ifi.uio.no](mailto:arneb@ifi.uio.no) or [Arne.J.Berre@sintef.no](mailto:Arne.J.Berre@sintef.no)

# 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
- 27/2: Oblig 1: Smart Building – Business Architecture and App/Portal with IFML WebRatio UI for Smart Building
  
- March (8-11) (Modeling of IoT/CPS/Cloud, Services and Big Data – UML SM/SD/Collab, ThingML Server-Side):
- 8-6/3: Basis for DSL and ThingML -> UML State Machines and Sequence Diagrams
- 9-13/3: ThingML DSL - UML Composite structures, State Machines and Sequence Diagrams II
- 10-20/3: Guest lecture, "Experience with Modelling", Anton Landmark, SINTEF
- 11-27/3: ThingML part 2 and UML Service Modeling, Architectural models, SoaML. Role modeling and UML Collaboration diagrams
  
- April/May (12-14) (MDE – Creating Your own Domain Specific Language):
- 12-3/4: Model driven engineering – Metamodels, DSL, UML Profiles, EMF, Sirius Editors – intro to Oblig 3
  
- EASTER – 10/4 og 17/4
- 20/4: Oblig 2: Smart Building – Individual and group delivery - Internet of Things control with ThingML – Raspberry Pi, Wireless sensors (temperature, humidity), actuators (power control)
  
- 13-24/4: MDE transformations, Non Functional requirements – Discussion of Oblig2 and 3
- 1. Mai – Official holiday
- 4/5: Oblig 3 - Your own Domain Specific Language – (ArchiMate) (Delivery – Thursday May 4<sup>th</sup> )
- 14-8/5: Archimate 2.0/3.0 (Oblig 3) and Xtext (for ThingML) and NFR (Discussion of Oblig 2/ 3)
  
- May (15-17): (Bringing it together)
- 15-15/5: Summary of the course – Final demonstrations (ESITO and/or GENUS), <http://www.esito.no/> and <https://www.genus.no/>
- 16-22/5: Previous exams – group collaborations (Guest lecture – ThingML language development, with Xtext, Franck Flerey SINTEF)
- 17-29/5: Conclusions, Preparations for the Exam by old exams
- June (Exam)
- 13/6: Exam (4 hours), Tuesday June 13<sup>th</sup>, 0900-1300

# Next lecture – May 29th

- Presentations and discussions of Oblig 3
- Exams for 2016 and 2015 (available on course web page)
- (No lecture/exercise on May 22nd)