

Modeling for openness in MAS

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1 Introduction

2 Our Propose

3 Example

4 Considerations

Multiagent System (MAS)

- A MAS may be composed of four dimensions:
 - **A**gents
 - **E**nvironment
 - **I**nteraction
 - **O**rganization
- For each MAS, dimensions may be arranged in a different way
 - One or more dimension may not be relevant and are not developed



Open MAS (I)

- Commonly, an open system is the one in which agents can enter and leave the system freely at runtime
- These new agents entering the system at runtime are unknown during the system development

Open MAS (II)

- Multi-agent program contest is an open system
 - The system is developed by a team in Germany
 - The agents are developed by different teams around the world
 - The team in Germany does not know how the agents are developed – for them, the agents are unknown during the system development
 - These agents will enter into the system at runtime to take part in the contest

Open MAS (III)

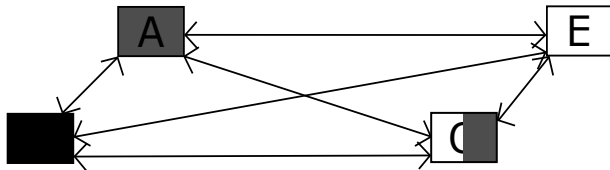
- Other dimensions also may be open
 - Environmental artifacts, interaction protocols, and organizational norms also may be included at runtime
 - Elements of environment, interaction or organization dimension that is unknown during the development

Open MAS (IV)

- An open MAS is the one in which any dimension may be changed at runtime
- That means, elements of any dimension (agents, artifacts, protocols, norms, ...) unknown during development may be included at runtime
- These new elements have to be integrated into the system at runtime, working with the existent ones

Open dimensions

- MAPC Scenario (from Germany guys perspective)
 - Open at agent dimension (they are developed by others)
 - Environment is fully developed by the Germany team
 - Part of the organization is developed (some roles are defined by the contest).
Some elements are included at runtime by the participant team organization (partially open)
 - Interaction is a non relevant dimension (nonexistent)



Designing openness

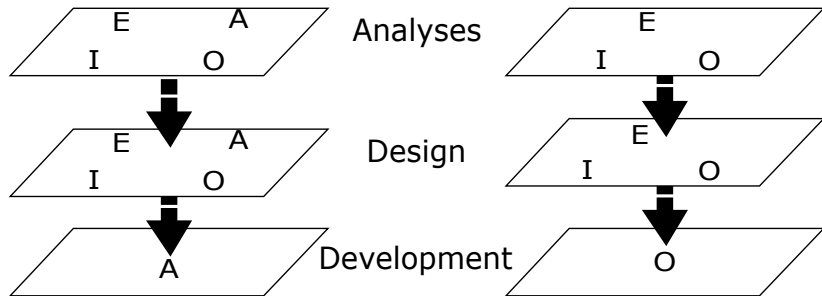
- Openness cannot be specified in a single component
It arises at runtime when new elements are included in the system.

What does it means to design openness?

What does it means to design openness?

- During the system design and development elements of some dimension are not known
- ~> They cannot be designed/developed
- But these elements will take part in the system at runtime
- ~> The system should be *designed* to properly “receive” these new elements

Methods (I)



Methods (II)

- These methods are dependent on one single dimension
Other dimensions specification have to be translated at agent or environmental primitives
Commonly are developed in target platforms that only deal with agent or environment concepts
- Methods do not offer guidelines to help the integration of new elements

Methods (III)

- **It does not prevent the design of an open MAS**
It constraints the specification of openness specific issues
- It is not easy to determine what is necessary at design time for a method properly deal with openness

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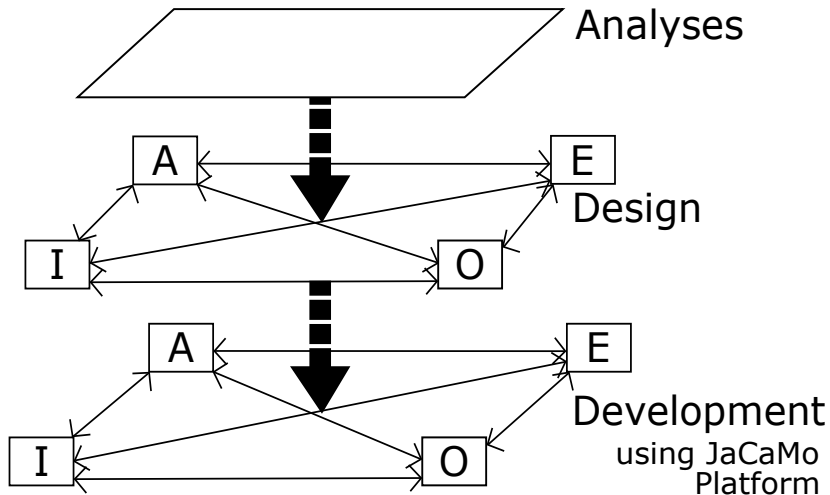
3 Example

4 Considerations

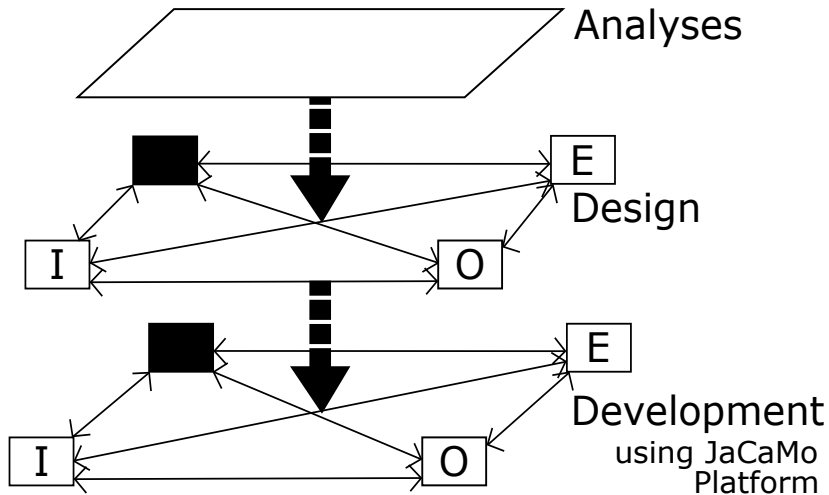
Requirements

- We propose a method for analysis, design, and development of open MAS
- Each dimension is specified independently, with its own concepts and abstractions
Each of them has their own metamodel
- Dimensions are connected by a set of *linking concepts*

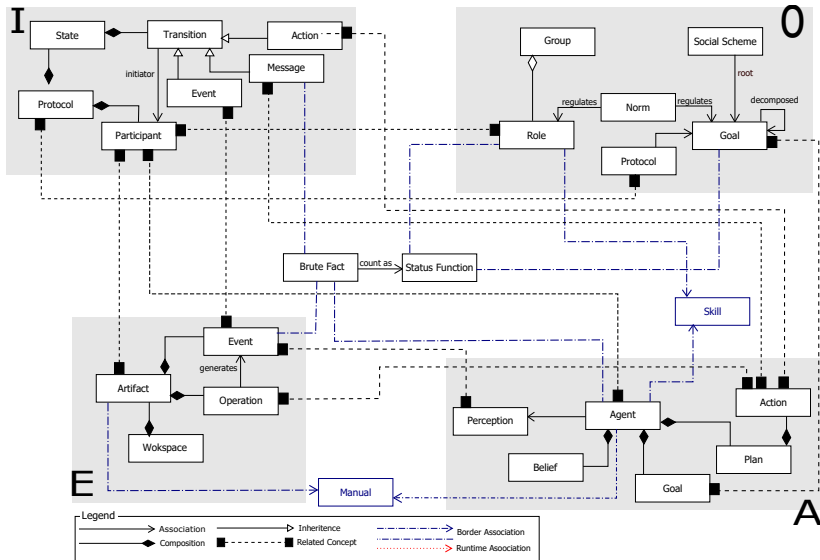
Method Overview



Method Overview



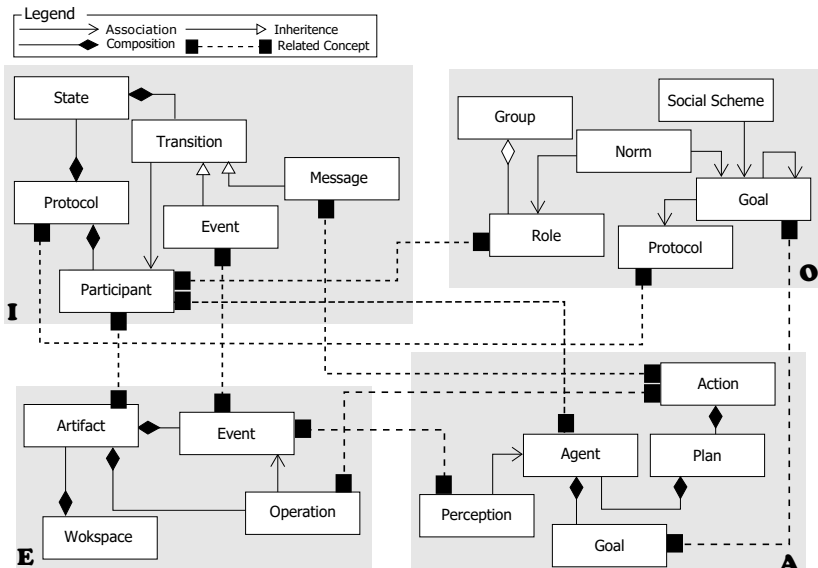
Full Metamodel



Linking concepts (I)

- Related concepts: concepts that have similar meaning in different dimensions

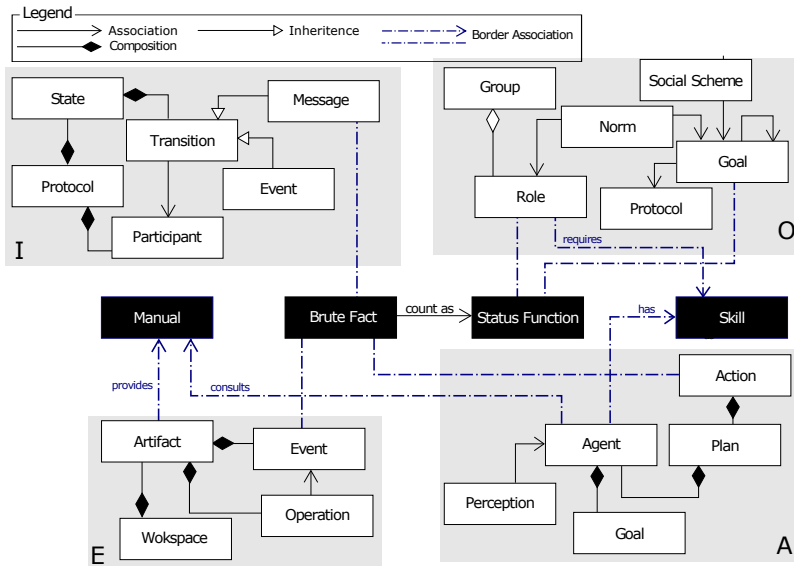
Related concepts



Linking concepts (II)

- Border concepts: provide at design time specific information about how dimensions are linked at runtime

Border concepts



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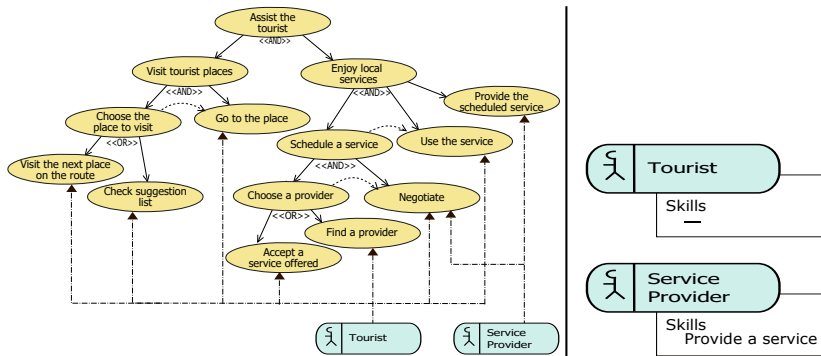
Traveler Assistant(I)

- Traveler assistant provides information about tourist-related spots and services, indicating places to visit, eat or relax
- Tourist and service providers (hotel, restaurants, tour operators) may negotiate prices and dates to provide services
- Tourists may access relevant information about visiting places

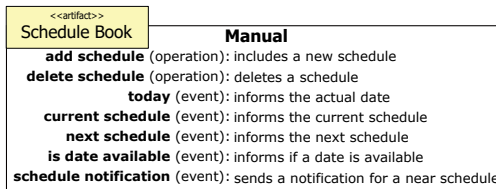
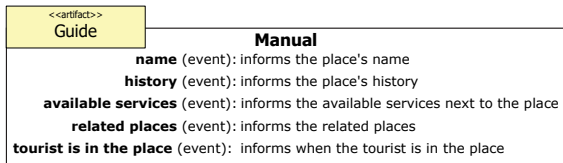
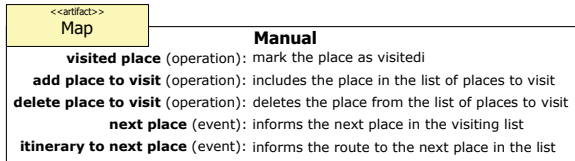
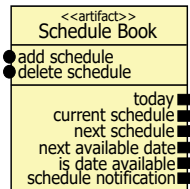
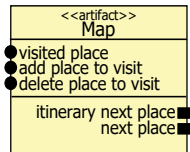
Traveler Assistant (II)

- In the analysis phase, a detailed system description is defined.
- This description is used as a starting point for the design phase.
- In this example, the system is open at agent dimension, since each tourist or service provider may develop its own agent to take part in the system.

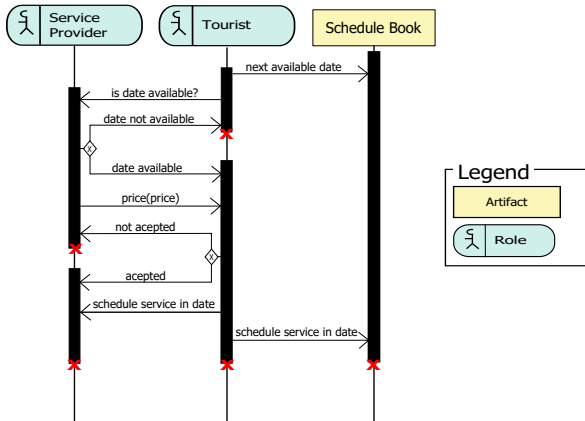
Organization



Artifacts

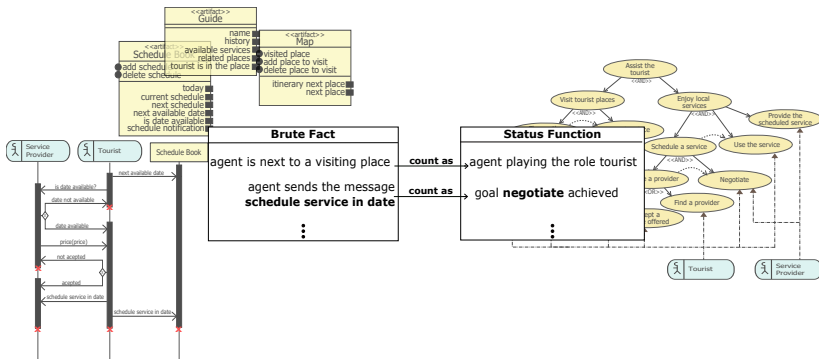


Interaction

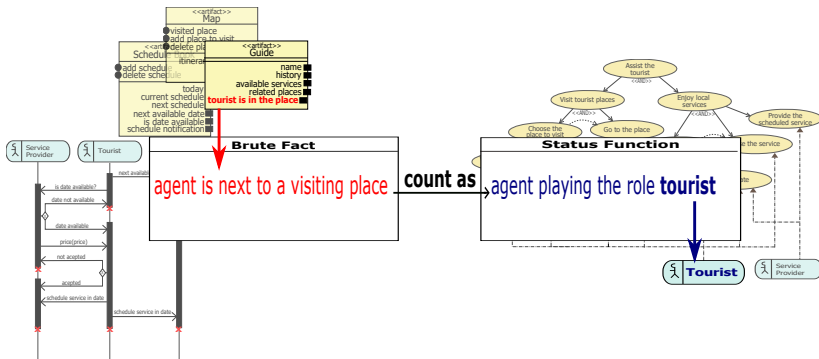


Example

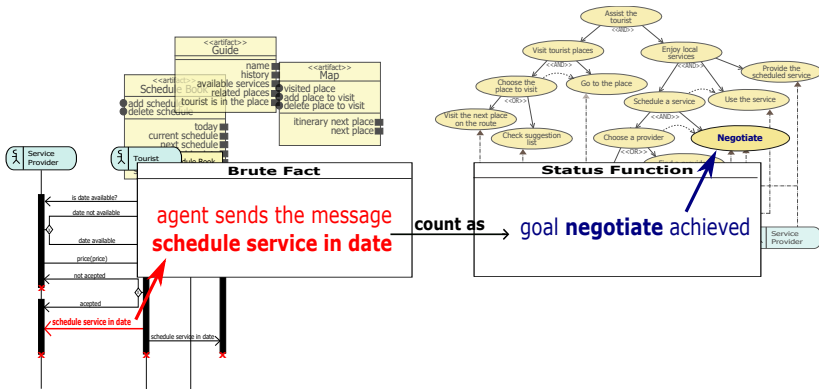
Brute Facts and Status Functions (I)



Brute Facts and Status Functions (II)



Brute Facts and Status Functions (III)



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Conclusion (I)

- We are developing a method to develop open MAS
- Each dimension is defined by its own set of concepts
- We also define a set of linking concepts that are used to link these dimensions
 - Related concepts
 - Border concepts

Conclusion (II)

- This is a works still in progress
- Some questions remain:
 - Minimal set of elements (roles + goals)
 - Roles and goals included at runtime
 - ...

That's all, folks!

Thanks a lot!