



MÄLARDALENS HÖGSKOLA
ESKILSTUNA VÄSTERÅS

A hybrid approach for multi-view modeling

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Multi-Paradigm Modeling 2011 – Wellington, New Zealand



Agenda

- Introduction
- Motivation
- Contribution
- Proposed Approach
- Conclusion
- Future Work



Introduction

- Continuous growth of software systems' complexity demands adequate techniques to face their development
- Model-driven engineering helps in tackling such complexity abstracting the real phenomena
- A problem is typically decomposed into different viewpoints, each of which deals with a domain-specific perspective
- Multi-view modeling mechanisms are usually distinguished between (ISO/IEC 42010):
 - ***synthetic***: each view is implemented as a distinct meta-model and the overall system is obtained as synthesis of the information carried by the different views
 - ***projective***: views are virtual, i.e. made of selected concepts coming from a single meta-model by non-relevant details



Motivation

- The synthetic solution allows to accurately separate different concerns and express view-related concepts thanks to its radical multi-metamodel nature (+)
- Adopting the synthetic solution raises problems mainly related to consistency management among different views (-)
- Technically, the projective solution relies on a single underlying metamodel to ease the consistency management; changes are always operated on a single shared model (+)
- The approach may become too restrictive because either the metamodel is too generic or the views are too specific to be reused in several development contexts (-)
- Moreover, the fact that generally the base metamodel does not have any concept of view embedded in it makes it difficult to express view-specific notions (e.g. editing rights for specific views) (-)

A thick orange arc that starts on the left and curves upwards and to the right, ending under the word 'Problem'.

Problem

SO..

Both approaches have advantages and drawbacks..

.. BUT

What if we try to take the best of each by combining them?



Contribution

- Automated mechanism representing a hybrid technique for multi-view modeling
- Based on the definition of multiple views as separate meta-models (synthetic)
- View meta-models are sub-portions of a single overall meta-model (projective)
- Changes are propagated from the modifying view to the overall model and from that propagated to the other views

Goal:

a good trade-off between synthetic and projective techniques for a more efficient and reusable multi-view modeling approach

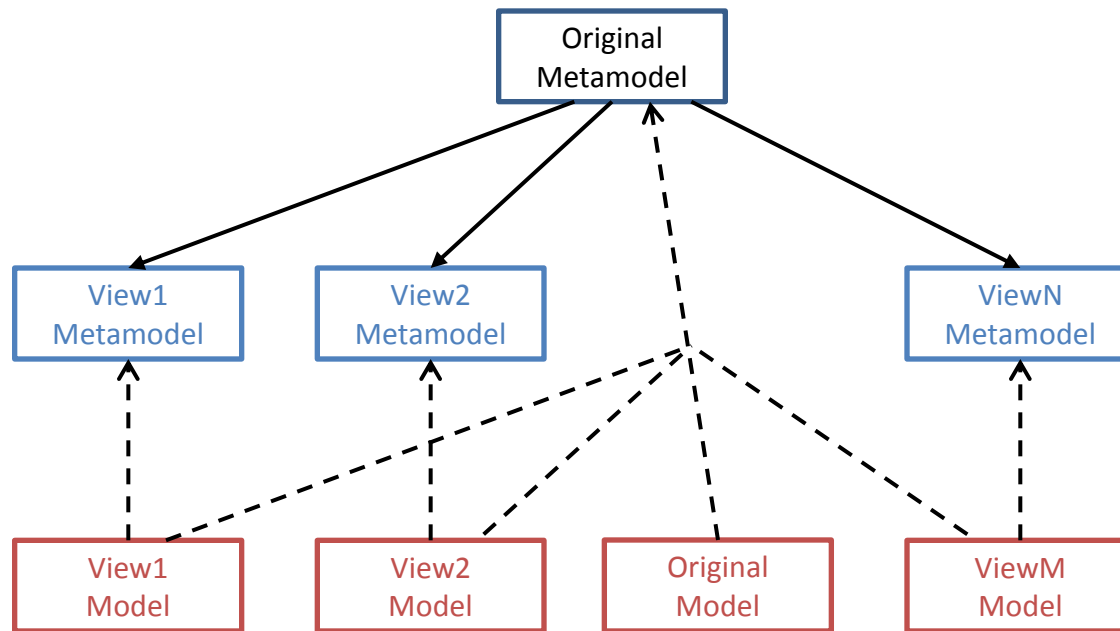


Multi-view Support

- View definition:
 - view defined as custom selection of a subportion of the overall metamodel
 - support for any number of views
 - support for overlapping views (different views can be built on top of (partially) overlapping sub-metamodels)
 - management of well-formedness issues
- Editing facilities:
 - each view should carry with it a set of modification rights on its elements coherent with the perspective it pertains to
 - support of customized view editor
- Synchronization management:
 - transparent merge of separate views, meaning that consistency management across views should happen without any end-user intervention
 - non-blocking management of concurrent manipulations for overlapping views



Views Creation



→ view creation

- - - -> conforms to



Views Creation Wizard

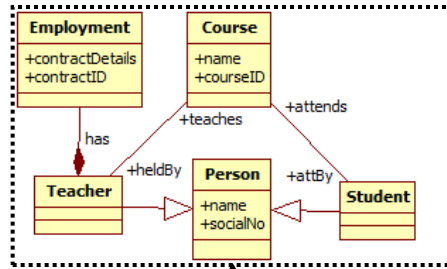
- **View properties selection:** general information needed for creating the view, storing it and generating a related Eclipse editor model
- **View elements selection:** the elements constituting the overall meta-model are shown and the developer is able to select each meta-element that is going to be part of the new view
- **Unique identifiers selection:** in order to allow synchronization for each selected meta-class a non-empty set of its meta-attributes and/or meta-references must be selected to act as its unique identifier
- **Editing rights selection:** once the view is populated, desired editing rights are selected for each of the selected elements among two possibilities:
 - Read-only
 - Read/write
- Further elements may appear automatically selected by the consistency checking engine to ensure the creation of a view whose models will be still consistent and conforming to the initial meta-model



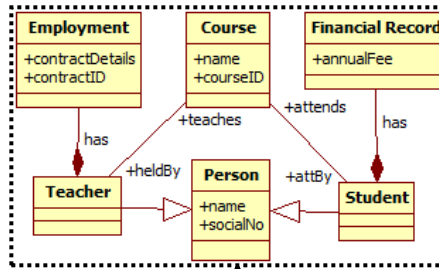
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The Synchronization Process

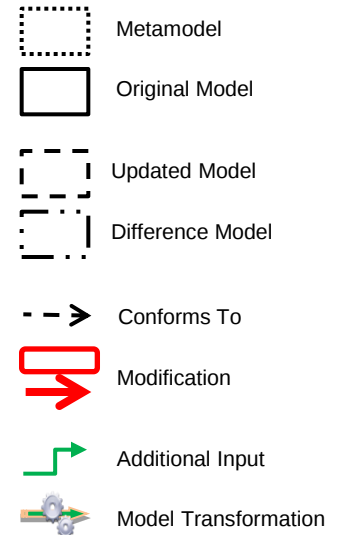
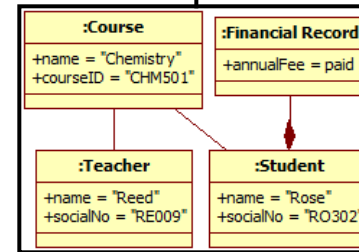
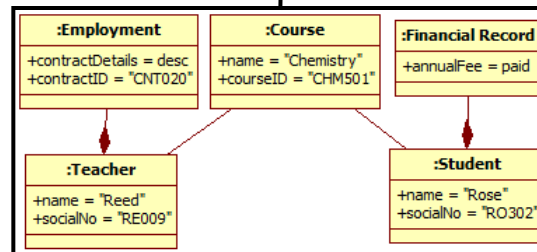
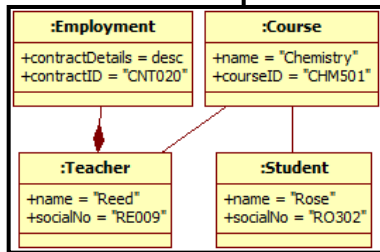
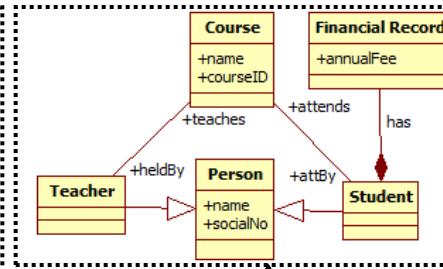
View 1 (Teacher) Metamodel



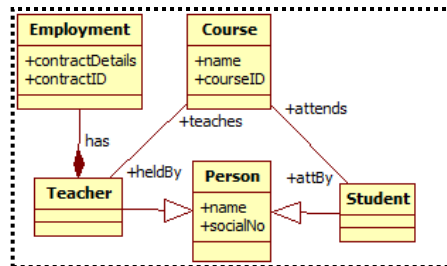
Original Metamodel



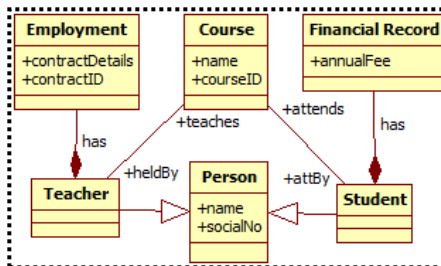
View 2 (Student) Metamodel



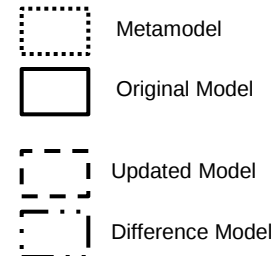
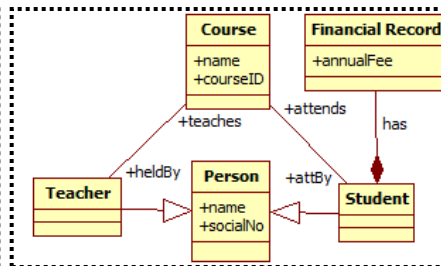
View 1 Metamodel



Original Metamodel



View 2 Metamodel

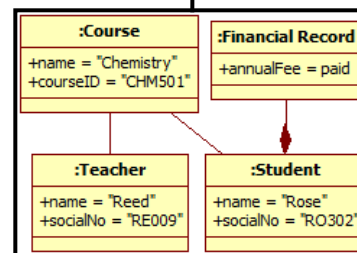
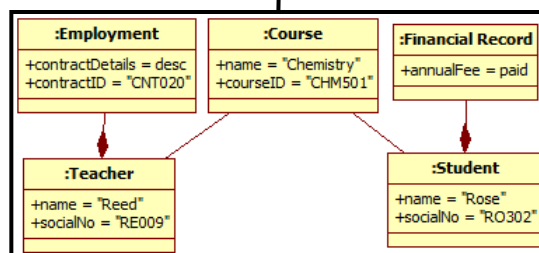
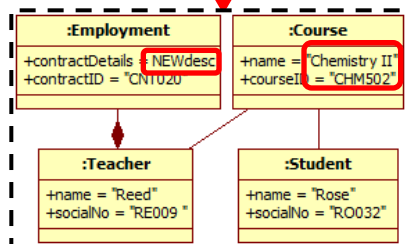
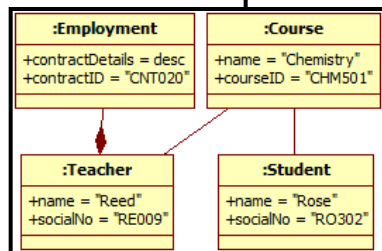


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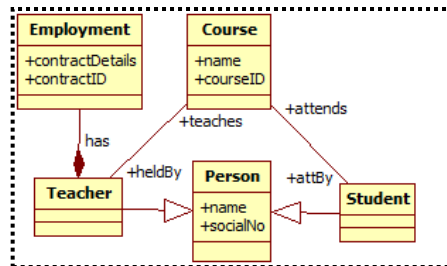
Modification (red arrow)

Additional Input (green arrow)

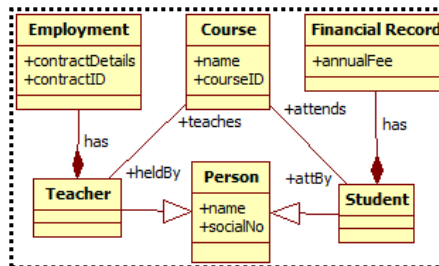
Model Transformation (gear icon)



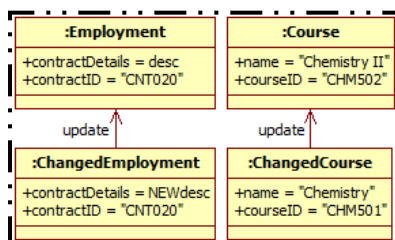
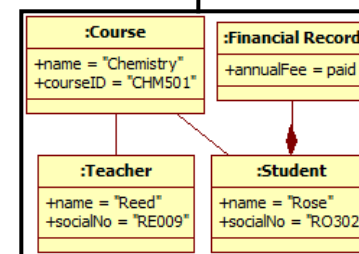
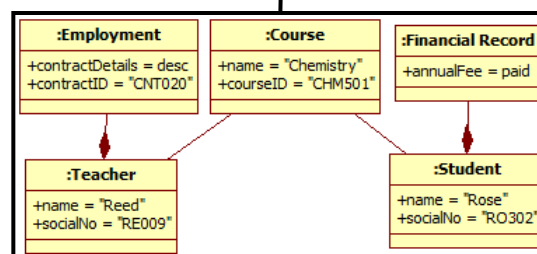
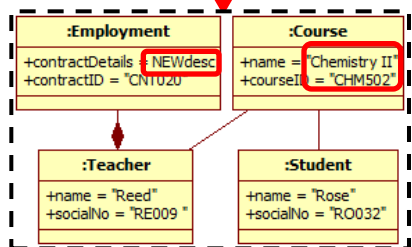
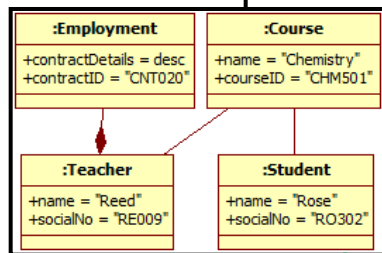
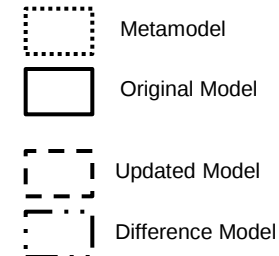
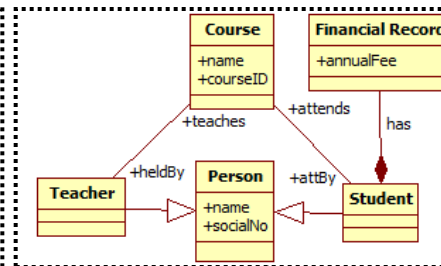
View 1 Metamodel



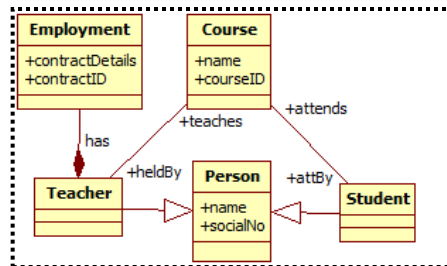
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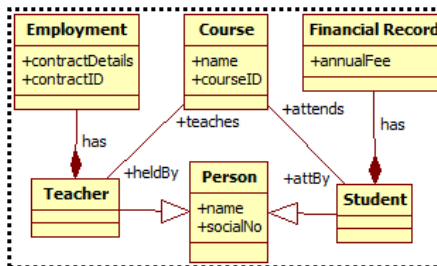
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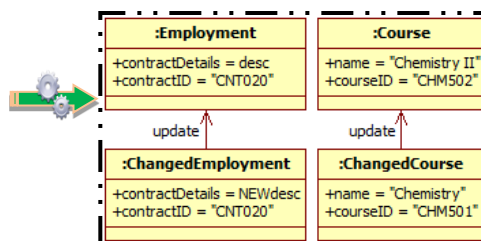
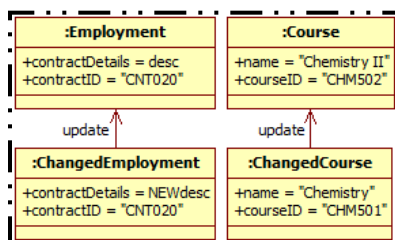
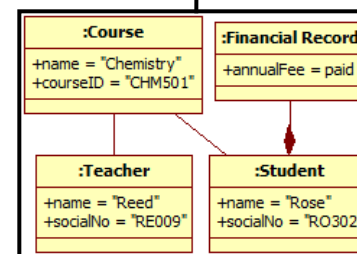
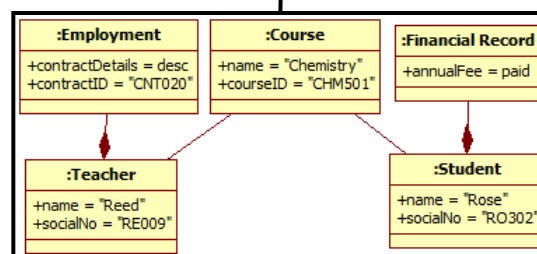
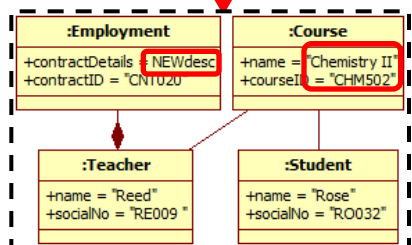
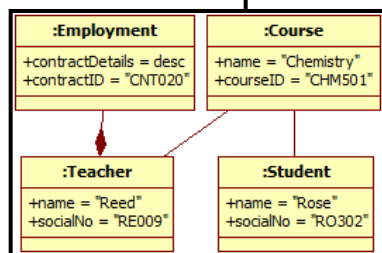
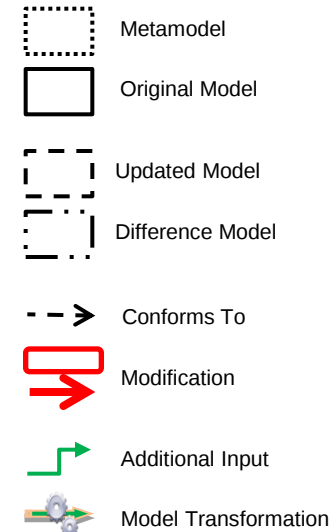
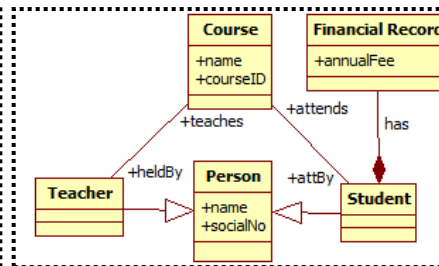
View 1 Metamodel



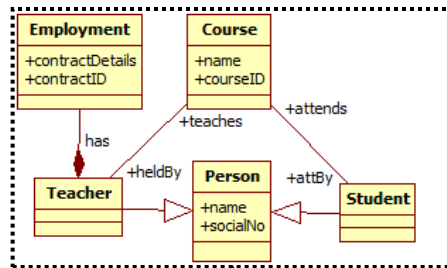
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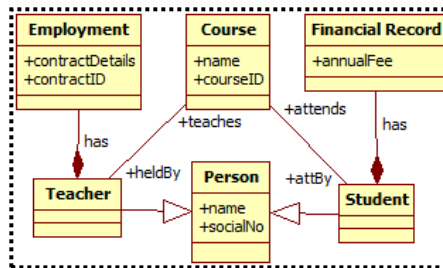
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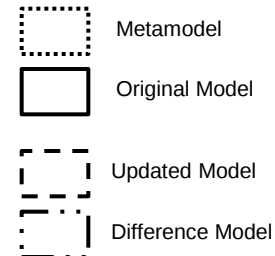
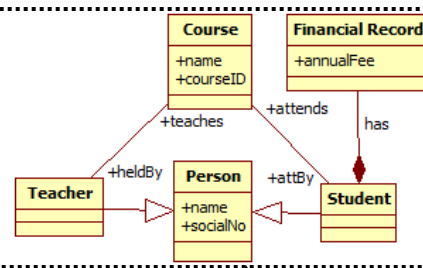
View 1 Metamodel



Original Metamodel



View 2 Metamodel

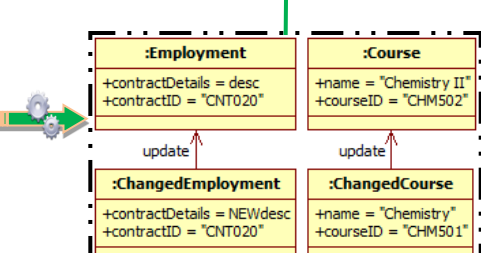
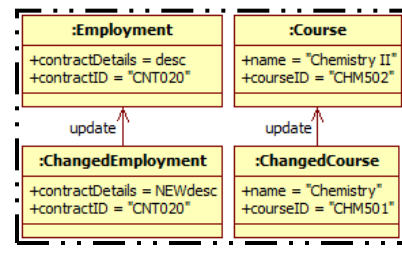
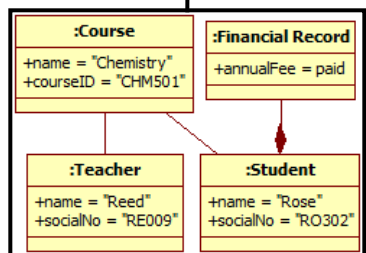
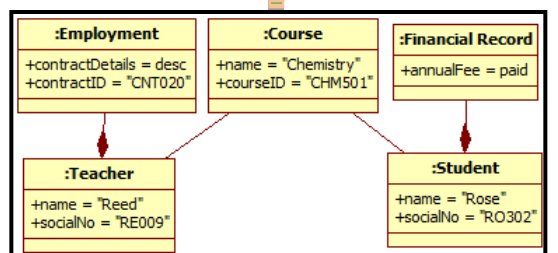
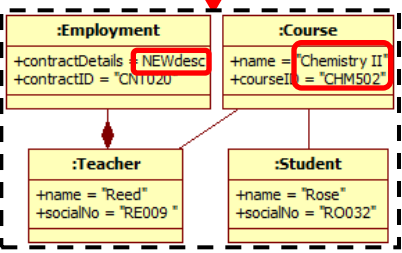
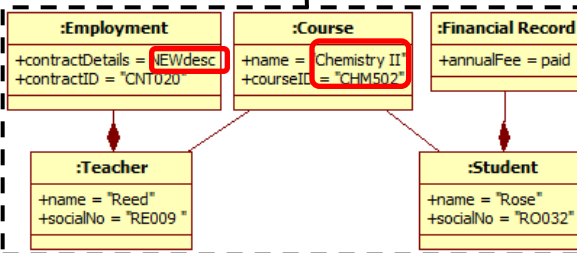
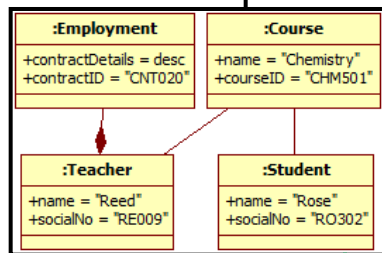


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 Modification

 Additional Input

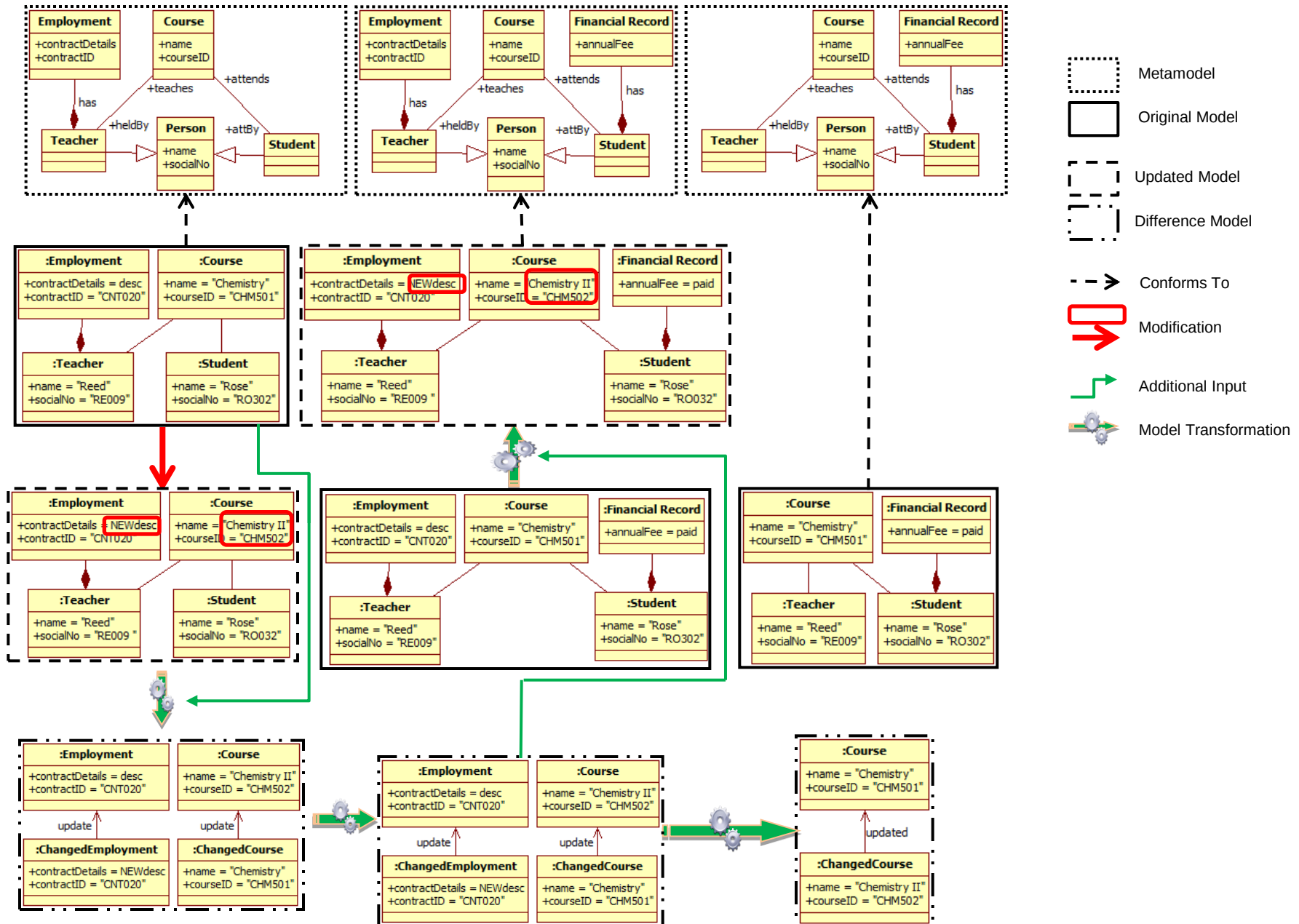
 Model Transformation



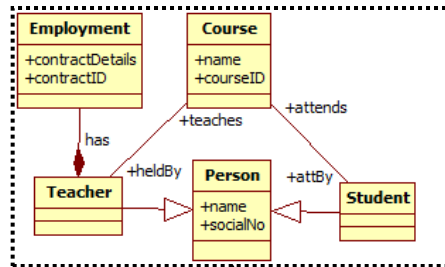
View 1 Metamodel

Original Metamodel

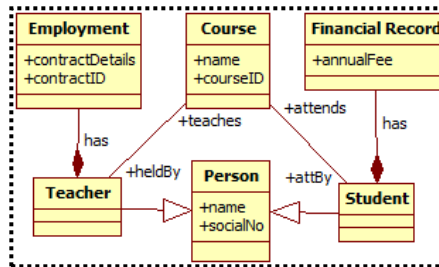
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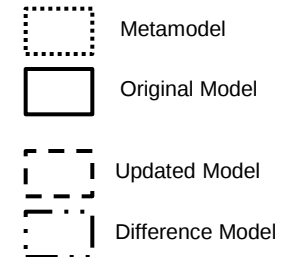
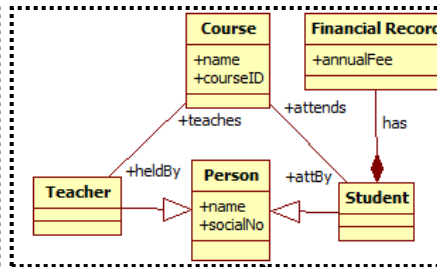
View 1 Metamodel



Original Metamodel



View 2 Metamodel

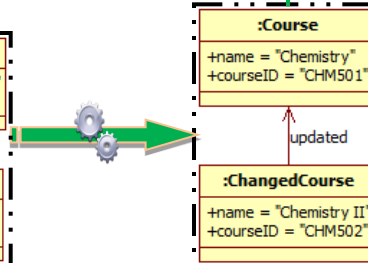
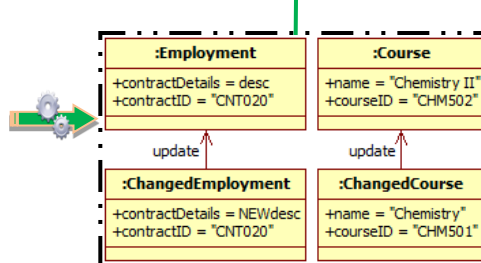
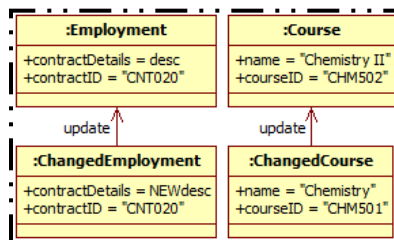
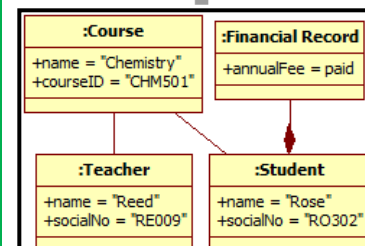
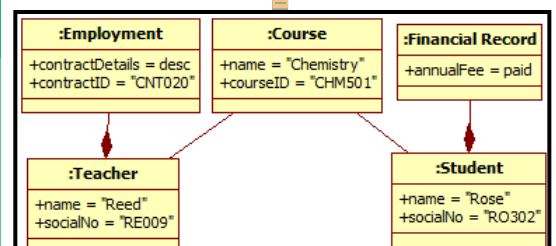
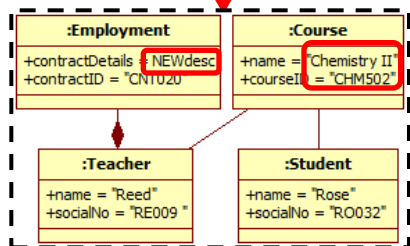
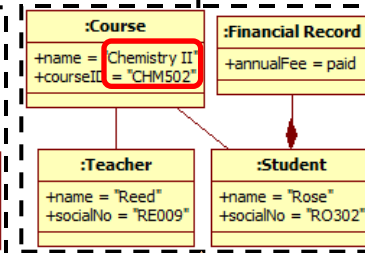
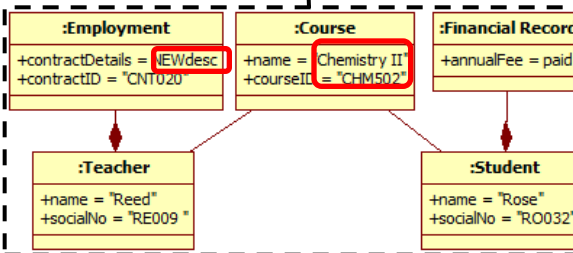
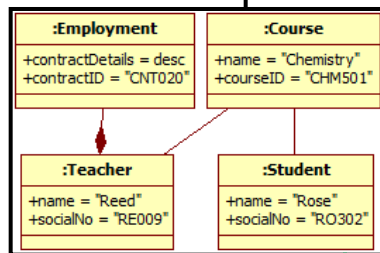


--> Conforms To

Modification

Additional Input

Model Transformation





Limitations

- Basic set of view customization features
- Element identification mechanism by means of unique identifiers as set of meta-attributes/meta-references
- Conflicts that may arise from concurrent modifications in overlapping views



Conclusion

- Approach for hybrid support to multi-view modeling through a combination of synthetic and projective approaches
- Definition of a set of basic needs for view customization
- Implementation of view creation wizard and synchronization mechanisms as well as generation of view-customized Eclipse editor
- Proposed solution based on EMF but approach independent of the modeling technology



Future Work

- Extension of view customization features
- Full automation of the process
- Validation of the proposed technique against a properly-sized case study to verify feasibility and analyze possible scalability issues
- Enhancement of the element identification mechanism
- Resolution of conflicts that may arise from concurrent modifications in overlapping views by means of suggested quick-fixes (when applicable)

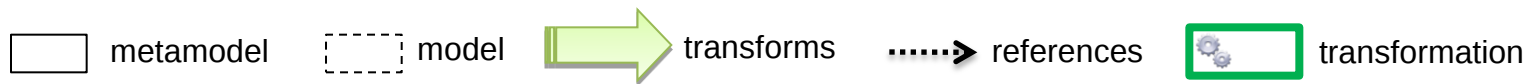
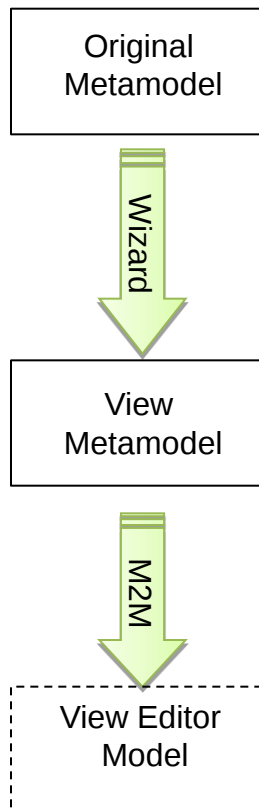


Thanks for Your attention..

Questions and/or comments?

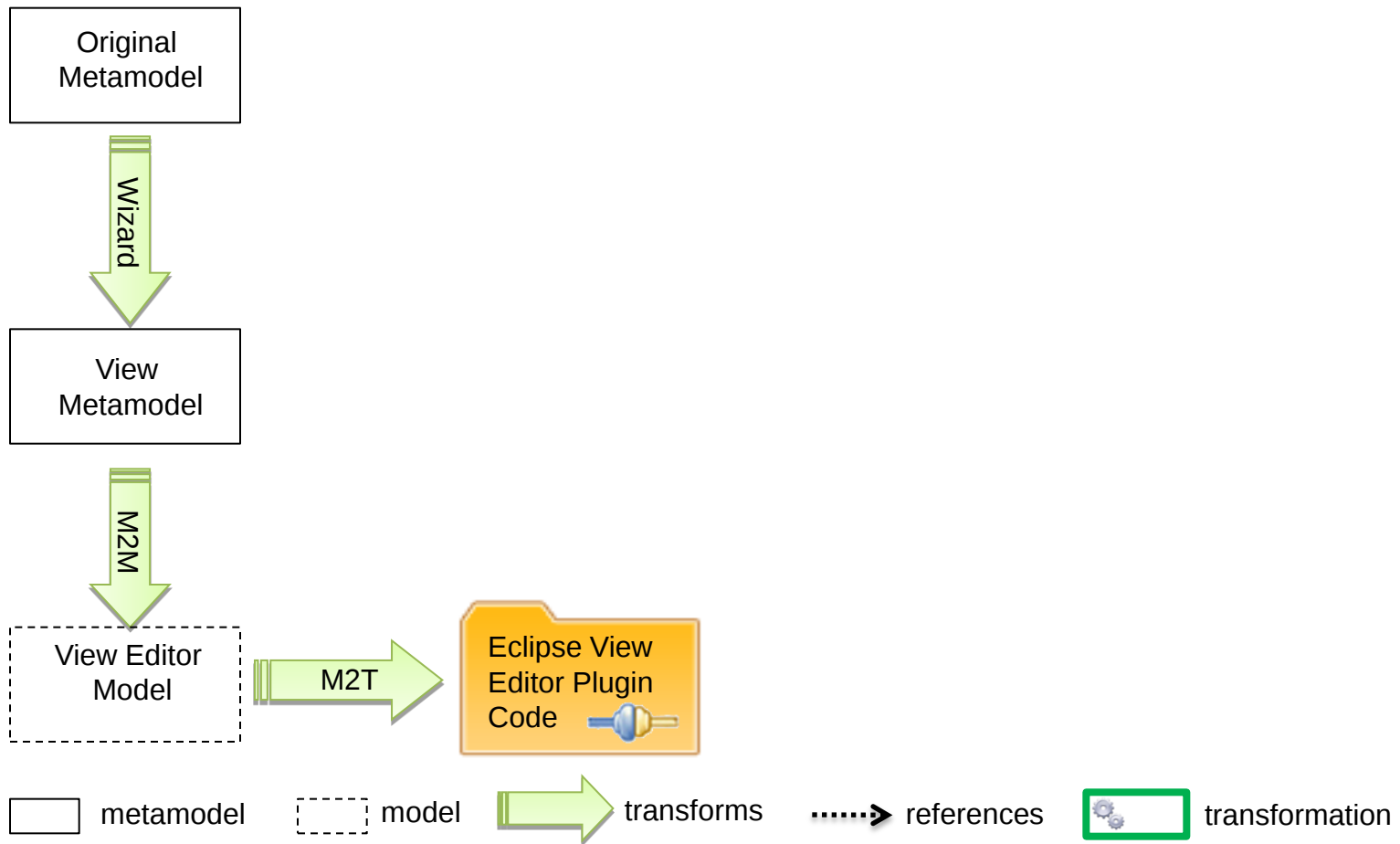


Synchronization Process



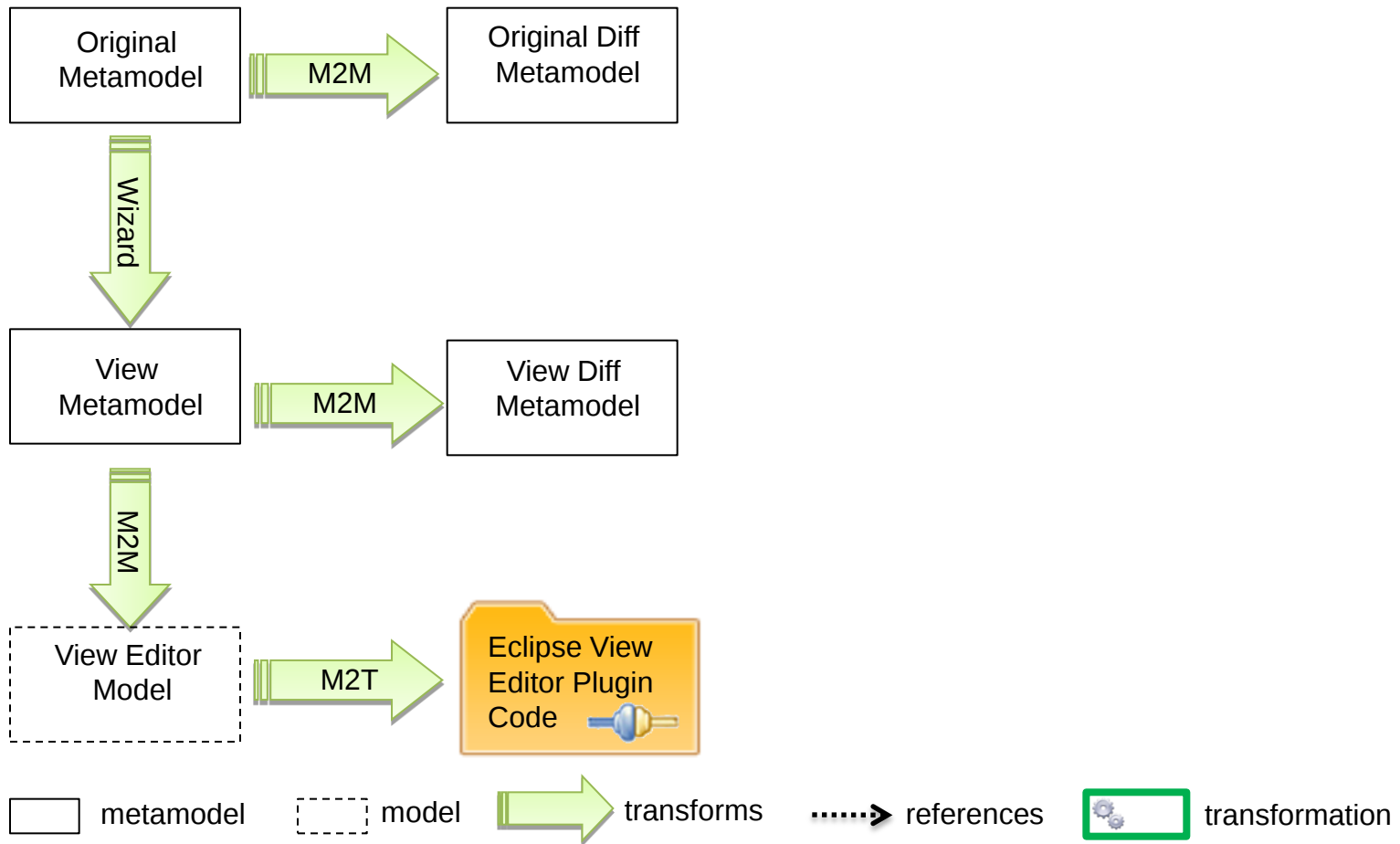


Synchronization Process



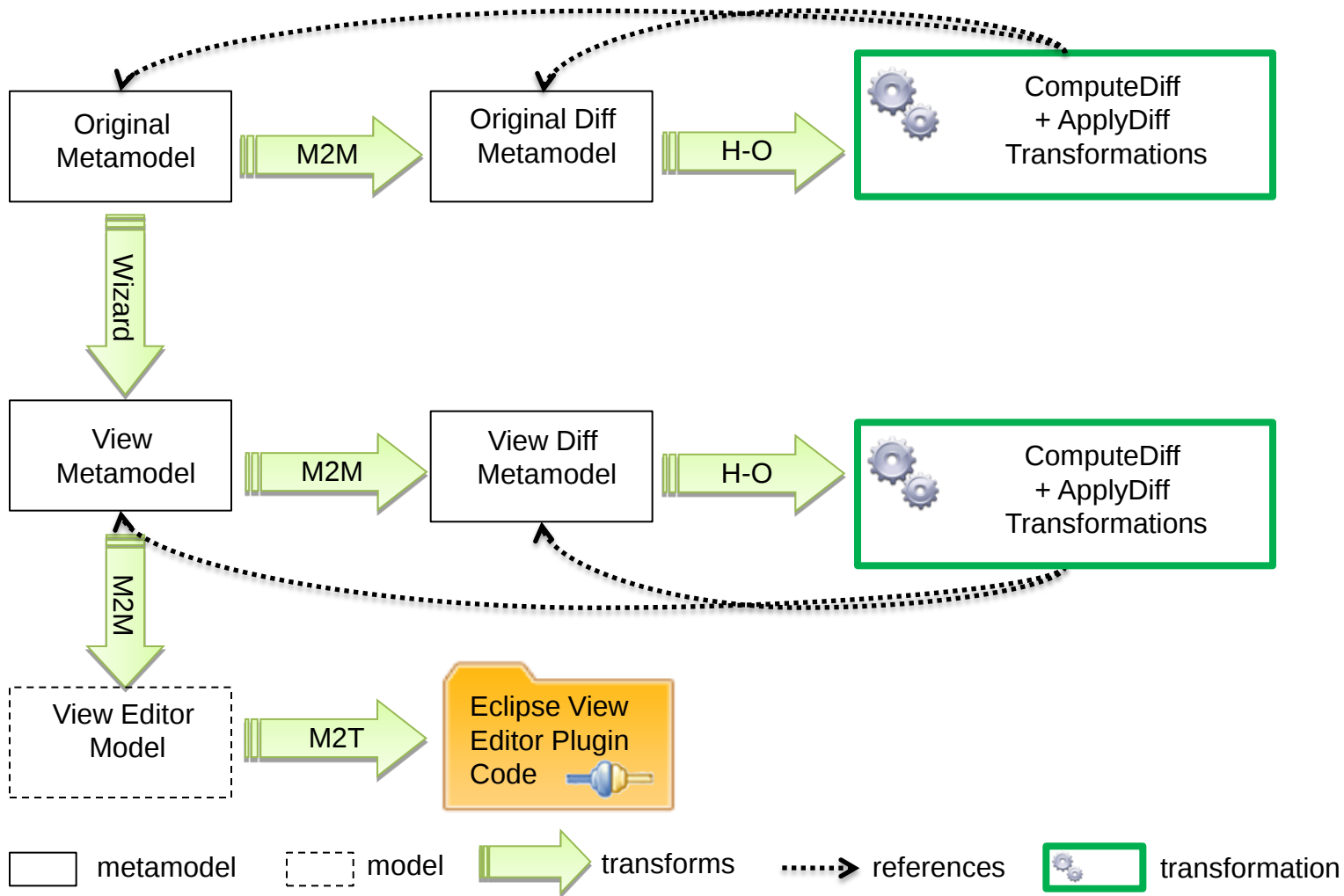


Synchronization Process



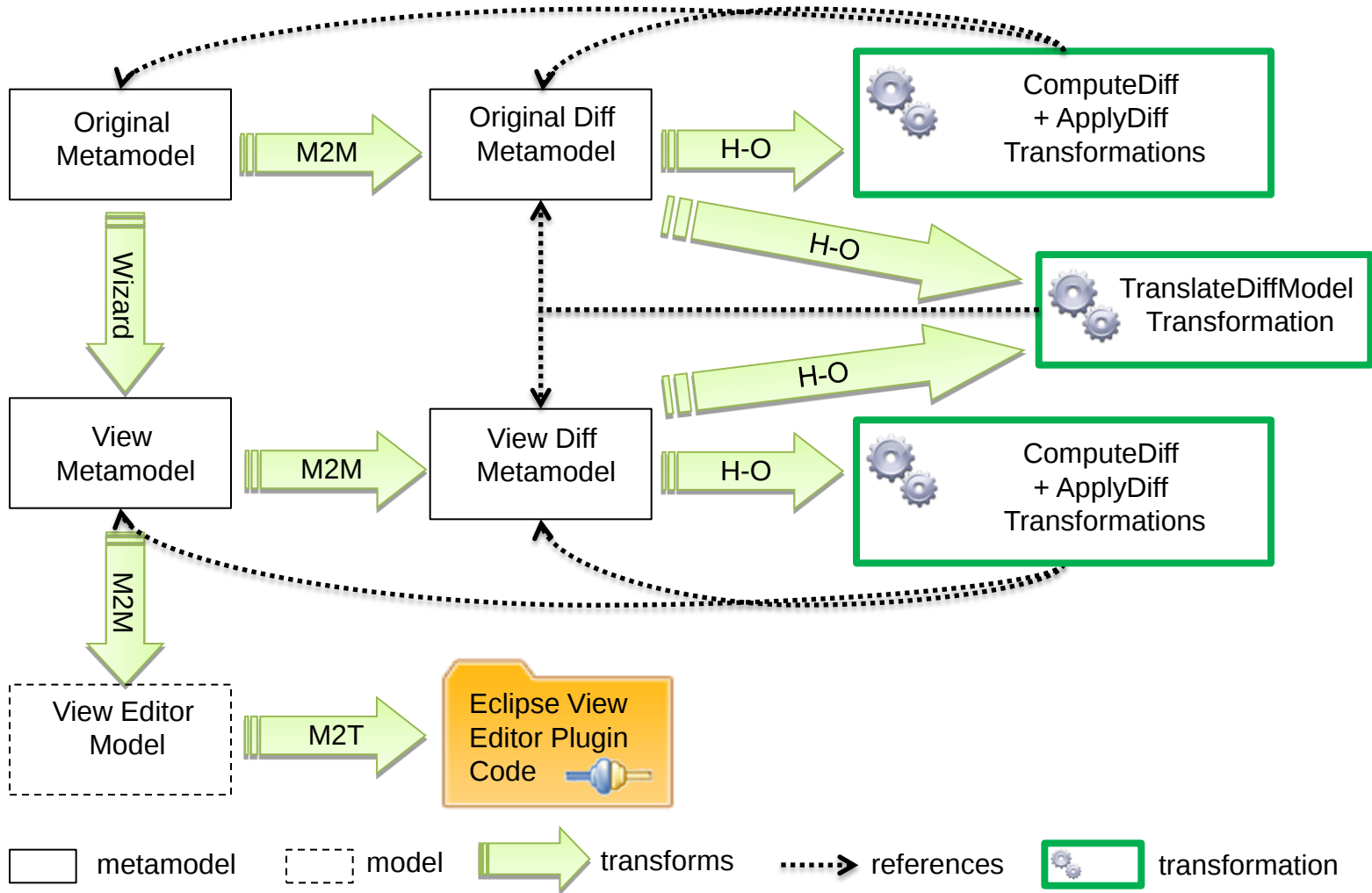


Synchronization Process





Synchronization Process





Synchronization Process

