Model Driven Evolution of Web Applications

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Web Applications: typical problems and main issues

- Web Applications (WAs) are subject to continuous maintenance and evolution.
  - to improve the WA external quality
  - to correct bugs or to introduce new functionalities
  - to adapt technological structure
- appropriate up-to-date conceptual and design models of the WA are needed
- reverse engineering techniques and tools to recover such models
  - several reverse engineering approaches to recover models of an existing WA: architectural views, static, dynamic and behavioural models, functional requirements models , domain conceptual models , business process models , presentation models
- The recovered models are used to support the WA comprehension and the maintenace/re-engineering tasks to meet new/changed requirements
  - a new 'traditional' evolution/re-design starts

Web Applications: typical problems and main issues

- Model driven approaches have been adopted to develop WAs
  - to increase productivity, simplify the design process, …
- Integrating reverse engineering and model driven web engineering can lead to model driven evolution approaches for WAs
  - to reduce the evolution effort while improving the quality of the modified WA
- The recovered models are used as the starting point of a model driven forward engineering phase to implement the required changes.
  - the MDD evolution approach would lead to the implementation of an evolved version of the WA, or a (fully) new implementation of it, with reduced effort and higher design quality

The Reverse Engineering Phase

It includes the following main steps:

- Selection/definition of the models to be recovered
- Selection/identification of tools able to recover the selected models
- Analysis/comprehension of the recovered models

Typical recovered models are:

- a domain model, also called information model, describing the concepts of the main domain objects the WA deals with;
- a navigational model, describing the navigation available to a user across the WA components;
- a publishing model, describing what and how 'things' are presented to users.

The Model Driven Phase

- The recovered models are analyzed to:
  - identify lacks and weaknesses of the recovered design
  - define changes in order to overcome them;
  - evolve/maintain the design to meet new or changed requirements.

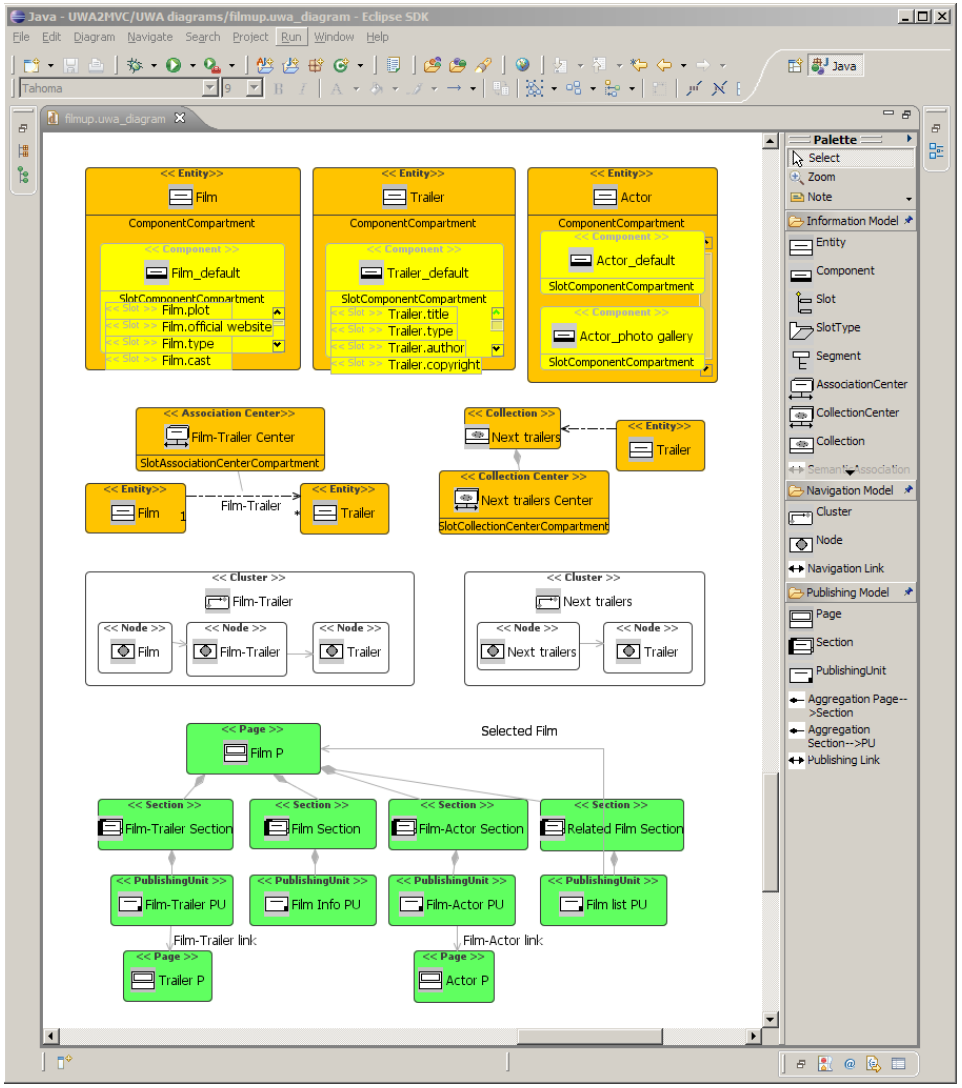
- The main components of a Model Driven Evolution approach are:
  - a modeling language definition standard, to represent formally standardized concepts (e.g., OMG MOF)
  - a way to model transformation technology to generate output models starting from the input models (e.g., ATL, QVT)
- Selection of a modeling language to define a meta-model to describe the WA according to the desired models
- Selection of a language to define a set of transformation rules to be applied to the input models to automatically get the output models/artifacts

THE UWA BASED MODEL DRIVEN EVOLUTION PROCESS

The UWA Reverse Engineering phase

- The existing WA is analyzed to recover:
  - the UWA Information Model
    - UWA Entities, Semantic Association and Collections are recovered
  - UWA Navigation Model, and
    - carried out by identifying Nodes and Clusters for the analyzed application
  - the UWA Publishing Model.
    - by identifying Publishing Pages, Publishing Sections and Publishing Units from the set of templates (each template grouping a set of cloned client pages) obtained during the phase of Information Model recovery

The UWA Reverse Engineering phase



Screenshot of the UWA graphical editor:
an excerpt of the UWA models recovered from a WA implementing a movie information portal

THE UWA BASED MODEL DRIVEN EVOLUTION PROCESS

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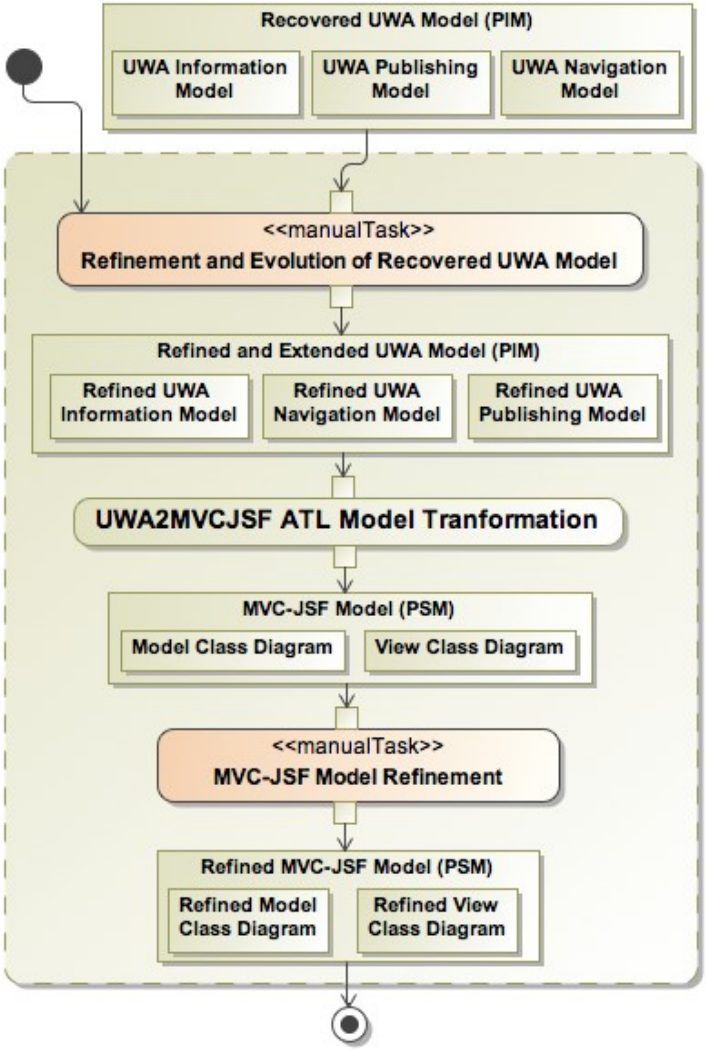
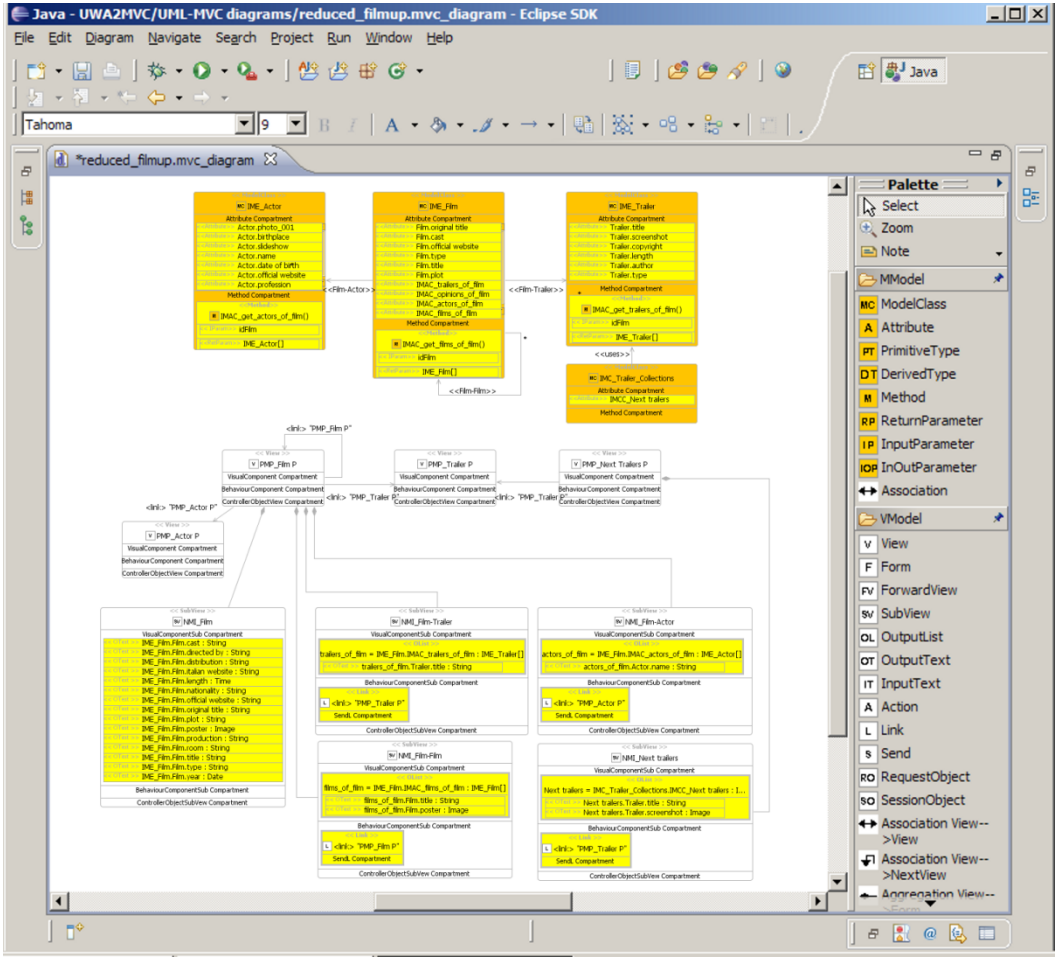


- The main actions of the UWA Model Driven phase

THE UWA BASED MODEL DRIVEN EVOLUTION PROCESS



Screenshot of UWA-MDD tool's graphical editor: an excerpte of the generated MVC-JSF design models

Conclusions

- A general process integrating reverse engineering and model driven engineering techniques for the evolution of WAs has been described
- The general process has been used to define and develop a process specifically tailored for the user-centered design methodology Ubiquitous Web Applications (UWA), to evolve existing Was
- The main advantages by using the model driven evolution process are: a reduction of the evolution effort, a higher quality of the resulting design, a higher re-usability of the evolved WA models and components

- Future work will be devoted to extend the tailoring of the general process (and of supporting tools) both to other types of models that can be recovered (not only UWA models), and to other target design models (not only MVC) and target platforms (e.g., mobile platforms).