

INFS4206/7206 Advanced Topics in Database

2006 Semester 2 Part 2 Model-Driven Architecture (MDA)

Last Week



- ❖ The **MOF** is a subset of UML used to specify metamodels. Uses **layering** and **packages** to organize large models.
- ❖ Alternate way to specify a model is by a specialisation of UML called a **profile**.

The Dream of MDA

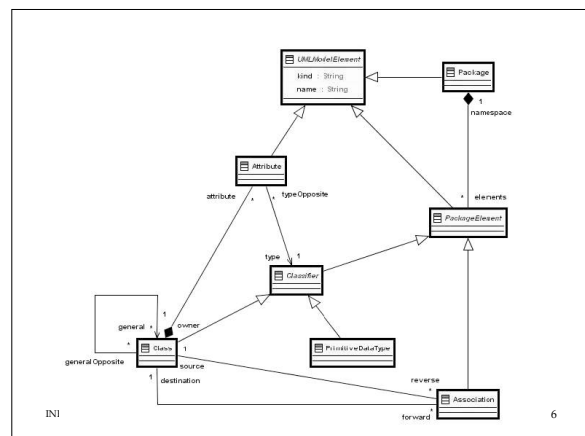
- ❖ We create a model of the application problem in some modeling tool
 - The relationship among business processes
- ❖ We create a technology for performing a class of task, eg workflow
 - And make a model of it (eg Workflow Reference Model)
- ❖ We establish a mapping between the constructs of the tool used to model applications and the constructs of the tool used to implement a relevant class of task
- ❖ We can then turn the model of the application problem into a system without doing any specific programming.

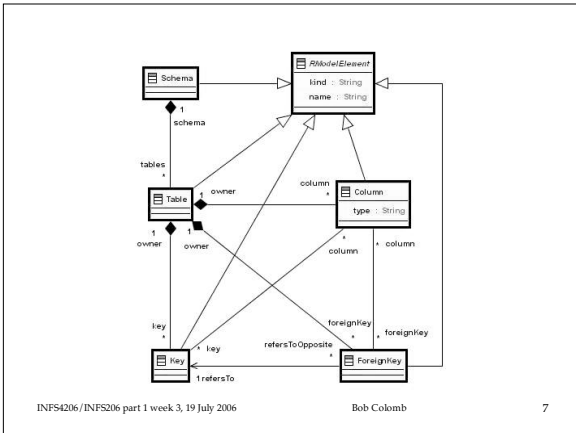
Not Entirely a New Idea

- ❖ Compilers from 3 and 4GLs to machine code
- ❖ Compilers from 4GLs to 3GLs
- ❖ But more interesting if mapping from one high-level structure to another
 - A conceptual data model to a relational database schema
- ❖ Especially if both are represented in MOF metamodels

We know about conceptual model to relational schema

- ❖ Class with attributes -> table with columns
- ❖ Association (n to 1) -> foreign key attribute
- ❖ Association (m to n) -> link table
- ❖ (Elmasri & Navathe 7.1.1 4th edn)
- ❖ STM repository from lecture 1 is an example
- ❖ As is SQL DDL repository





Observe

- ❖ Not enough information in UML classes model to differentiate Key from Column
- ❖ So Key is constructed as an OID distinct from any attribute (in the instances model, not shown).
- ❖ Therefore ForeignKey is not an attribute, either

❖ UML's lack of an identifiers model makes mapping to RDB problematic

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E&N 7.2.1 Mapping Subclasses

- ❖ A Superclass and subclasses to different tables sharing a key
- ❖ B Subclasses to different tables sharing superclass attributes
 - Subclasses must be total
- ❖ C Table for superclass with subclass attributes optional, distinguished by type attribute
 - Subclasses must be disjoint
- ❖ D Option C but with multiple type attributes
 - Works for overlapping subclasses

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UML helps somewhat

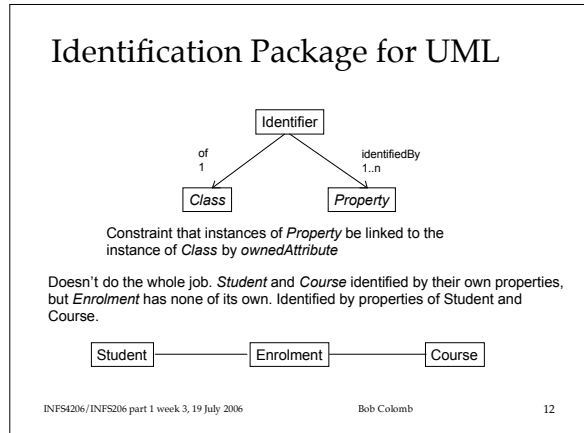
- ❖ UML Powertypes (Super 52) GeneralizationSet
 - Total - isCovering = true
 - Disjoint - isDisjoint = true
- ❖ Distinguishing between options A and others requires
 - Number of optional attributes (available)
 - Distribution of subclass membership (not)
 - Frequency of queries on common attributes (not)

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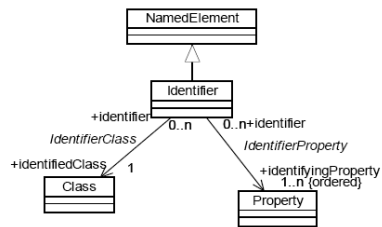
What to do when not enough info?

- ❖ Need to add to the specification. Either by modifying the target or the source.
- ❖ Modifying the target easier, but less satisfactory
 - Must maintain mods through versions of the source
- ❖ Better to add information to the source
- ❖ Can require additional metamodels

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Better Identification Metamodel



Identification package populated by model instance along with UML metamodel. Now mapping can mark columns as keys. (We saw the profile for this last week.)

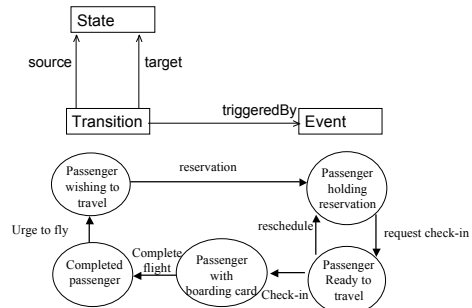
Extent-Descriptive Predicates

- ❖ We need to add additional information to our model
 - Distribution of subclass membership
 - Frequency of queries on common attributes
 - Expected size of extent
 - Probability of a min multiplicity 0 property being missing
- ❖ Many ways to do this
 - One way is to use annotatedElement meta-association

Can use MDA to build visual editor

- ❖ Associate shapes which can contain text with kinds of classes
- ❖ Associate lines with slots for text with kinds of associations
- ❖ Each graphic object has API to create/delete/render

How would one map STM model?



Mapping Tools

- ❖ There are tools to specify mappings.
- ❖ OMG tool specification under development
 - Query-View-Transform
- ❖ Being used in Ontology Development Metamodel project

Summary: Key Terms



- ❖ **Model-Driven Architecture** main driving application for OMG.
- ❖ Most interesting aspect is **mapping** from one metamodel to another.
- ❖ Most interesting mappings **require more information** than exists in bare source metamodel.
- ❖ Many open problems.

Resources

- ❖ MDA V 1.1
 - On course web site as pdf file.
- ❖ Further information on OMG site
 - <http://www.omg.org/mda/presentations.htm>