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Extending the UML 2 Activity Diagram with Business Process Goals and Performance Measures

and the Mapping to BPEL

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FFORTE

bm:bwk

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Theory about Business Processes

- **Definition:** „A business process is a group of tasks that together create a result of value to a customer. [1]
- Its purpose is to offer each customer the right product or service, e.i., the right deliverable, with a high degree of performance measured against cost, longevity, service and quality.“ [2]
- **Process goals** and **performance measures** are available in process theory
- **BUT:** visibility in conceptual Business Process Modeling Languages (BPMLs) is not available!

[1] Hammer, M.: Beyond Reengineering - How the process-centered organization is changing our work and our lives. Harper Collins Publishcers, 1996.
[2] Jacobson, I., Ericson, M., Jacobson, A.: The Object Advantage - Business Process Reengineering with Object Technology. ACM Press, Addison-Wesley Publishing, 1995.

Goals of the Extension

- Current **BPMLs** [3] **do not provide** explicit **notation elements** for process goals and their measures
  - E.g. designer has no possibility to integrate time limits

1. Extending a well-known BPML to make goals and performance measures conceptually visible

Time | Quality | Costs | Goals

2. Mapping the performance measures onto the Business Process Execution Language (BPEL) to make them available for execution and monitoring

[3] List B., Korherr B.: An Evaluation of Conceptual Business Process Modelling Languages, Proceedings of the 21st ACM Symposium on Applied Computing (SAC'06), April, Dijon, France, ACM Press, 2006.

Contribution of the Extension

- **Modelling of goals** allow
  - to **structure process design**,
  - to **evaluate the process design**,
  - to better understand the broader **implication of the process design**, and
  - to **evaluate the operating process**
- **A mapping to BPEL** allows to
  - to **convert/transform the business process models** developed in an UML modeling tool into BPEL
  - to **monitor the process instances** continuosly

Outline

- UML Metamodel - extended with Goals and Performance Measures
- Example: normal AD vs. extended AD
- Mapping Relation between AD and BPEL
- Conclusion
- Outlook and Future Work

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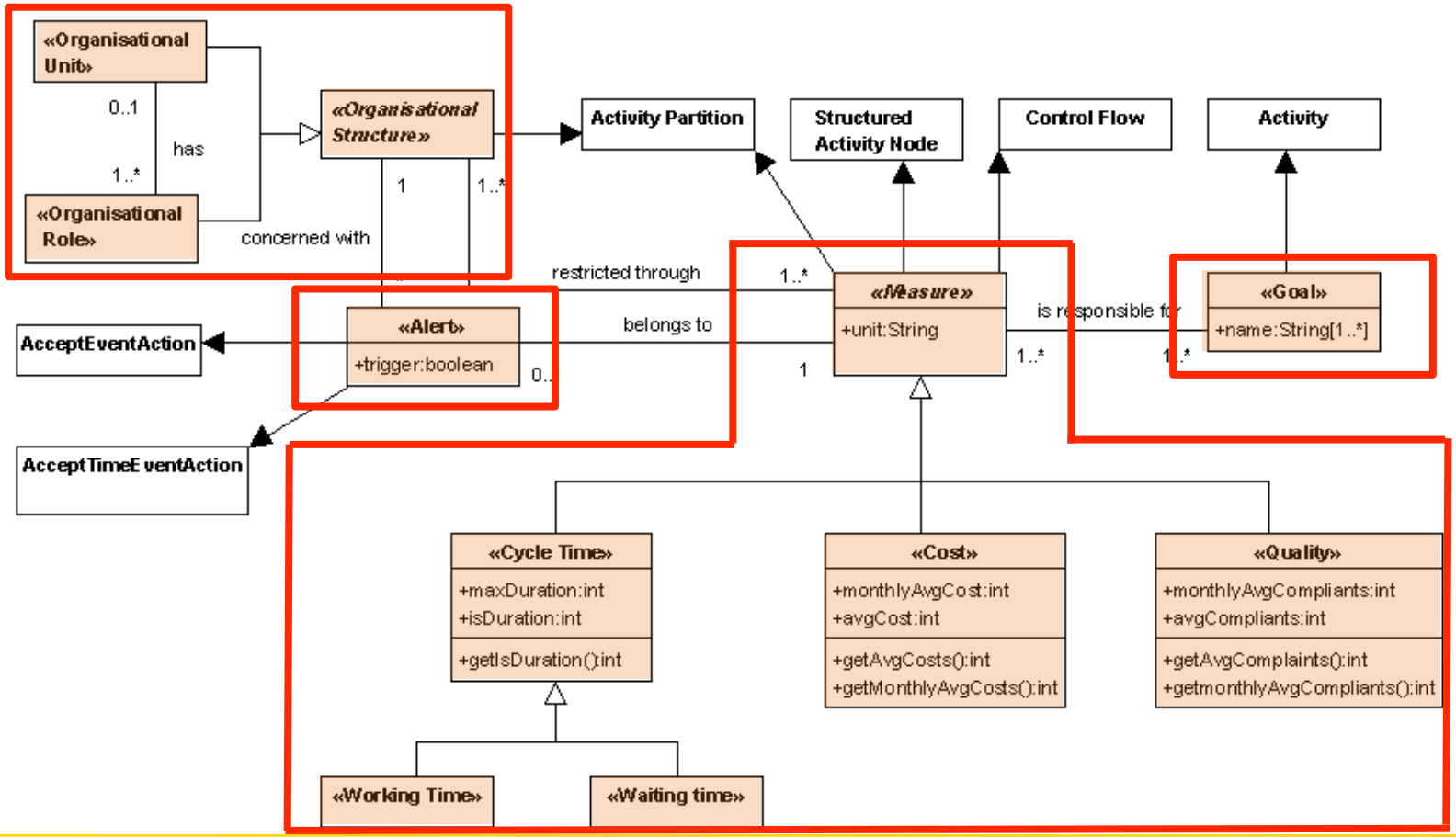
Mechanisms for the Extension

- Activity Diagrams are used for
  - modelling business processes as well as for
  - describing control flows in software
- Activity Diagrams do not support the graphical representation of
  - process goals and
  - performance measures

Extension mechanism of UML: extend and adapt the metamodel to a specific area of application through the **creation of profiles**

The extended UML 2 Metamodel of ADs



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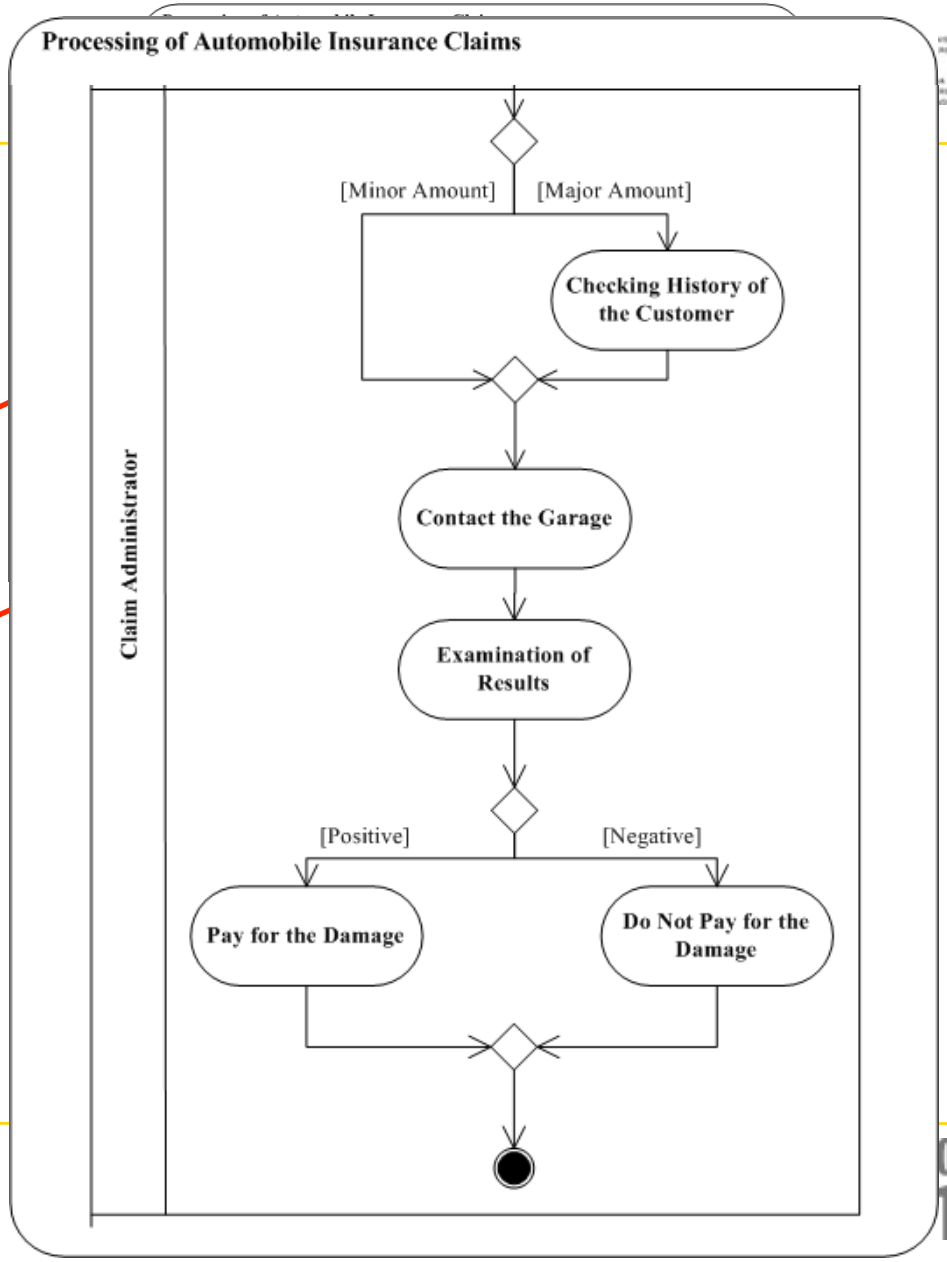
Example of a normal AD

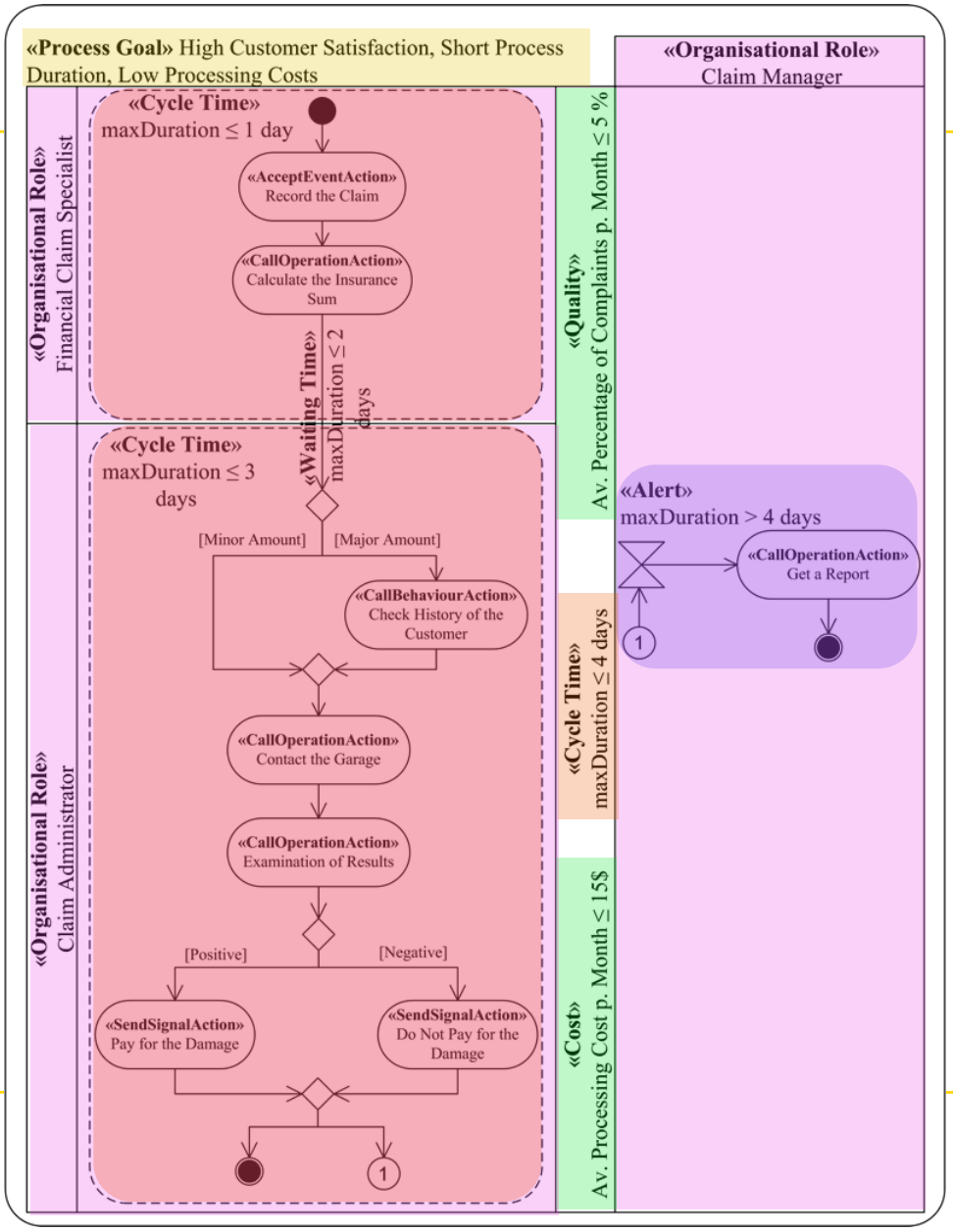
Actions

Control Flows

Activity Partitions



Example of an extended AD



Applying the UML 2 Profile to an Example

- Refined the Activity Diagram by including a set of stereotypes
  - based on the various types of actions specified in the metamodels of actions in the UML superstructure
  - inspired by the approach of Bordbar [4]

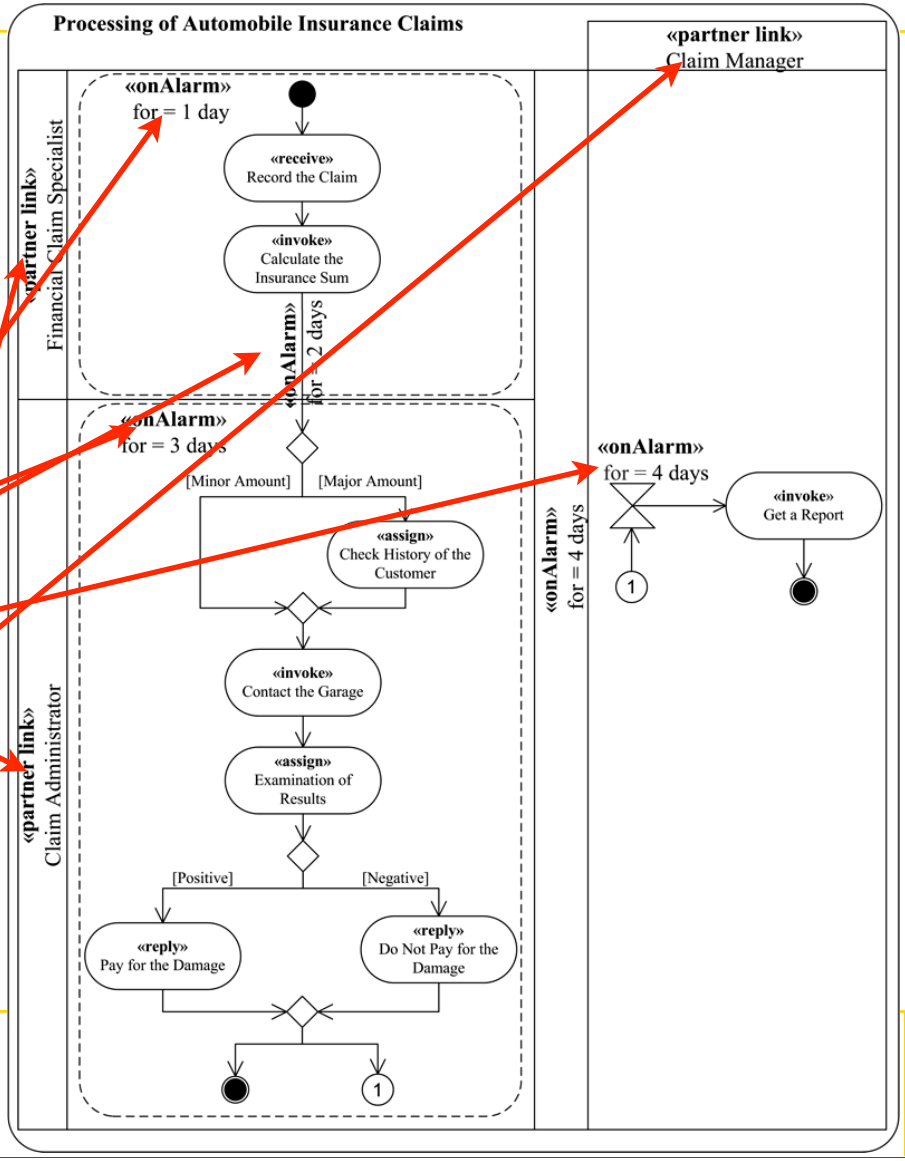
- Mapping the different actions to tags of the Business Process Execution Language (BPEL)
- BPEL is a language for specifying business process behaviour based on Web Services
- inspired by the approach of Bordbar [4]

Extending the approach with business process goals and performance measures

[4] Bordbar B., Staikopoulos A.: On Behavioural Model Transformation in Web Services, Proceedings of the ER 2004 Workshops, Shanghai, China 2004, Springer Press, 2004.

Mapping to BPEL

UML Stereotype	BPEL Tag
«Cycle Time»	«onAlarm»
«Waiting Time»	«onAlarm»
«Working Time»	«onAlarm»
«Alert»	«onAlarm»
«Organisational Unit»	«partner link»
«Organisational Role»	«partner link»



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Related Work 1/2

- **Aguilar et al [5]:** developed a set of measures to evaluate the structural complexity of business process models on the conceptual level
  - use the Business Process Modeling Notation (BPMN)
  - focus lies on measuring the core elements of BPMN
- **Vitolins [6]:** wants to provide precise definitions of typical process measures for a UML 2 AD like notation
  - annotates cost and time to each action seperately as a note
  - no considerations about to integrate the performance measures as graphical notation elements

[5] Aguilar, E. R., Ruiz, F., Garcia, F., Piattini M.: Evaluation Measures for Business Process Models, Proceedings of the 21st ACM Symposium on Applied Computing (SAC'06), April, Dijon, France, ACM Press, 2006.
[6] Vitolins, V.: Business Process Measures, Proceedings of International Conference Baltic DB&IS 2004, June 2004, Riga, Latvia, Scientific Papers University of Latvia Vol. 673, University of Latvia, 2004.

Related Work 2/2

- **Bordbar et al:** transformation of the UML 2 AD to BPEL
  - transformation is based on metamodels
  - uses OCL as transformation language
- **Gardner et al [7]**: UML Profile for Automated Business Processes
  - enables BPEL processes to be modelled using an existing UML tool
  - uses „old" UML version 1.4 and BPEL 1.0

[7] Gardner, T., Amsden J., Griffin C., Iyengar S.: Draft UML 1.4 Profile for Automated Business Processes with a mapping to the BPEL 1.0. IBM alphaWorks (2003).

Conclusion of the Extension of ADs

- **UML 2 profile for …**
  - … integrating business process goals and
  - … performance measures into UML 2 activity diagrams
- **The profile provides** an explicit illustration of the performance measures
  - time,
  - cost, and
  - quality
- **Mapping to BPEL:**
  - transformation of a specific BPML and its time based performance measures into an execution language
  - possibility to monitor the process instances continuously

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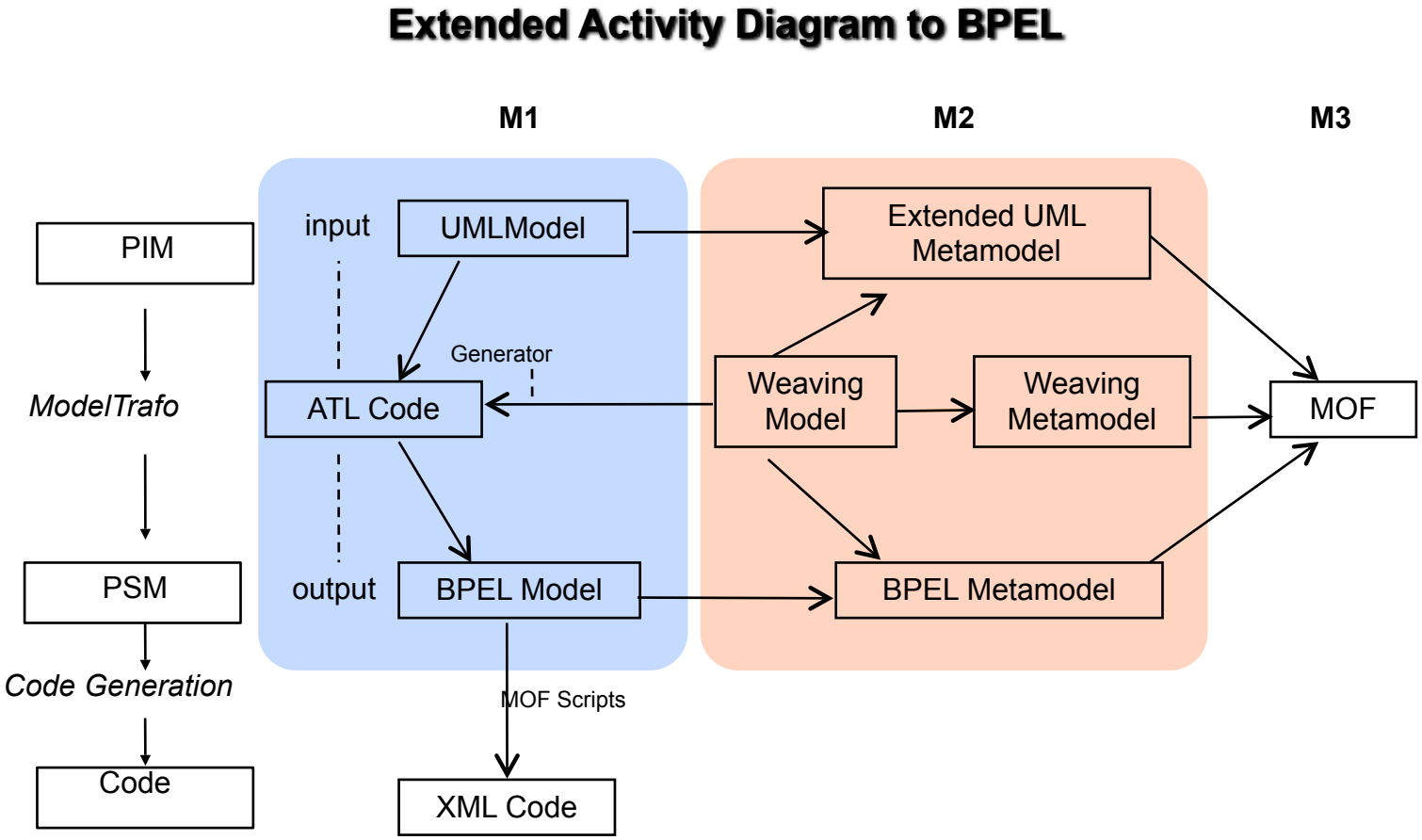
Future Work


Extended Activity Diagram to BPEL
M1
M2
M3
PIM
input
UMLModel
Extended UML Metamodel
Generator
ModelTrafo
ATL Code
Weaving Model
Weaving Metamodel
MOF
PSM
output
BPEL Model
BPEL Metamodel
Code Generation
MOF Scripts
Code
XML Code