02291: System Integration

Model-Driven Architecture (MDA)

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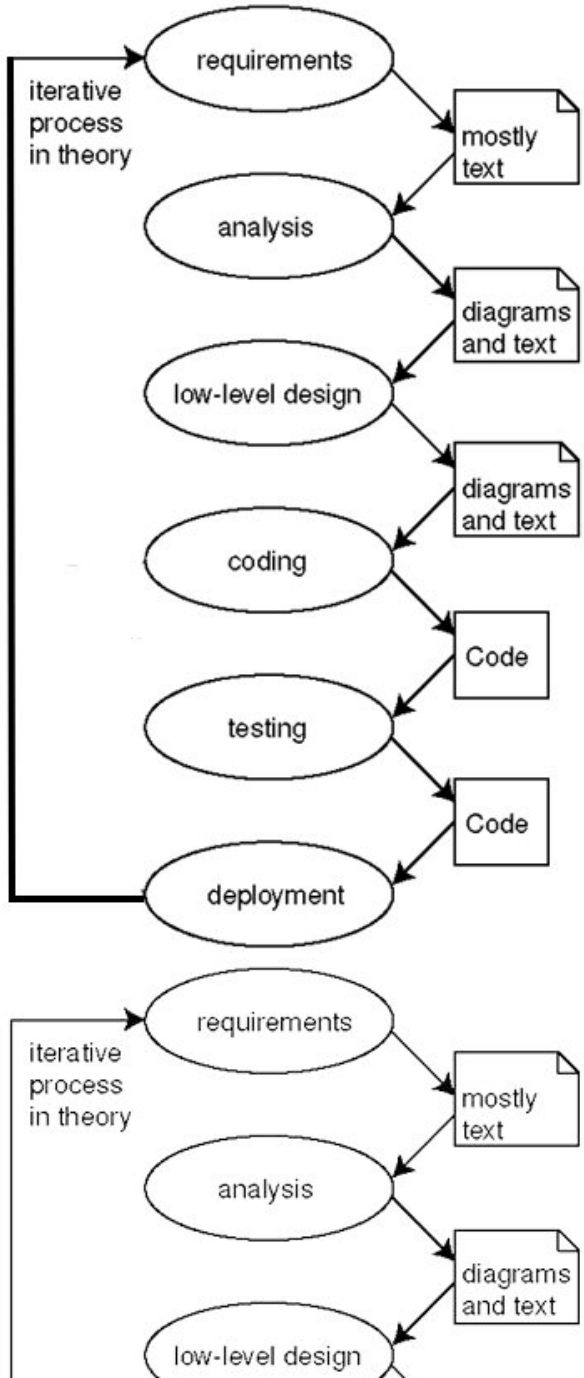
Traditional Development to MDA

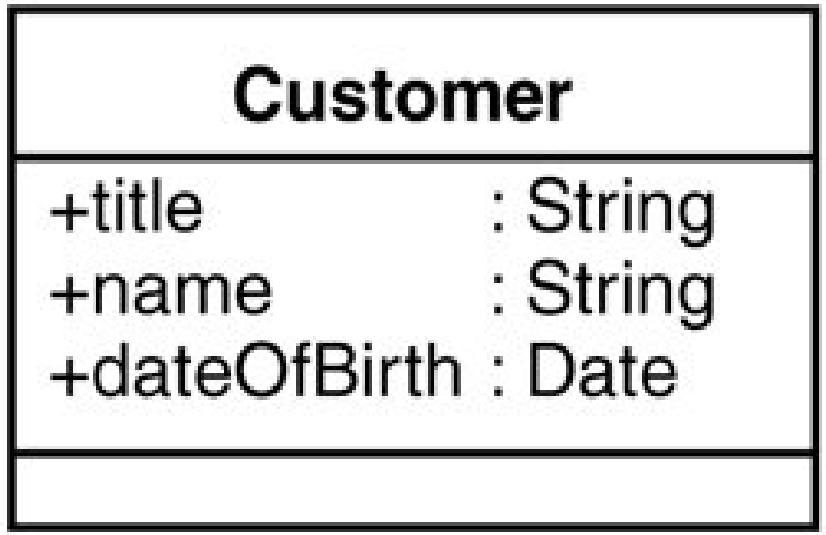


MDA

- Model Driven Architecture (MDA)
  - → Derive code from models through transformations
- Literature
  - Anneke Kleppe, Jos Warmer, Wim Bast ”MDA Explained”, 2003, Addison Wesley Professional
  - MDA Website by OMG (`http://www.omg.org/mda/`)

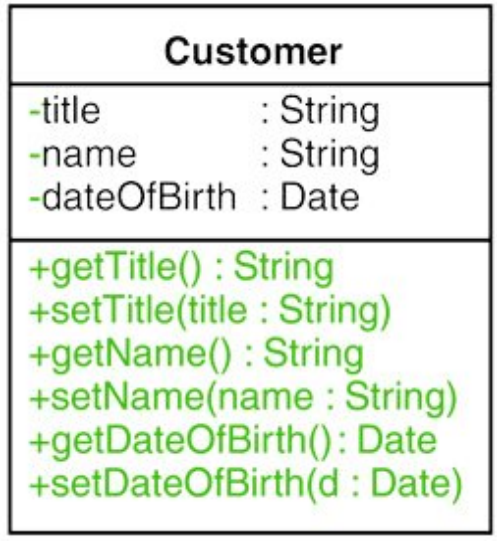
Example I: Attributes

Platform Independent Model (PIM):



Example I: Attributes

Platform Specific Model (PSM) for Java:

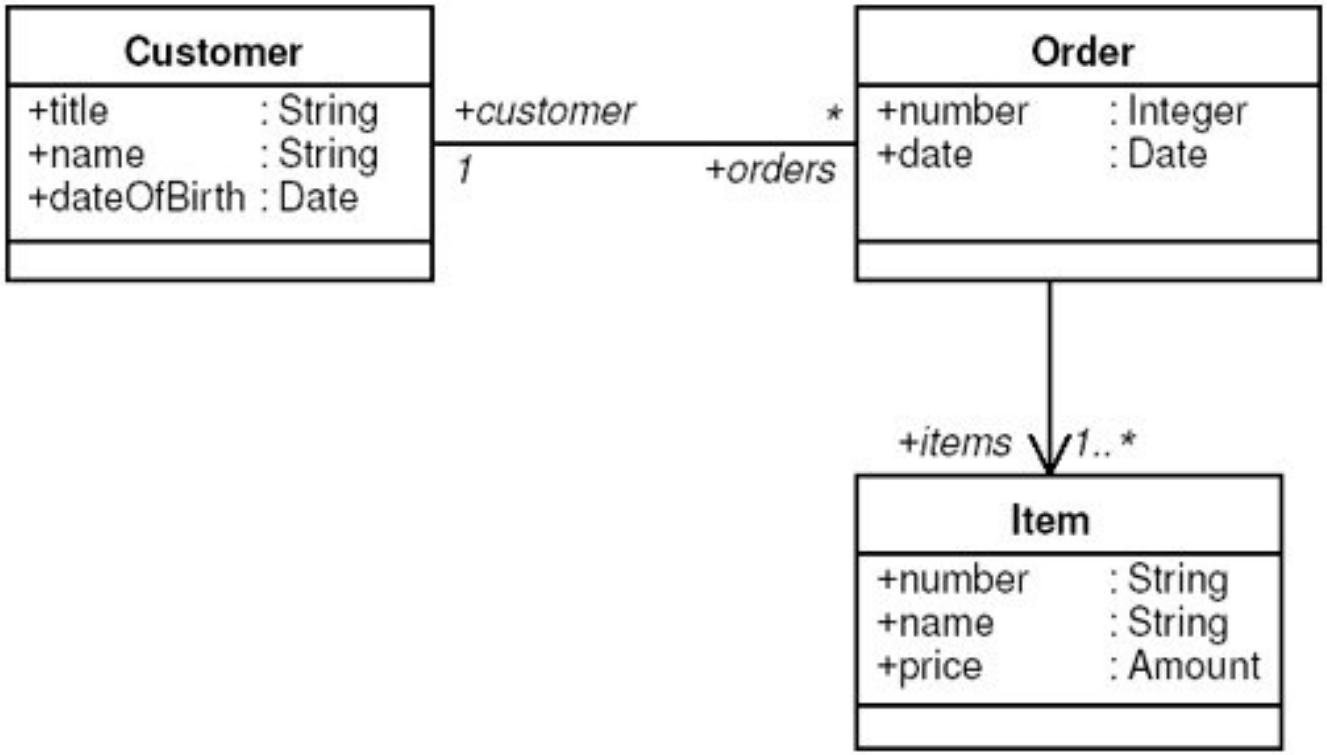


Transformation PIM $\rightarrow$ PSM

- Introduce getter and setter methods for each attribute

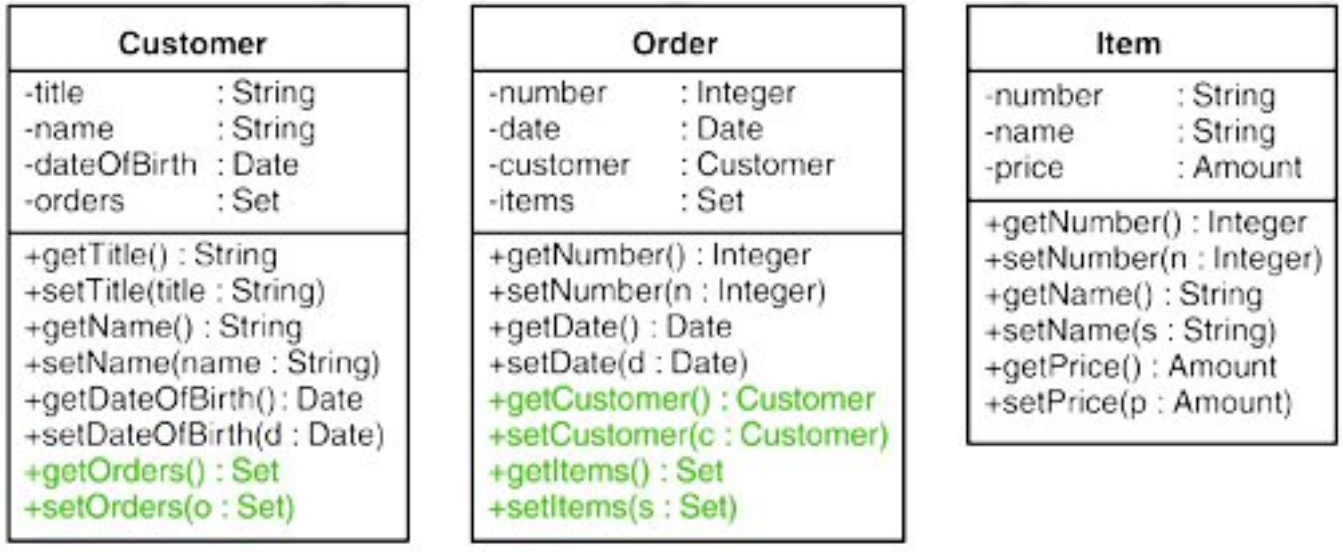
Example II: Associations

PIM:



Example II: Associations

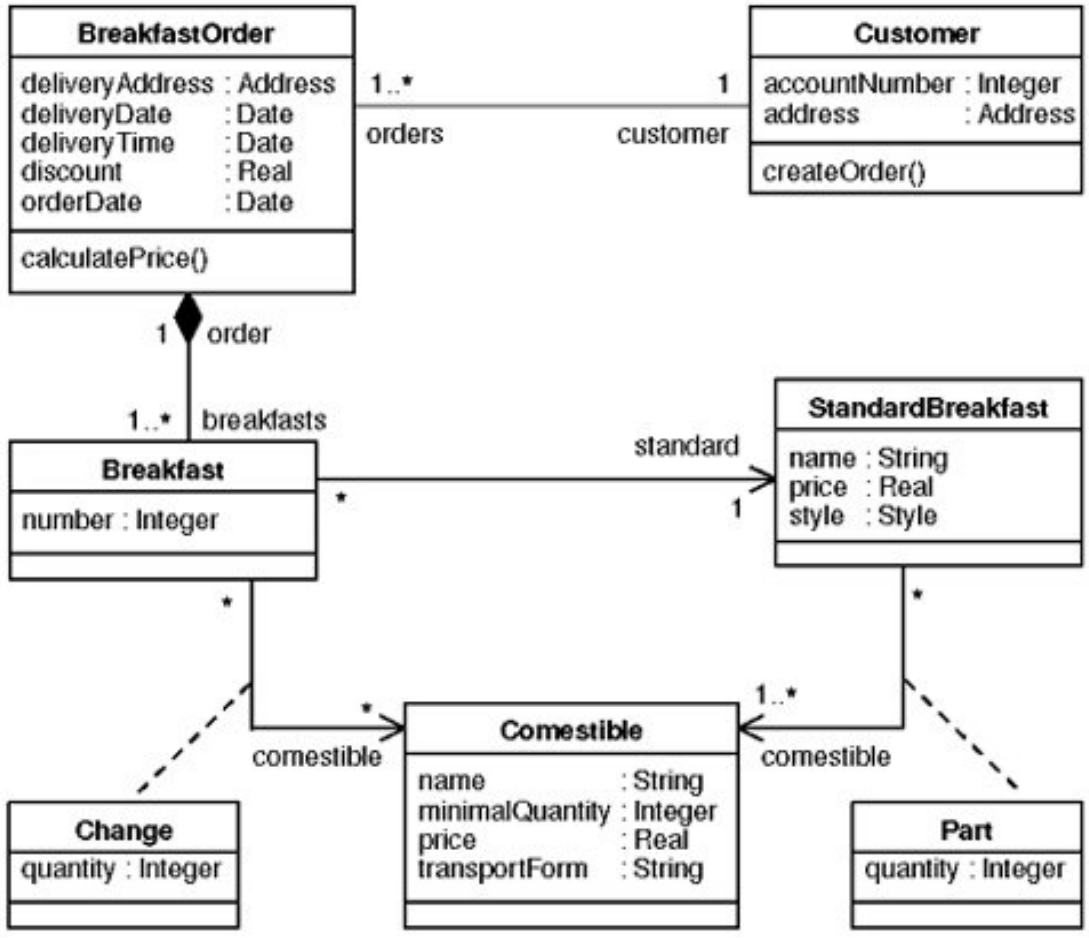
PSM for Java



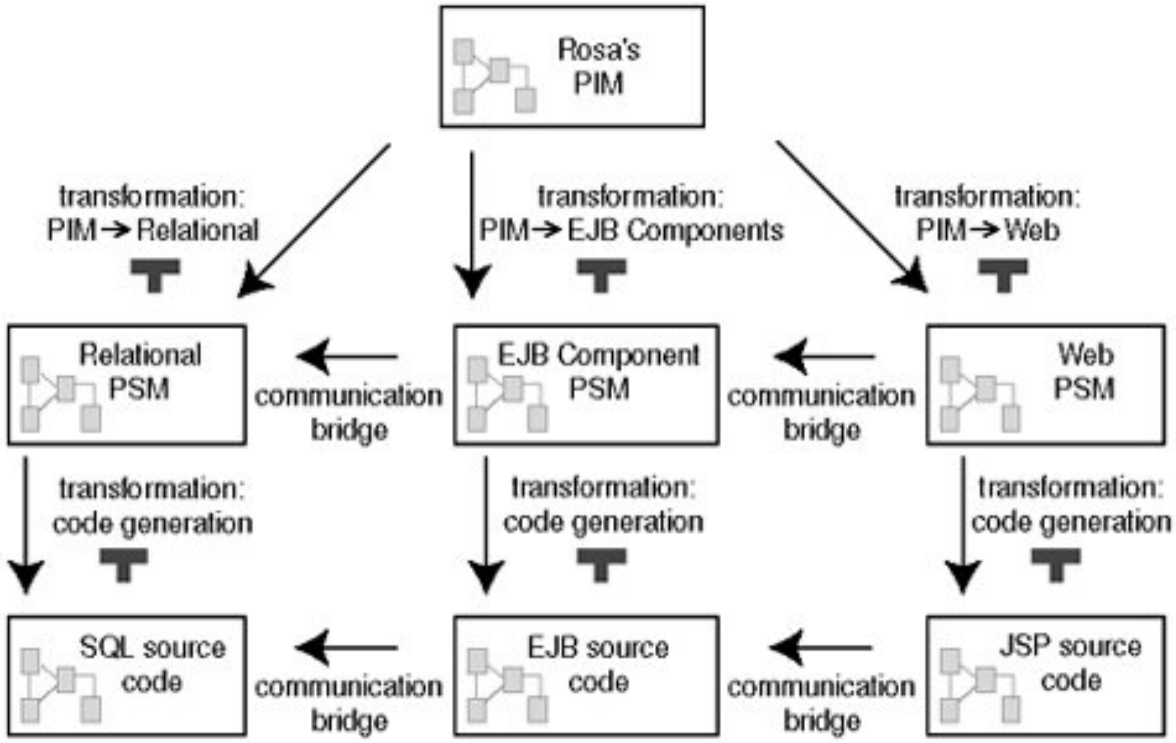
Transformation PIM $\rightarrow$ PSM

- Introduce an attribute for a navigable association

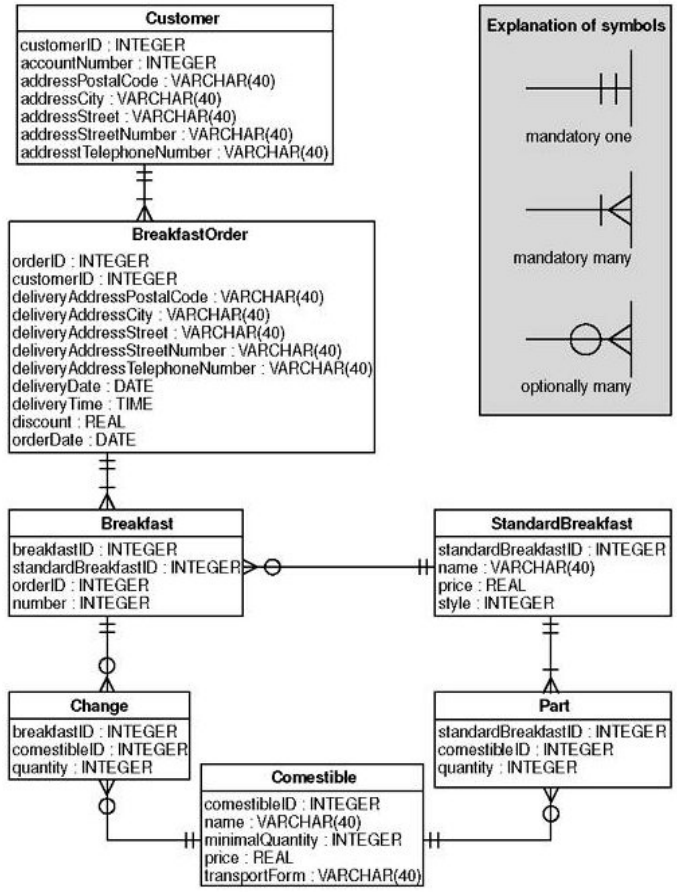
PIM for Rosa's Breakfast Service



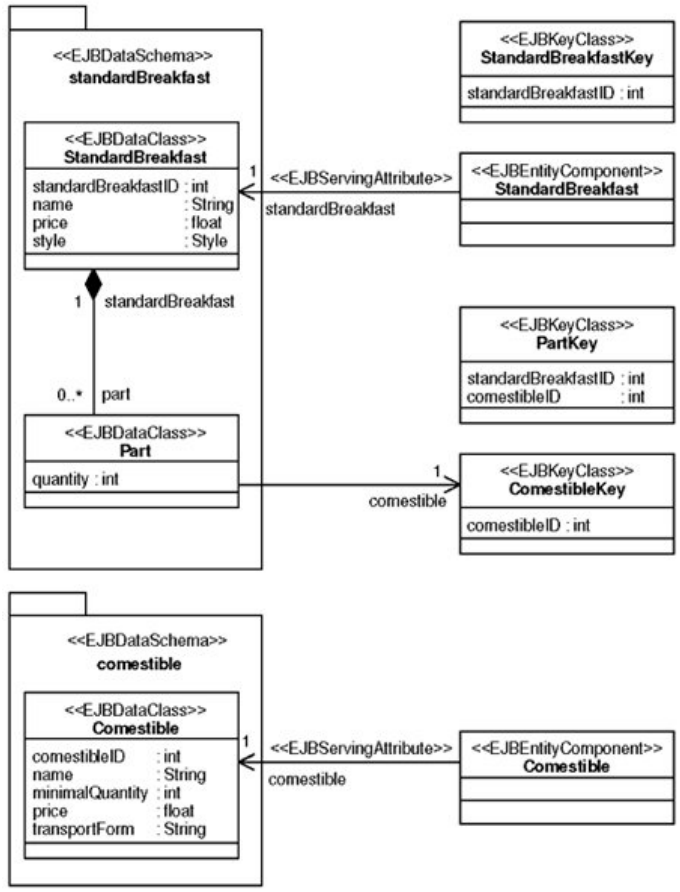
MDA for Rosa's Breakfast Service



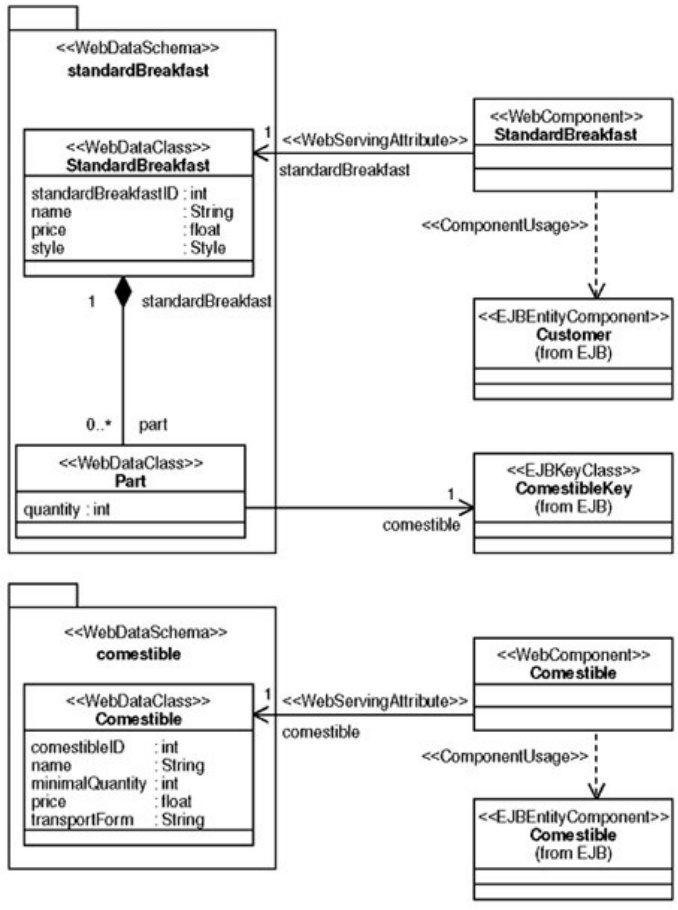
PSM Relational database model



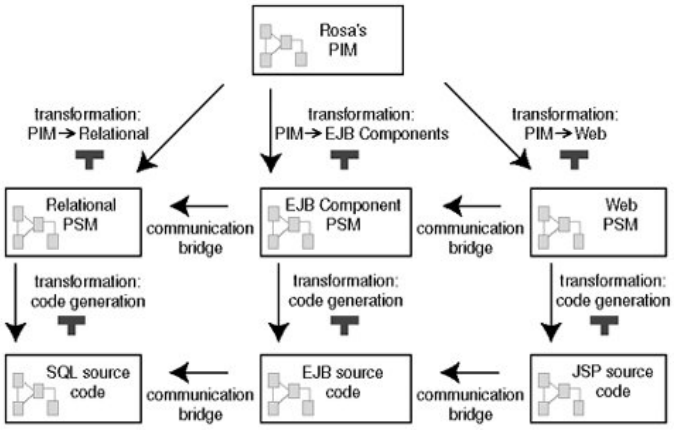
PSM EJB

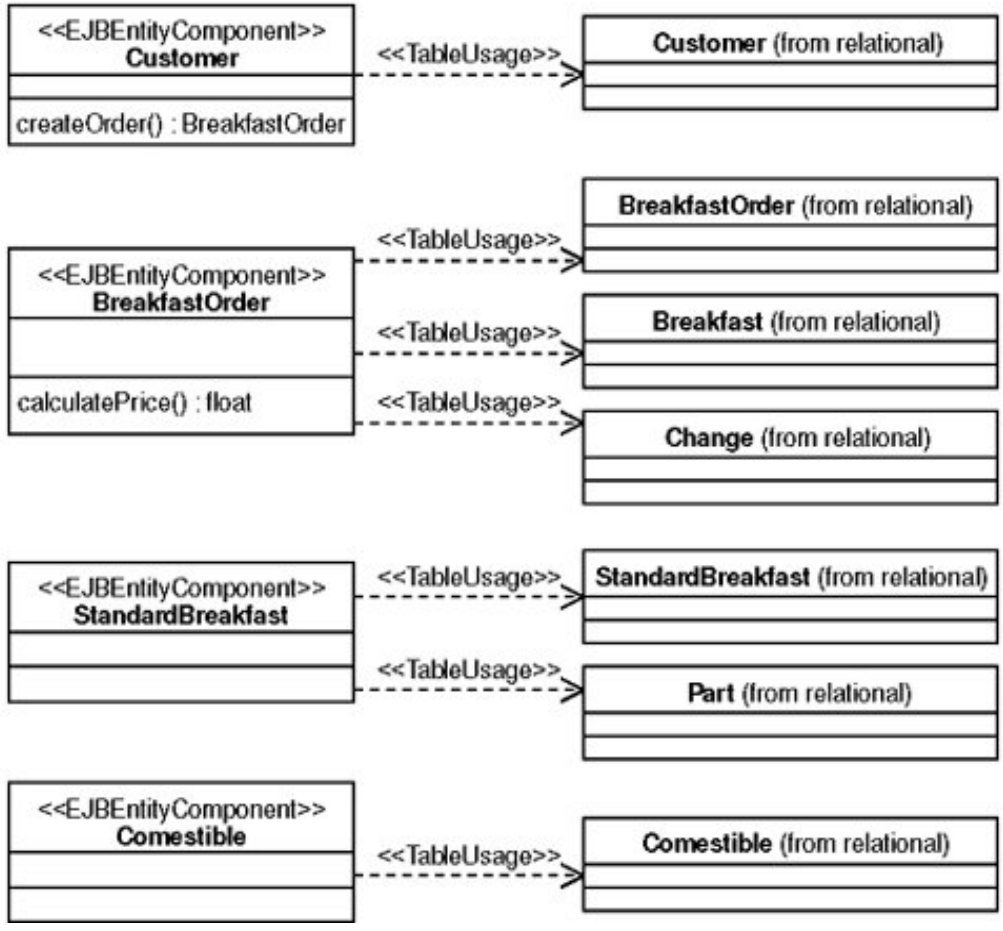

<<EJBDataSchema>>
standardBreakfast
<<EJBDataClass>>
StandardBreakfast
standardBreakfastID : int
name : String
price : float
style : Style
1
standardBreakfast
0..*
part
<<EJBDataClass>>
Part
quantity : int
<<EJBKeyClass>>
StandardBreakfastKey
standardBreakfastID : int
1
<<EJBServingAttribute>>
standardBreakfast
<<EJBEntityComponent>>
StandardBreakfast
<<EJBKeyClass>>
PartKey
standardBreakfastID : int
comestibleID : int
1
comestible
<<EJBKeyClass>>
ComestibleKey
comestibleID : int
<<EJBDataSchema>>
comestible
<<EJBDataClass>>
Comestible
comestibleID : int
name : String
minimalQuantity : int
price : float
transportForm : String
1
<<EJBServingAttribute>>
comestible
<<EJBEntityComponent>>
Comestible

PSM Web Interface

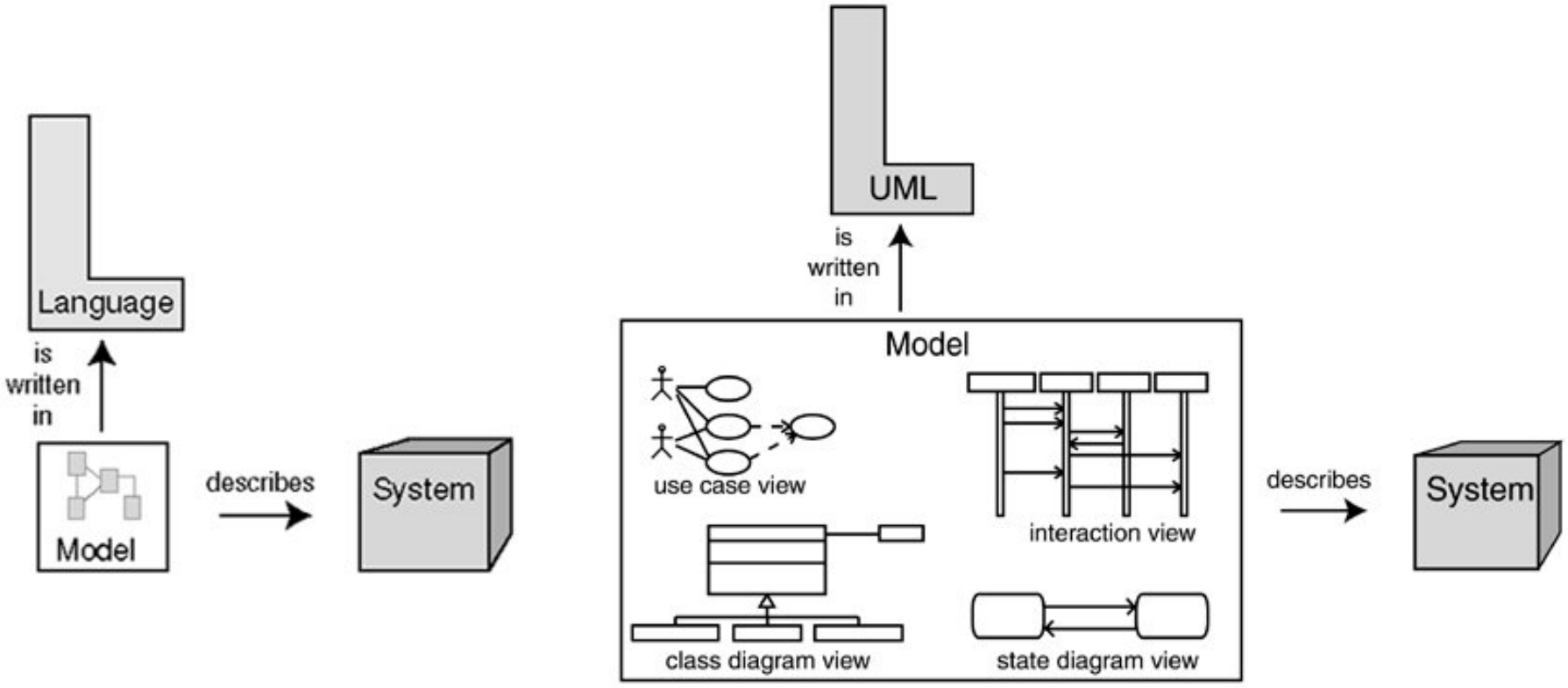


Communication Bridge EJB relational DB





Principles of MDA: Models



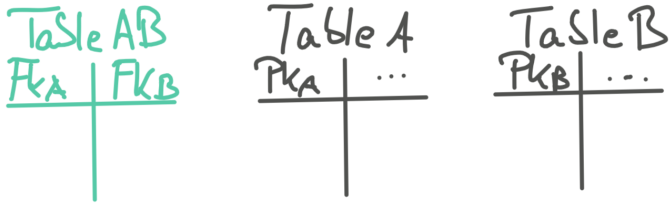
Example Transformation

Transformation of associations to DB schema (Pseudo Code)

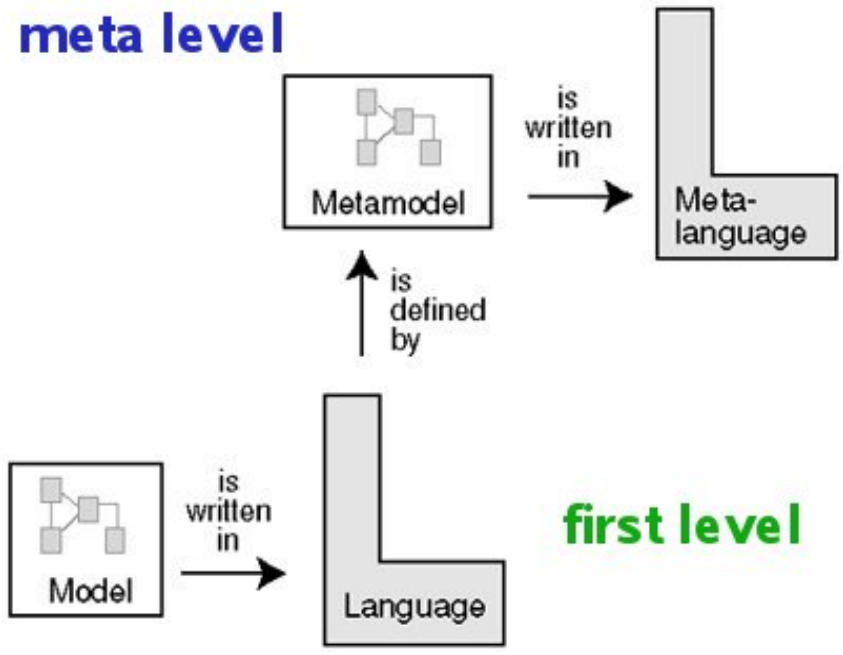
```
if the association A to B has multiplicity at both
   ends more-than-one
then  create a table representing the asso
      and create foreign keys in the new ta
      referring to table A and to table B
else ....
endif
```

Transformation from UML

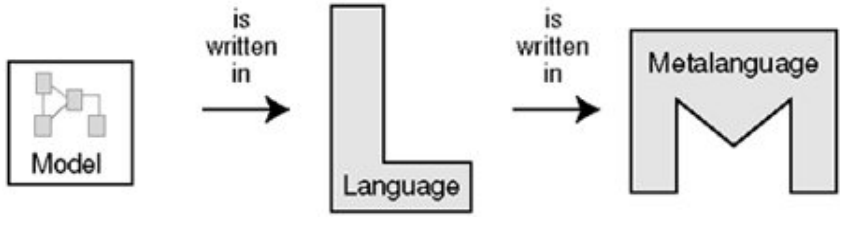
To Relational Databases



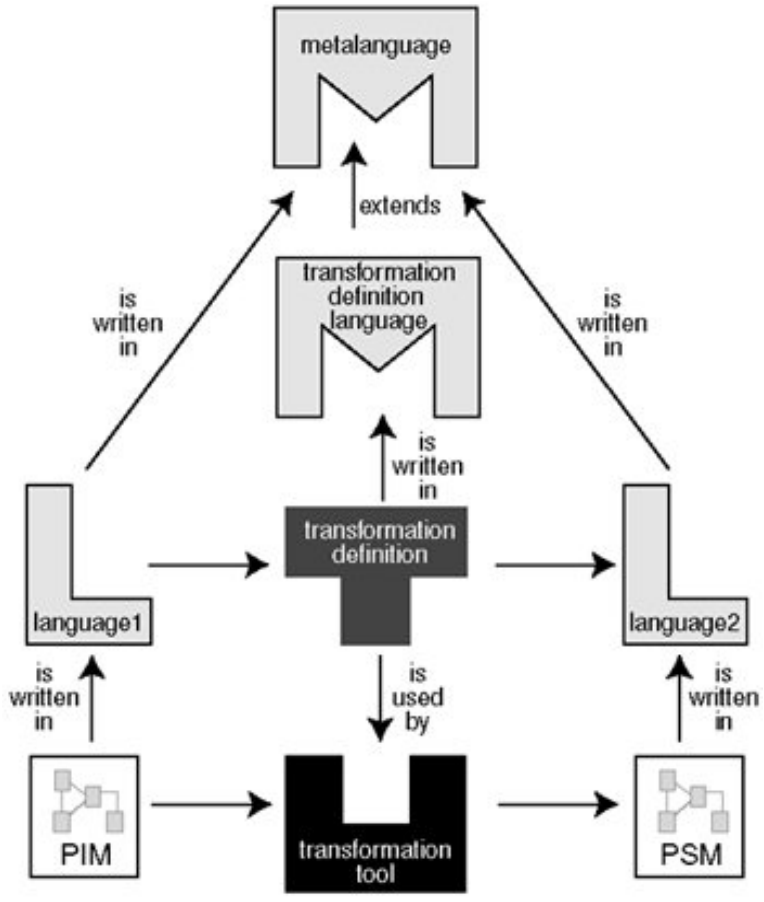
MDA and Metamodels



Short notation for the previous diagram



MDA and Metamodels

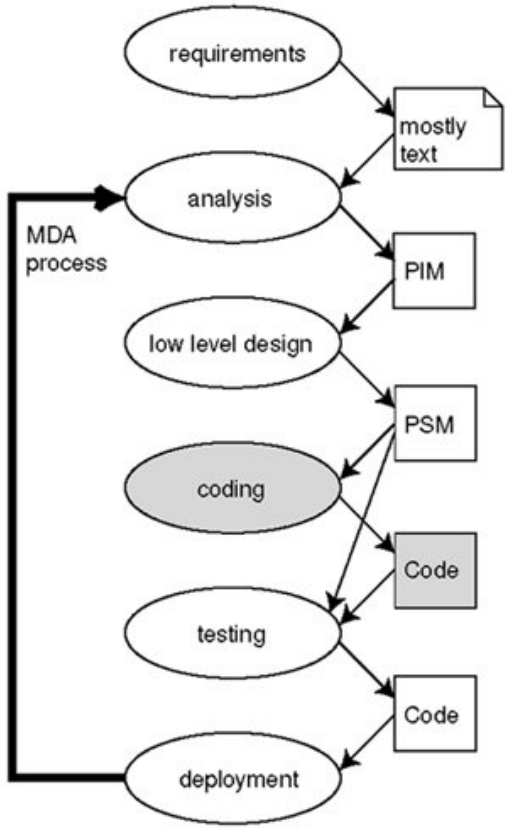


- UML: Meta Object Facility (MOF)
- → OMG MDA (`http://www.omg.org/mda`)
- EMF: Eclipse Modelling Framework
- 02162 Software Engineering II

The MDA/MDA promise

Years	Programming was done by...
1950	Raw machine code
1950–1965	Assembly languages
1965–1985	Procedural programming languages
1985–today	Object-oriented programming languages
today– . . .	What is next?

The MDA/MDA promise



MDA

- Benefits
  - Higher productivity
  - Portability
  - Interoperability
  - Maintenance and Documentation
- Issues
  - Modelling is abstraction
    - Transformations need to add things
    - The interaction of multiple models
  - Behavioural models