

A metamodeling-based approach for method fragment comparison

Eleventh International Workshop on
Exploring Modeling Methods in Systems Analysis and Design
(**EMMSAD'06**)

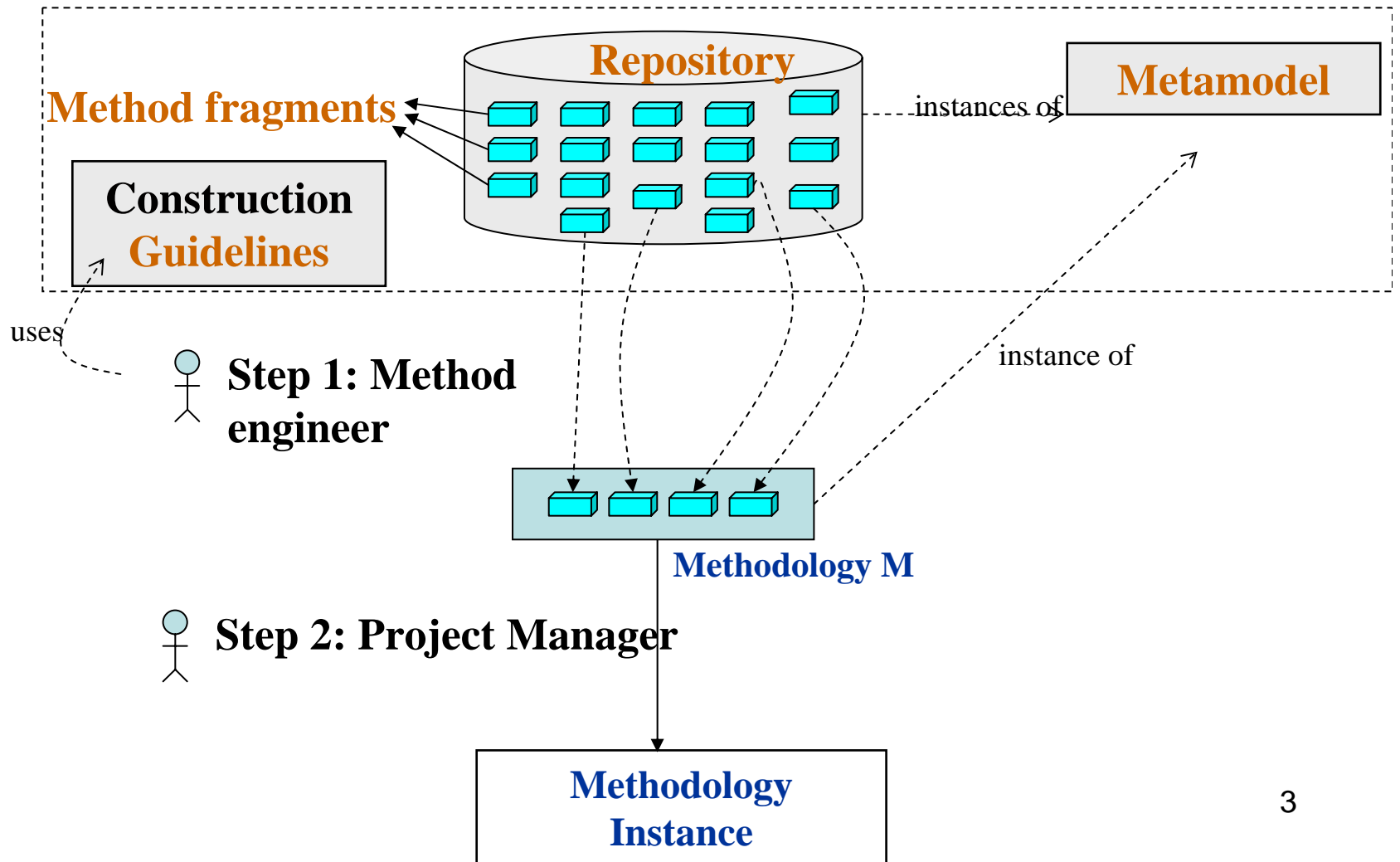
*Massimo Cossentino, Salvatore Gaglio, **Brian Henderson-Sellers**
and Valeria Seidita*

Outline

- I. Context and aim of research
- II. The need for standardization
- III. Existing method fragments
- IV. Comparison
- V. Conclusion

I. Context and Aim of Research

Method Engineering



Our goal

- Fragment repository (a.k.a. methodbase) is the key concept of the method engineering approach
- Explore existing fragment definitions in order to identify differences among different approaches and to identify which elements and concepts could be helpful for the extraction/creation of method fragments

II. The need for standardization

- ISO
 - Recognized international standardization body
 - Process reference models e.g. 12207, 15504
 - Metamodel for development methodologies
- FIPA
 - (Foundation for Intelligent Physical Agents) is a technical committee of IEEE Standards society
 - It aims at producing standards for the interoperation of heterogeneous software agents
- OMG
 - Provides de facto standards in field of object technology
- Standard methodology metamodels - present possibilities:
 - OMG's SPEM
 - AS4651 (SMSDM)/draft of ISO24744 (SEMDM)

III. Existing method fragments

- Brinkkemper et al.'s approach
- Rolland, Ralyté and colleagues (Method Chunk)
- OPF
- FIPA

Brinkkemper et al.'s method fragment

- Method fragment is a coherent piece of information system development
- Two kinds of method fragment
 - Process fragment
 - Describes the stage, activities and tasks
 - Product fragment
 - Concerns the structure of a process product (deliverables, diagrams etc.)

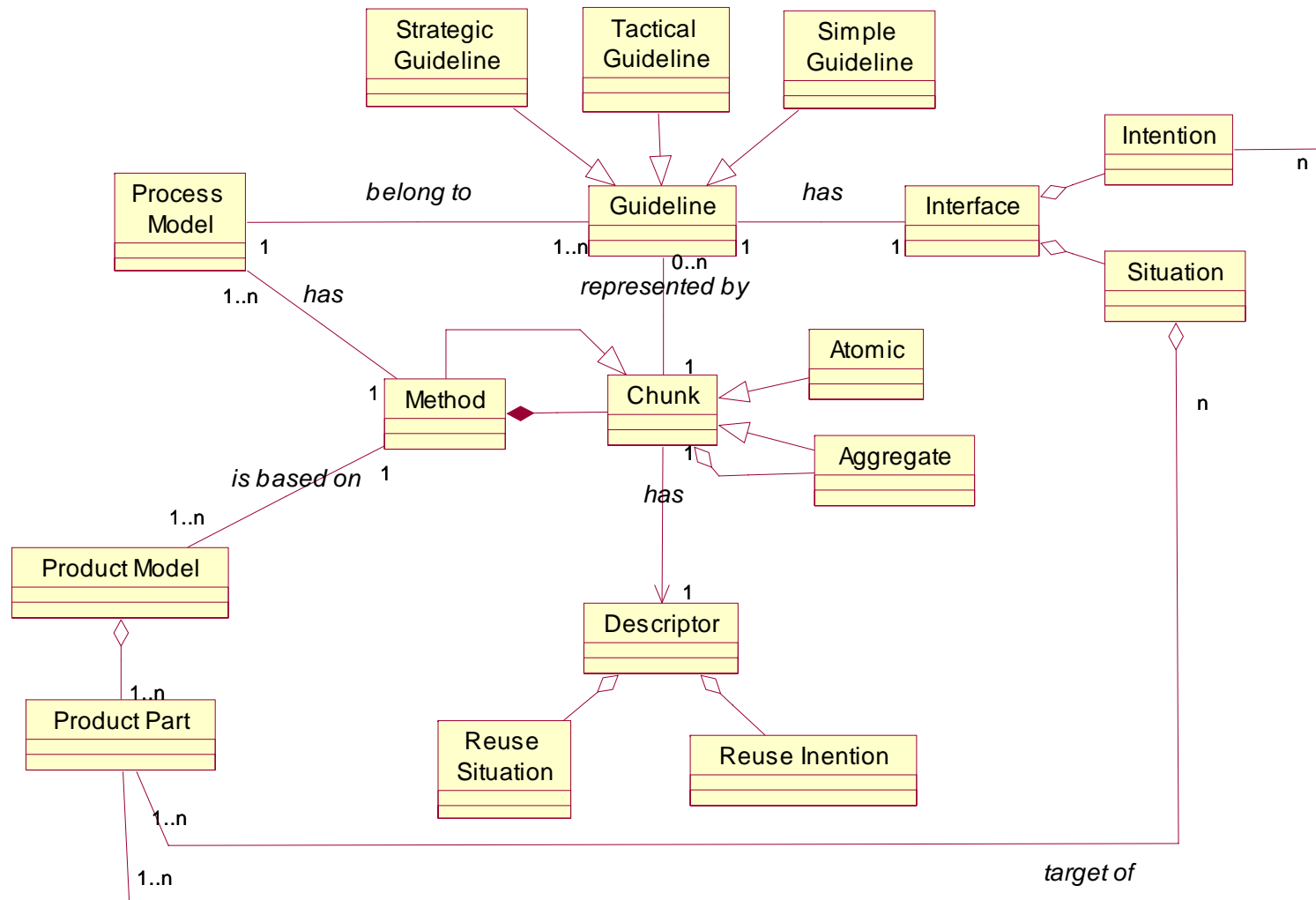
- Metamodel based on three orthogonal dimensions:
 - Perspective
 - The process and product perspective on fragment
 - Abstract level
 - Conceptual (i.e. descriptive), technical (i.e. executable) and external (i.e. user-focussed) level
 - Layer of granularity
 - The level of decomposition at which a method fragment resides
 - Method, stage, model diagram and concept
- A fragment can be composed of other fragments and can have relationships with other fragments

Method Chunk – Rolland, Ralyté et al.

Method chunk (seen as a consistent and autonomous component)

- It represents a portion of a process with its resulting work products
- It integrates the product and the process aspects of method fragment
- It is represented using a metamodel (UML notation)

Method Chunk Metamodel



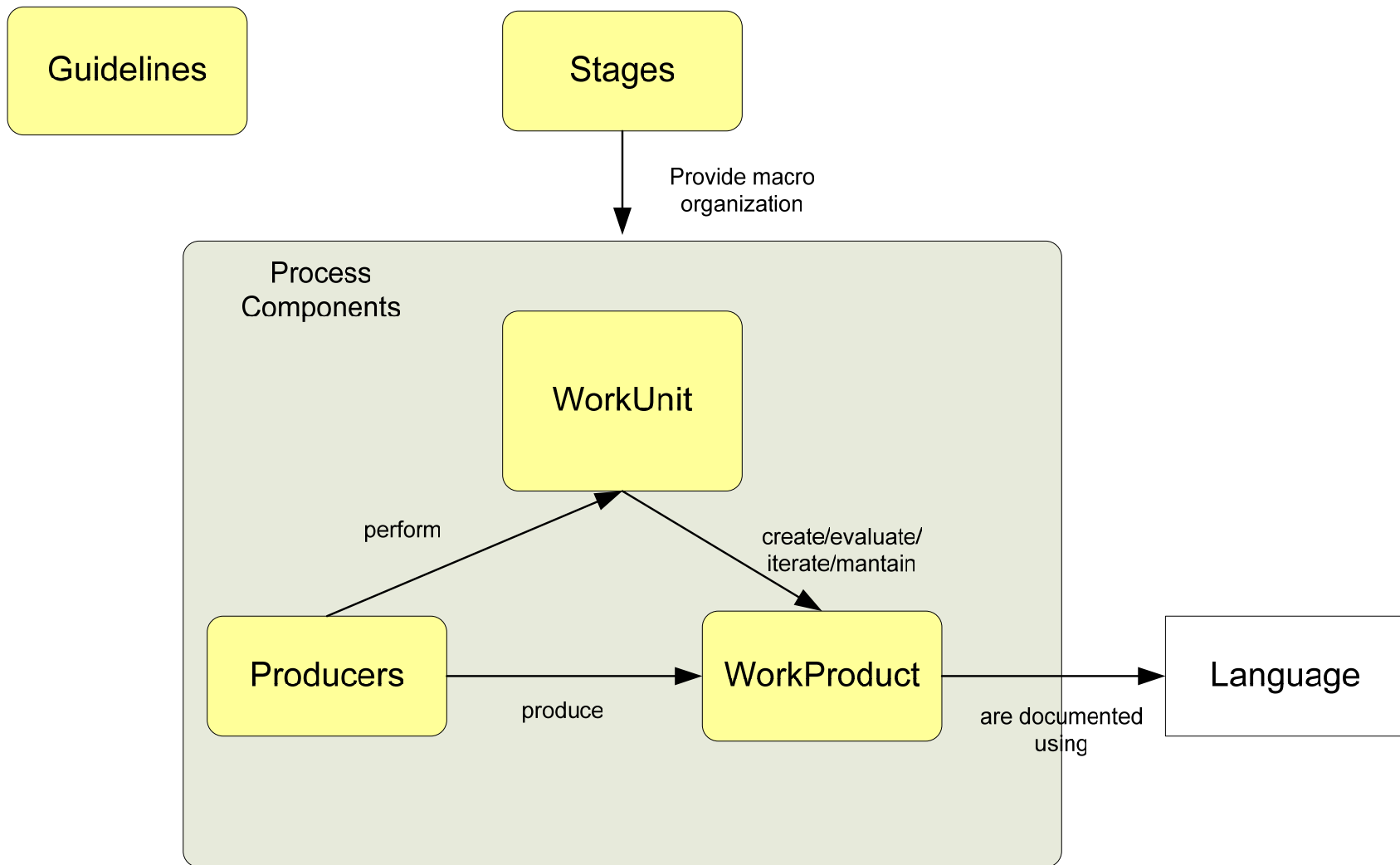
Method Chunk Metamodel

- Composed of two parts:
 - The process aspect
 - Each chunk can be atomic (simple) or can aggregate other chunks
 - Guideline, embodies the method chunk knowledge to guide the designer
 - Situation, the condition of chunk applicability
 - Intention, the objective to perform
 - Descriptor, describes the situation in which the chunk can be reused
 - The product aspect
 - Composed of Product Model, Product Part and Guideline
 - For each process part there is at least one product; but any one product part could participate in several method chunks
 - Guideline is also part of the product model, it describes how to generate a product

OPF method fragment

- Reflects best practices in existing methodologies and used to construct new ones
- It is generated and stored in a repository with all its guidelines based on OPF metamodel
- The metamodel is composed of five main metaclasses
 - Each metaclass produces a method fragment (process *or* product fragment)

OPF Metamodel



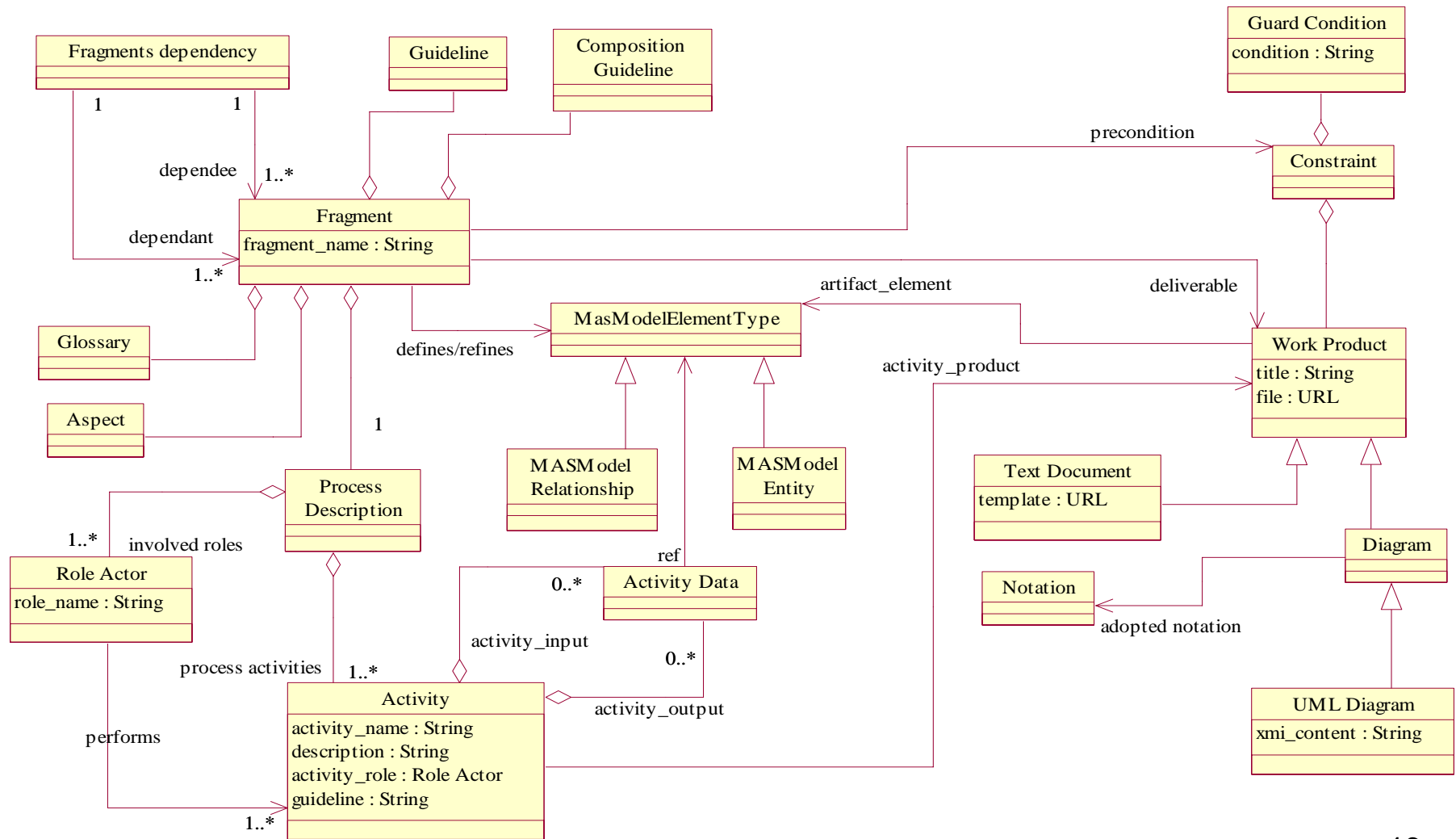
OPF Method Fragment

- Main elements of OPF Metamodel
 - WorkUnit (Activities, Tasks and Techniques), operations performed by Producers during a development process in order to produce a specific WorkProduct; Activities and Tasks describe what is to be done whereas Techniques describe how to do a portion of work
 - WorkProduct, the artefact
 - Producer, the stakeholder performing a work unit
 - Stage, provides the organization of process in terms of phases and lifecycles i.e. offers calendar time
 - Guideline, useful to instantiate the metamodel elements, to create method components and to create the method itself

FIPA fragment

- A reusable part of a design process
 - Composed of a set of activities performed by process roles in order to produce a kind of artefact (work product)
- Based on process description model from the OMG SPEM V1
- FIPA Fragment Metamodel is divided into three areas
 - Description of fragment (process perspective: activities, process role and work product)
 - Condition for fragment reusability
 - Fragment representation in the methodbase
- Use of SPEM (Software Process Engineering Metamodel) notation

The Metamodel of FIPA method fragment



FIPA Fragment

- First area
 - A fragment is composed of a Process description (what is to be done and in what order)
 - It aggregates activities (the description of the work performed by one process role, the role actor)
 - A work product is whatever is produced, consumed or modified by a fragment; it is based on the assumption that a work product is MAS metamodel element oriented
 - FIPA Methodology TC aims at identifying methodologies for developing multi agent systems
 - Fragment refers to a MAS metamodel and its purpose is to enact its instantiation

FIPA Fragment

- Second area
 - Elements for fragment reusability
 - Glossary, a list of terms
 - Aspect, instructions for identifying the field of fragment application
 - Guidelines, a set of rules providing a description on how to perform an activity
- Third area
 - Method fragment representation in the repository
 - Fragment dependency, a list of dependee and dependent fragments useful for methodology composition

IV. Comparison

- Our comparison is based on two different viewpoints:
 - structural and functional
- Structural
 - Starting from fragment metamodel we look at differences in terms of elements, name of elements (i.e. same meanings and different names, same names and different meanings)
- Functional
 - Based on fragment extraction/construction philosophy
 - Explores the features of elements leading to the extraction/creation activity

Structural comparison results

		Method Fragment	Method Chunk	OPF Fragment	FIPA Fragment
Process	<i>What</i>	Stage, Activity, Task and Steps		Activity, Task	Activity
	<i>Input/output</i>	WorkProduct	Situation (input), Intention (output)	WorkProduct	ActivityData (input/output)
	<i>How</i>		Guideline Interface	Technique	Guideline
	<i>When</i>			Stage Build Phase	
	<i>Who</i>			Producer (directly, undirectly)	Role Actor (Perform, Assist)
	<i>Reusability and Assembly</i>	Relationship with other fragments	Descriptor (ID, name, type, application domain)	Guideline	Glossary Aspect Composition-Guideline Fragment-Dependencies

Structural comparison results - 2

	Method Fragment	Method Chunk	OPF Fragment	FIPA Fragment
Product	Deliverables, Milestones Documents, models and diagrams	ProductPart Guideline	WorkProduct Model Document	WorkProduct MMMElements
			Modelling- Language (Notation, Language)	

Structural Comparison Results

- For each method fragment we outline the main elements of which a design process is composed (who, what, how and when)
- Two different aspects of fragment
 - Process aspect
 - Three metamodels specify the elements related to the work to be performed (at different levels of details for each fragment, i.e. Activities, Tasks and Steps), whereas method chunk metamodel does not present such an element because it represents by itself the work to be done during a development process with all the necessary guidelines.

Structural Comparison Results-2

- Guidelines: different kinds in different fragments, different names and different features, for instance
 - in FIPA and method chunk, a guideline aims at describing how to perform the activities,
 - in OPF this element is called Technique and Guideline only refers to the way of composing the fragment
- Input and output of different fragments: they are quite different in different approaches
 - they are work products, in case of method fragment and OPF, or whatever data of an activity, in FIPA fragment
- Temporal aspects: information on distribution of work is present in a graphical form
 - graph, SPEM activity diagram

Structural Comparison Results-3

- Stakeholder: it is considered only in two metamodels (FIPA and OPF)
- Reusability/assembly: all fragments present elements useful for reusability and assembly activities
 - the concept of method fragment, in all these approaches, is oriented to the construction of a methodology
- Product aspect
 - Work Product is the central element in all the presented metamodels for fragments. In addition, some of them specify the modelling language

Functional Comparison

- Criteria
 - The comparison starts from the consideration that repository creation is an important phase in method engineering (object or agent oriented)
 - Each fragment in the repository comes from existing methodologies (extraction phase) or has been created from scratch
 - Fragment extraction/creation is based on the specific element the method engineer wants to manage in the fragment

Functional Comparison - Results

- This comparison refers to the possibility of identifying some key elements as the main focus of the fragment
 - This means that each fragment aims at defining/relating/refining some elements of the system metamodel
 - The knowledge of these elements is fundamental in the assembly phase

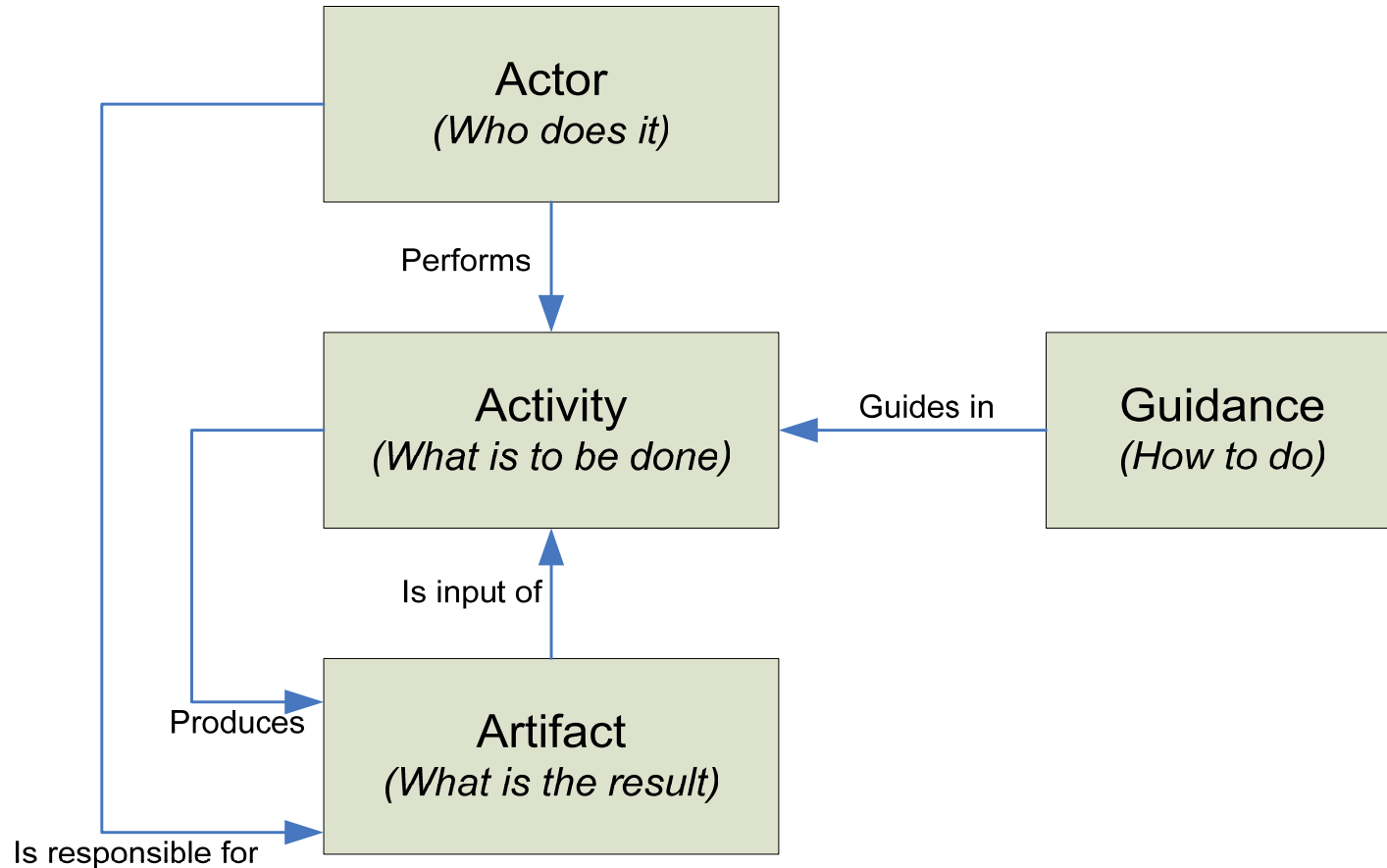
We investigate which metamodel features lead to the extraction/construction of a method fragment

- Method chunk and method fragment approaches consider both the process and the product aspects of existing methodologies for their decomposition
 - the former focuses only on some specific situations and intention for the creation of new ones
- FIPA fragment construction is work-product oriented
- OPF fragment is an instance of metamodel concept, considering one concept at a time (we can have activity fragments, task fragments and so on);
 - it is the smallest method fragment (in the sense of granularity level)

A synthesis attempt

- All fragments are defined considering they are constituent part of a design process
- Important elements of method fragments:
 - Process and product aspects
 - The presence of stakeholder
 - Possibility of reuse and assembly
 - Guidelines
- Different levels of granularity of the definition and representation of fragments

- A higher level metamodel summarizing different approaches



Conclusion

- With this work we have achieved:
 - A deeper knowledge and understanding of different approaches and different repositories
 - Improved our capabilities in using existing repositories
- Future work
 - Identification of the best level of granularity of fragments for useful merging of repositories
 - In the whole comparison process, we maintained the original terminology; thus, an ontological comparison can be considered