Modelling and Metamodelling

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Model Driven Engineering

The OMG Model Driven Architecture

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October 2009

Organisation du module : Partie IDM

- Séances : 8 cours, 4 TD/TP, 15 BE + 15 projets
- Évaluation théorique : Examen
- Évaluation pratique : Projets (mi-parcours et fin)
  - Métamodélisation (structure et sémantique statique)
  - Syntaxe concrète (texte et graphique)
  - Génération code
  - Transformations de modèles
- TP en monôme : étude de cas itérative
- BE/Projet en binôme : extension étude de cas

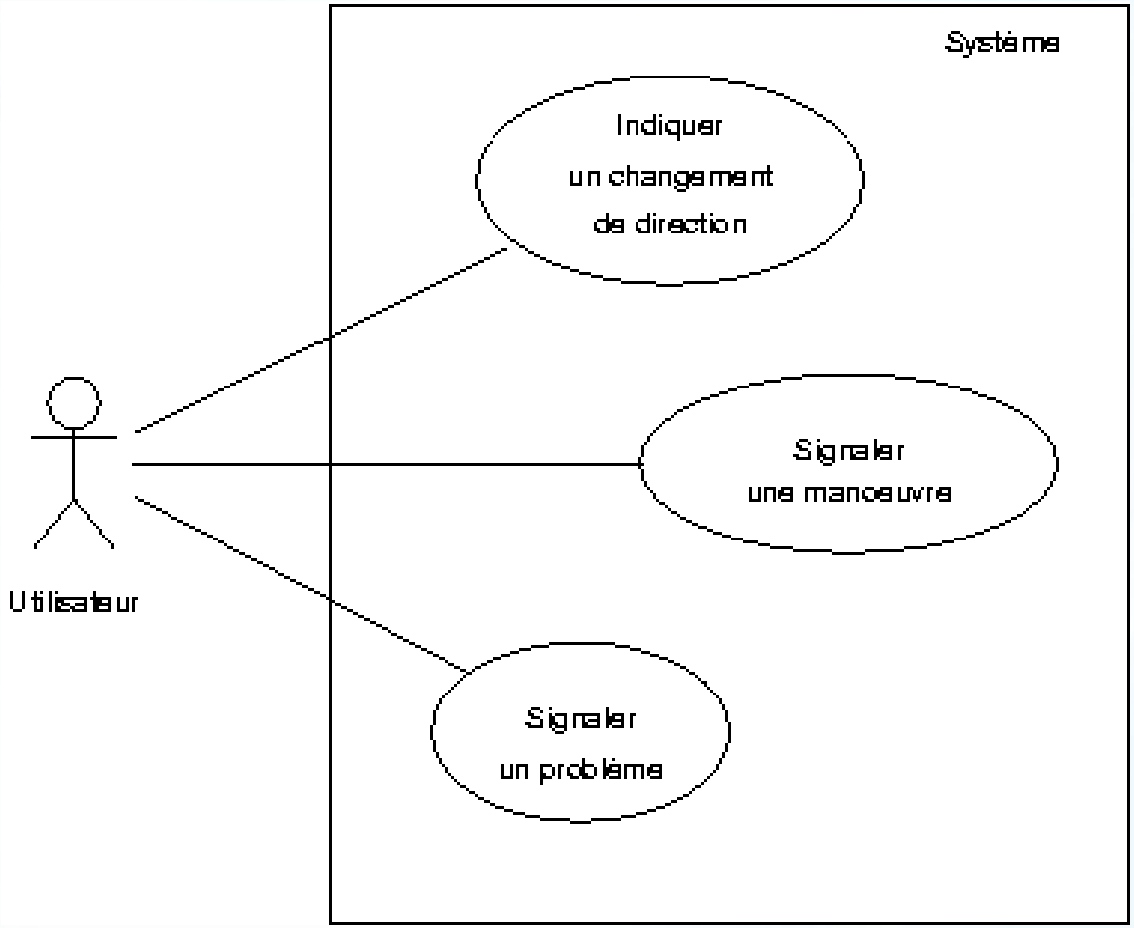
Modelling purpose

- Help in understanding complex systems
- Separation of Concerns/Aspects
- Abstract from specific platforms
  - Architecture
  - Operating system
  - Language
- Abstract from specific domains
- Reuse
- Formalization
- Communication

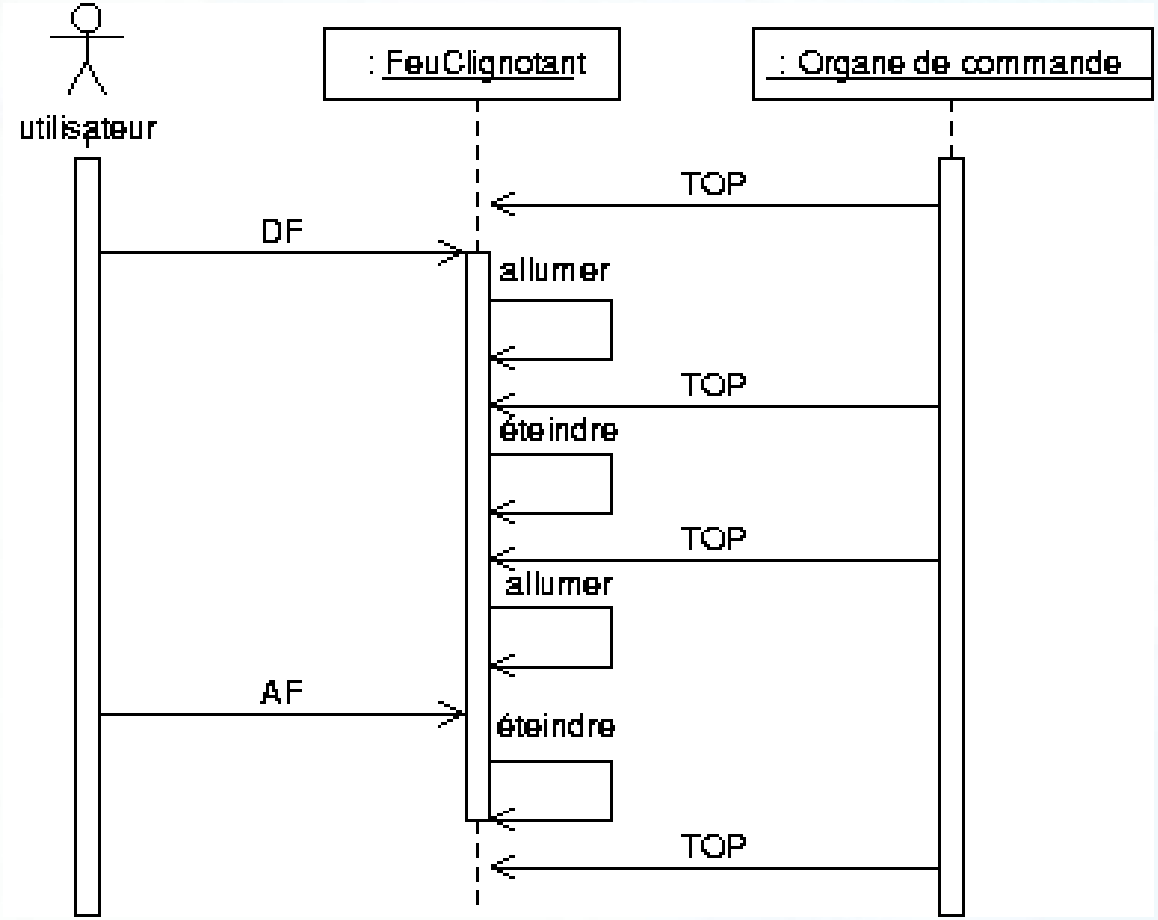
Multiple models

- Lifecycle steps
  - Requirement analysis (computation independent)
  - Specification/Conception (platform independent)
  - Implementation/Deployment (platform dependent)
- Refinement level
- Separation of concern
  - Multiple domains (application)
  - Multiple platforms (technologies, hardware, software)
  - Multiple constraints (services/Quality of Service)

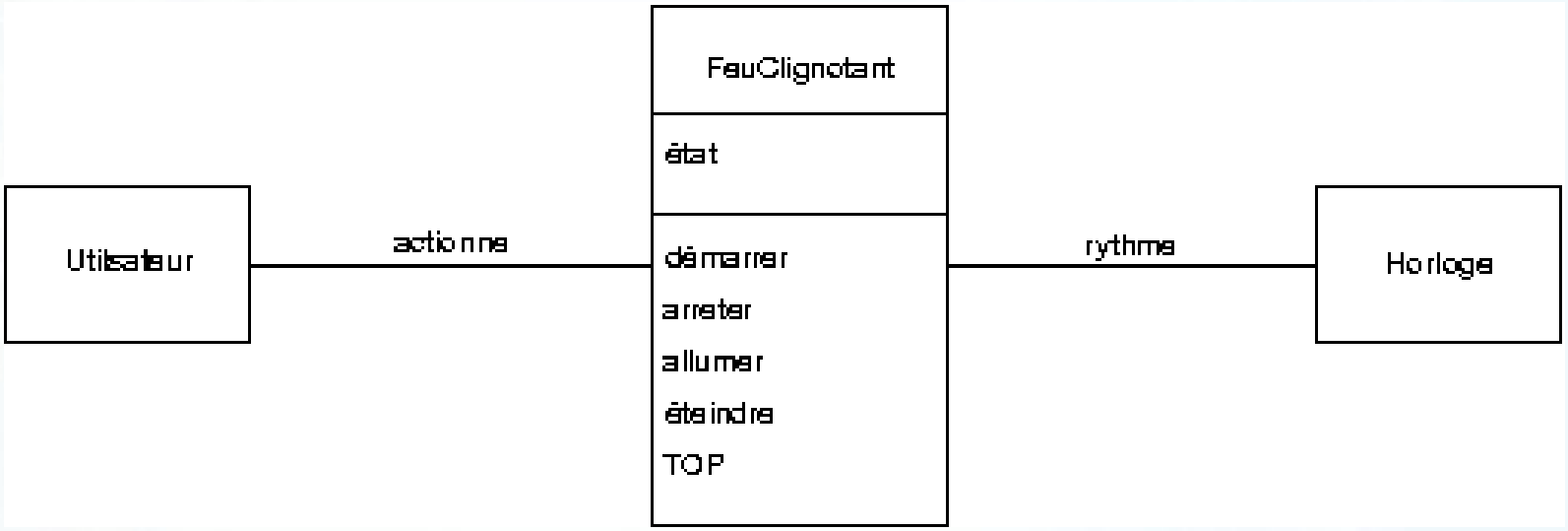
Requirement analysis example: UML Use Case



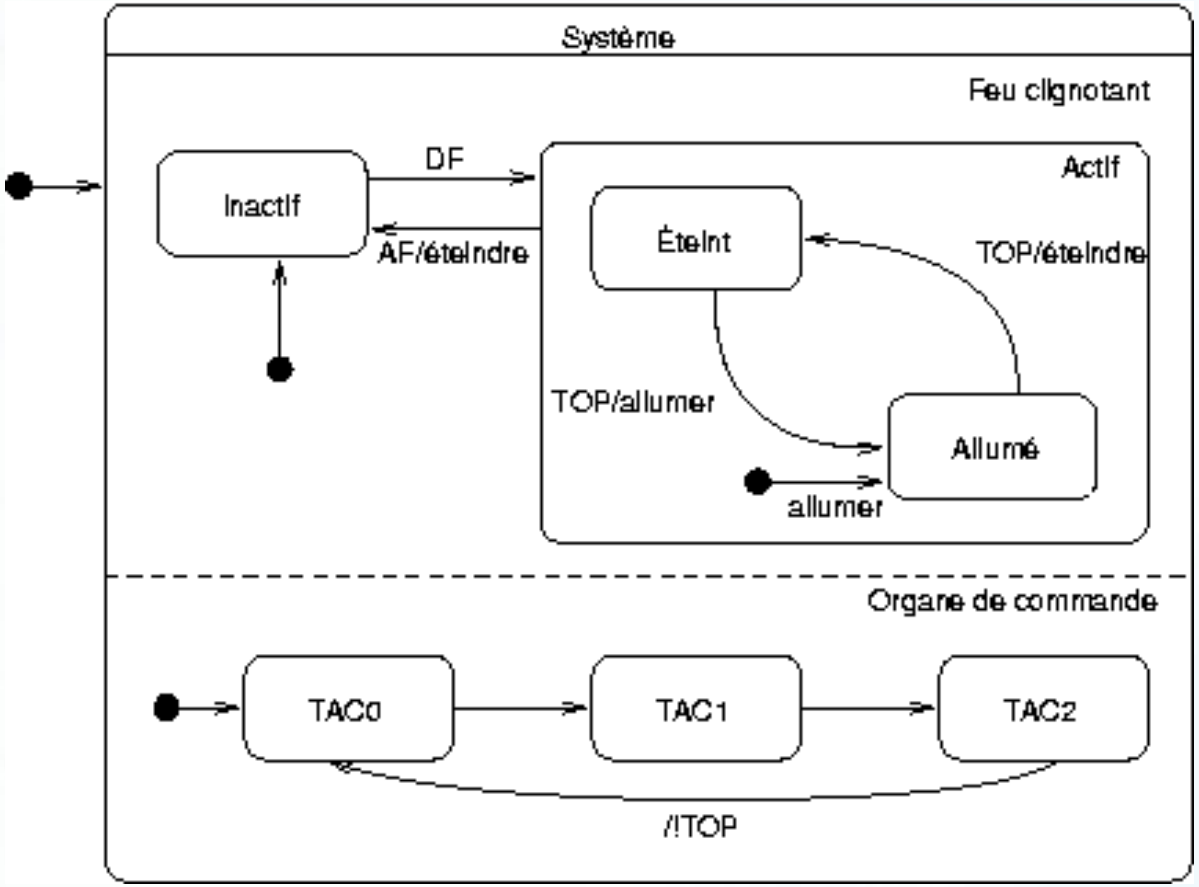
Behaviour modelling example: UML Sequence charts



Data Modelling example: UML Class diagram



Behaviour Modelling example II: UML State diagram



Model Transformation

- Purpose : relate an application multiple models
- Mean : Build one model using another one
  - Extract information from the initial one
    - Actors, Classes, Attributes, Methods, Evenements, Actions
  - Generate the final one using the information
- Is it bijective ?
- Is it total ?
- What about code generation ?
- Transformations can be modelled

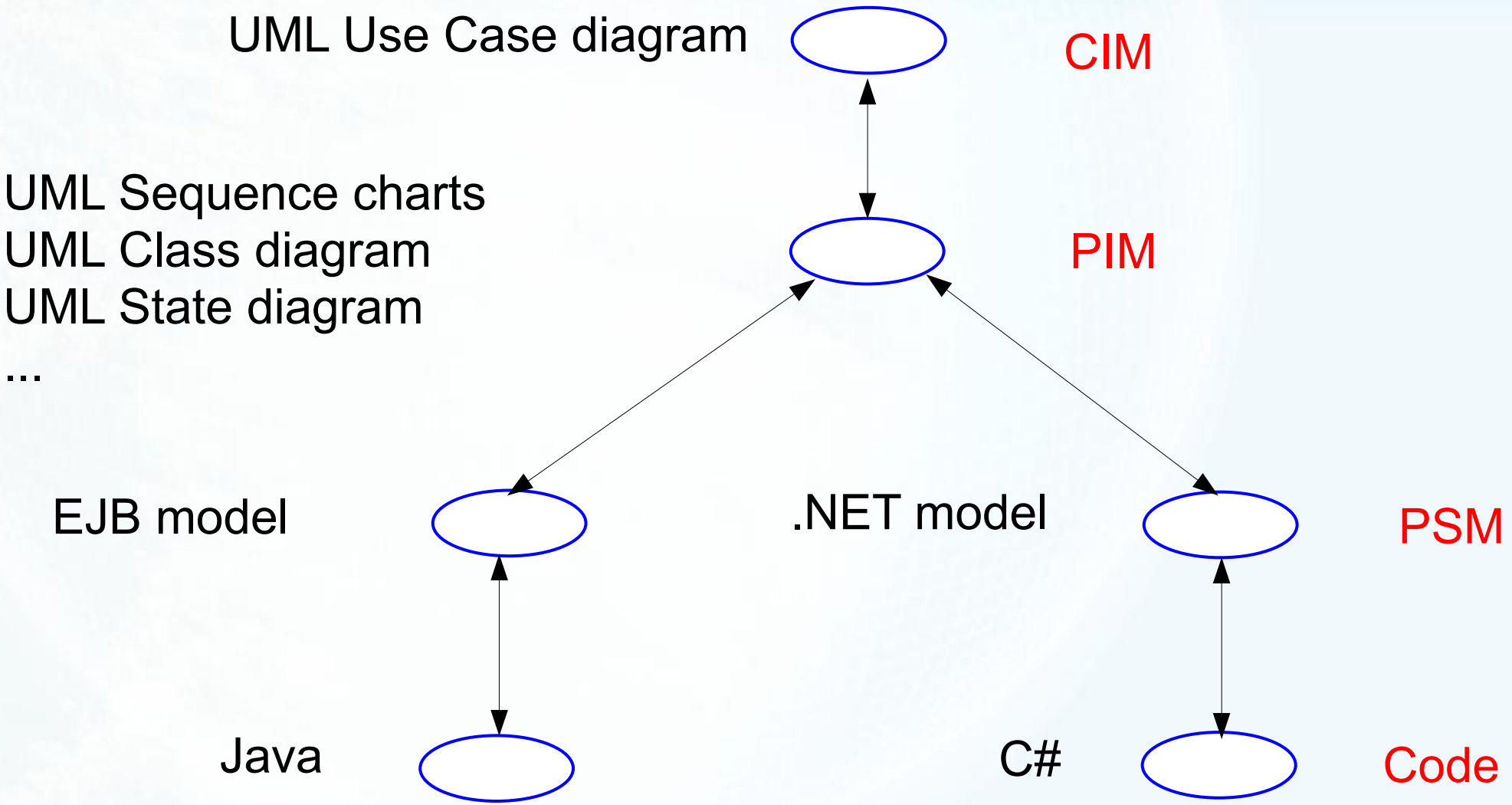
OMG Model Driven Architecture (MDA)

1999 : Standard for previous concepts

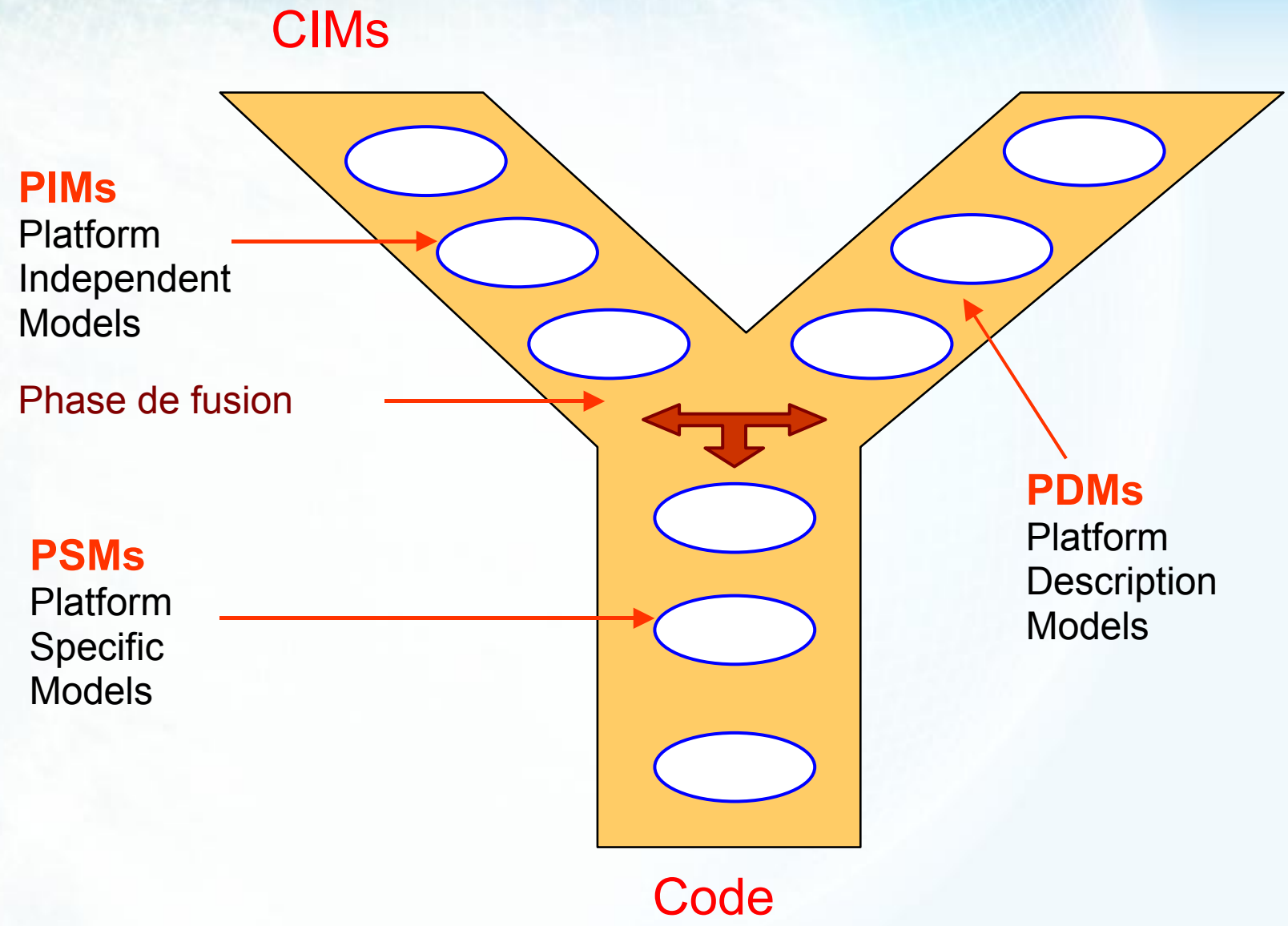
Model centric approach

- CIM : Computation Independant Model
  - Requirement analyses
- PIM : Platform Independent Model
- PSM : Platform Specific Model
- PDM : Platform Description Model
  - Transformation from PIM to PSM

Example


UML Use Case diagram
CIM
UML Sequence charts
UML Class diagram
UML State diagram
...
PIM
EJB model
.NET model
PSM
Java
C#
Code

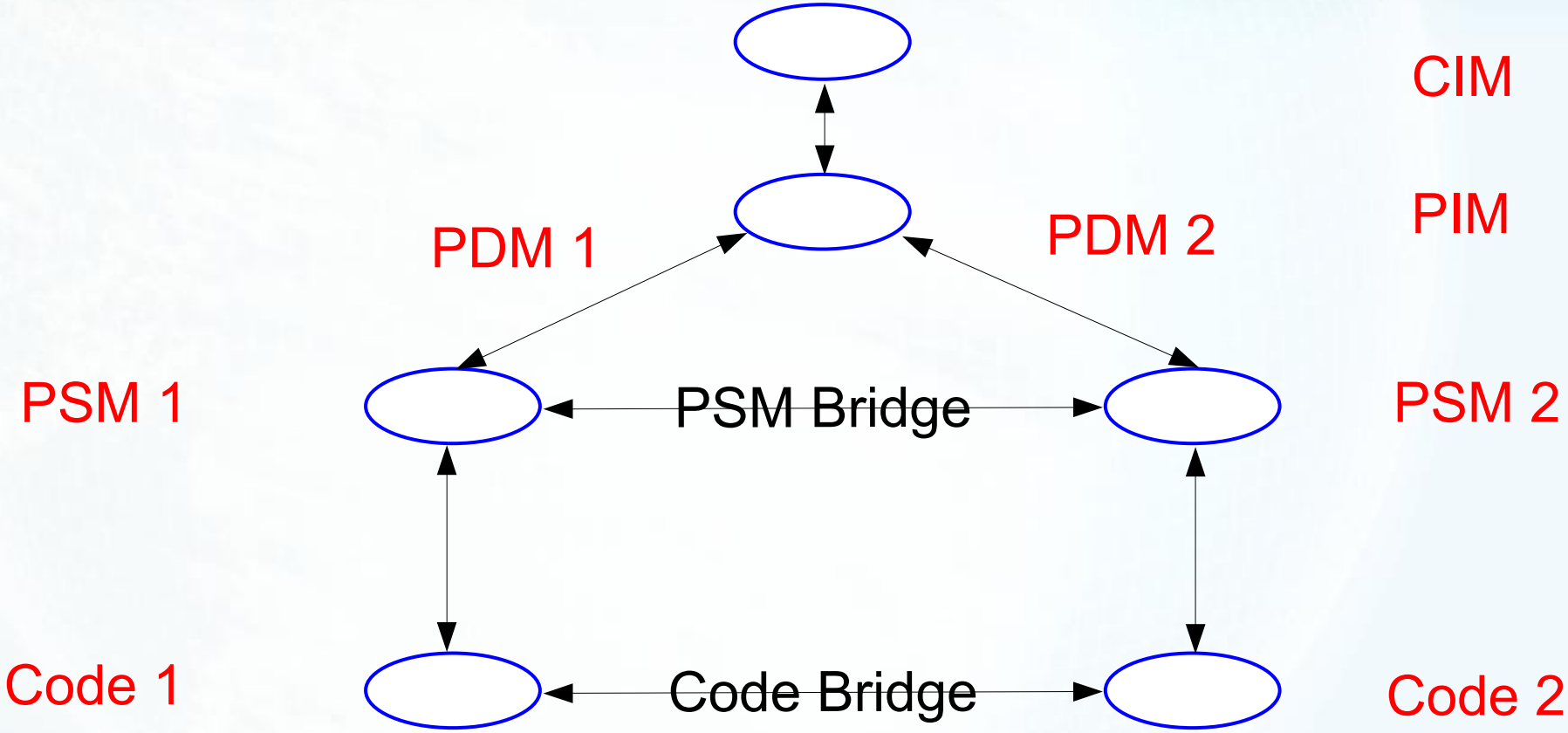
Y LifeCycle


CIMs
PIMs
Platform
Independent
Models
Phase de fusion
PSMs
Platform
Specific
Models
PDMs
Platform
Description
Models
Code

The real Y LifeCycle

- The Y cycle is idealist
- Real lifecycle
  - Many preoccupations
  - A Y for each one
- In fact : A forest with merge nodes
  - Childs are refinements

Interoperability : Bridge model



Meta-Modelling

- A model is an instance from a modelling formalism
- Formalism : Language (textual ou graphical)
- Requirements :
  - Store/Retrieve models
  - Edit models (textual, graphical)
  - Validate models
  - Transform models
- Purpose :
  - Uniform approach
  - Patterns
  - Generative approach
- HowTo : Modelling models themselves