

MAS Meta-models on Test: UML vs. OPM in the SODA Case Study



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Outline

- Meta-models in AOSE area
- **Purpose:** evaluate the effectiveness of two approaches (UML and OPM) to express the meta-models
- **Case study:** SODA, an AOSE methodology
- Conclusions and Future Work

Why Meta-models?

- Meta-modelling enables checking and verifying the completeness and expressiveness of a methodology by understanding its deep semantics.
- In the context of MASs, a meta-model should be a structural representation of the elements that constitute the actual system
 - agents, roles, behaviour, ontology...
- With their composing relationships

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Meta-models in AOSE

- Several meta-models of AOSE methodologies can be found in the literature
- Although a number of these adopt some kind of UML extensions to express system models, while others adopt some ad-hoc symbology for the same purpose
- The meta-models of all such methodologies are still expressed in UML

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Why UML & OPM?

UML

- industry standard
- aspect decomposition (multiplicity problem)
- only object
- meta-models usually exploit only package, class, and associations

OPM

- new emergent approach
- detail decomposition (zooming mechanisms)
- objects and processes
- single diagram (OPD) and a corresponding subset of English (OPL)

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Why SODA?

- SODA (Societies in Open and Distributed Agent spaces) widely deals with social issues
- Interaction as the key aspect: a system entity appears in a SODA model only in that it is involved in some interactions
 - social interaction
 - environmental interaction
 - coordination issues

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The SODA Methodology

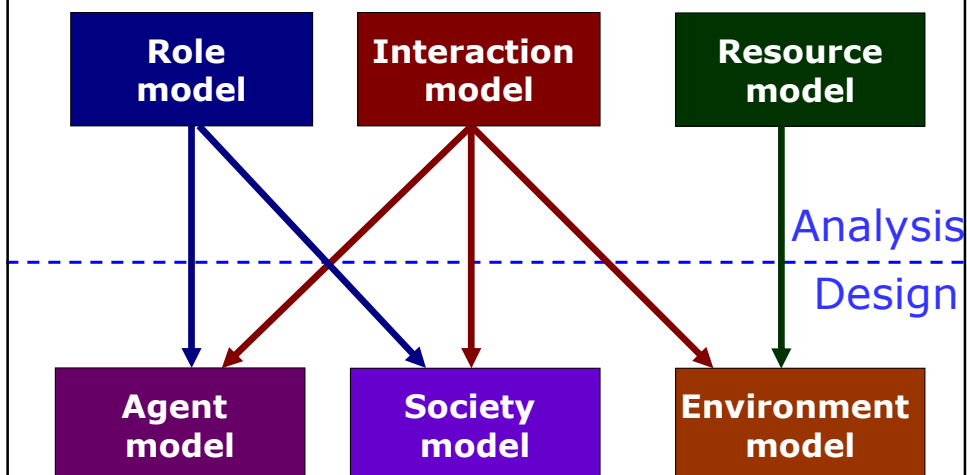
- The SODA **analysis** phase is based on three models:
 - the *role model*
 - the *resource model*
 - the *interaction model*
- The SODA **design** phase is also based on three models:
 - the *agent model*
 - the *society model*
 - the *environment model*

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Model Relation

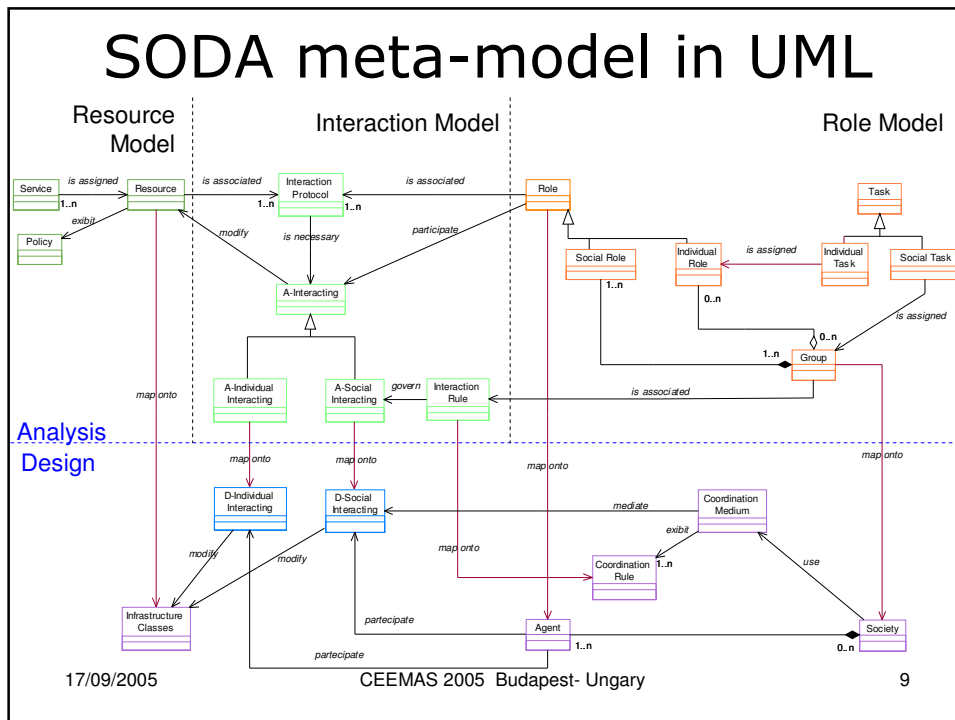


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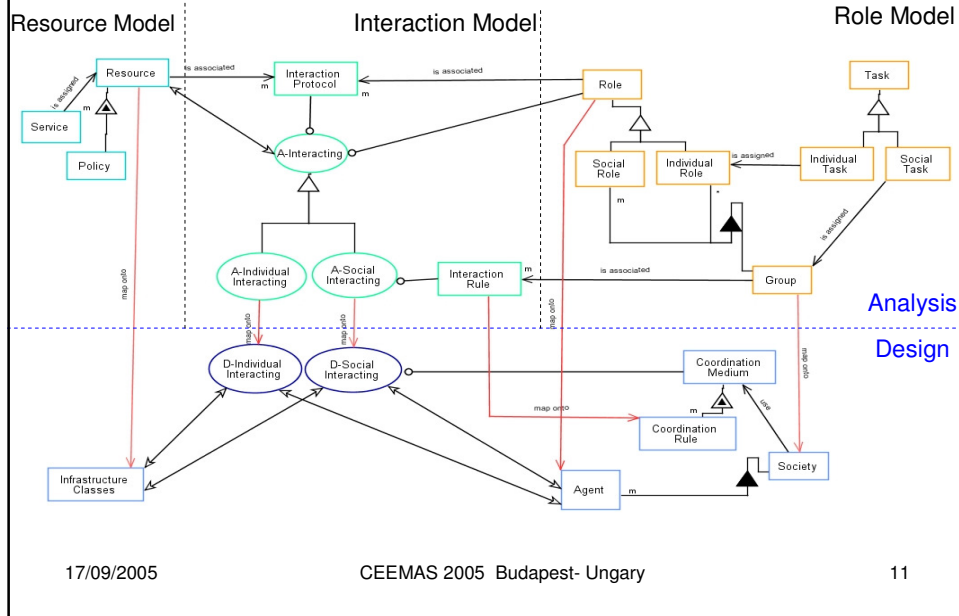
SODA meta-model in UML



UML Meta-model in Detail

- SODA organisational structure is well captured by UML
- Centrality of interaction in SODA is well emphasised
- Interaction is badly captured: class is not good for modelling dynamic aspects
- Relations between the structural entities and the “interaction entities” are critical
- Connection from the analysis phase and design phase: “map onto” is somehow vague

SODA meta-model in OPM



OPM Meta-model in Detail









- Many aspects still hold: the overall model structure is the same
- Interaction as a *OPM process*
- Replace UML generic (tagged) associations with a new, semantically-clear symbology
- Some metamodeling relations are still difficult to express
 - relation between “structural entities” and “interaction entities”

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UML & OPM: Pros and Cons

	UML	OPM
Structural parts		
Dynamic parts (<i>interaction</i>)		
Relation between structural and dynamic parts		
Relation between "phases"		

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Summing Up

- Both UML and OPM proved expressive enough to capture the structural parts of the SODA methodology
- Both approaches present some problems when asked to appropriately model the concept of interaction
- Relation of *participation* in interaction is a problem
- This indicate that while both UML and OPM are suitable to model the dynamic behaviour of systems, this ability is not conserved if they are used to build meta-models

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Conclusions

- We put to test two meta-modelling approaches in order to check their expressiveness and suitability to the meta-modelling of MAS methodologies
- Our conclusion: neither approach is actually able to capture all the AOSE desired aspects in a satisfactory way. In particular:
 - the structural part is reasonably well modelled but
 - dynamic part is captured only partially

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Ongoing Work: A Roadmap to Artefacts

- Artefact as the means for modelling and shaping the agent environment



- New meta-model is need to catch:
 - Agents + Artefacts
 - Agents speak to agents and
 - Agents use Artefacts

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Future Work

- Exploring how to overcome the modelling weaknesses
- Extending the SODA meta-model to catch
 - the *zooming mechanism*
 - the concept of *artefact*
- Forthcoming in SODA:
 - the *topological model*
 - the *organisational model*

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Works in TFG “AOSE”

- The currently work in TFG “AOSE” aimed to create a standard meta-model putting together the best aspects of the AOSE methodologies.
- The standardisation is a relevant issue, but the TFG approach open several questions:
 - Which methodologies?
 - What are the best important aspects in MASs?
 - How compose the aspects?
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