

Modeling Notation Source

MESSAGE

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1 Introduction

MESSAGE (Methodology for Engineering Systems of Software Agents) [Mes99] [Mes01] is an agent oriented software engineering methodology, developed in particular for the needs of the telecommunications industry. However, it covers most of the fundamental aspects of the MAS development, and it can be thought as a generic methodology applicable also to other domains.

MESSAGE modeling language extends UML metamodel with 'knowledge level' agent-oriented concepts, and uses the same metamodel language as UML for description of its abstract syntax.

2 Notation Overview

The MESSAGE modeling language uses the following concepts (modeling elements):

Agent – an atomic autonomous entity that is capable of performing some (potentially) useful function. An agent can play roles, provide services, perform tasks, achieve goals, use resources, be a part of an organization, and participate in interactions and interaction protocols.

Organization – a group of agents working together to a common purpose. An organization can provide services, achieve goals, use resources, be a part of another organization, group subordinates into one collection, and participate in interactions and interaction protocols. Behavior of an organization is achieved collectively by its constituent agents.

Role – a concept that allows the part played by an agent to be separated logically from the identity of the agent itself. A role describes the external characteristics of an agent in a particular context. A role can be played by agents or organizations, provide services, perform tasks, achieve goals, use resources, be a part of an organization, and participate in interactions and interaction protocols.

Remark: agent, organization and role are commonly called *autonomous entities*.

Resource – a concept used to represent non-autonomous entities such as databases or external programs. A resource can be used by autonomous entities.

Task – a unit of activity with a single prime performer. Composite tasks can be expressed in terms of causally linked sub-tasks. A task can be performed by an autonomous entity and is causally connected to other tasks or goals.

Interaction – an act of exchanging messages among participants in order to achieve some purpose.

Interaction Protocol – defines a pattern of message exchange associated with an interaction.

Goal – an intention of an autonomous entity to achieve some desired state. Goals are "wished" by autonomous entities, can be decomposed into sub-goals, and can imply execution of tasks.

Information Entity – an object encapsulating a chunk of information.

Message – an object communicated between agents. Transmission of a message takes finite time and requires an action to be performed by the sender and also the receiver. The attributes of a message specify the sender, receiver, a speech act (categorizing the message in terms of the intent of the sender) and the content (an information entity).

The notation of aforementioned modeling elements is depicted in Figure 1.

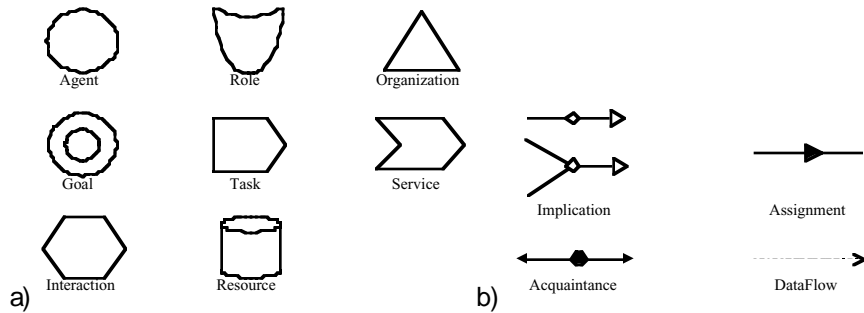


Figure 1: Notation of a) concept symbols, b) relations

MESSAGE defines a number of views (or perspectives) that emphasize different aspects of the full model. Each view focuses on a limited but consistent aspect, but together they provide a comprehensive view of the whole system. The following sections describe particular views.

2.1 Organization View

This view shows concrete entities (agents, organizations, roles, and resources) in the system and its environment, and coarse-grained relationships between them. Figure 2 provides examples of two different organization diagrams.

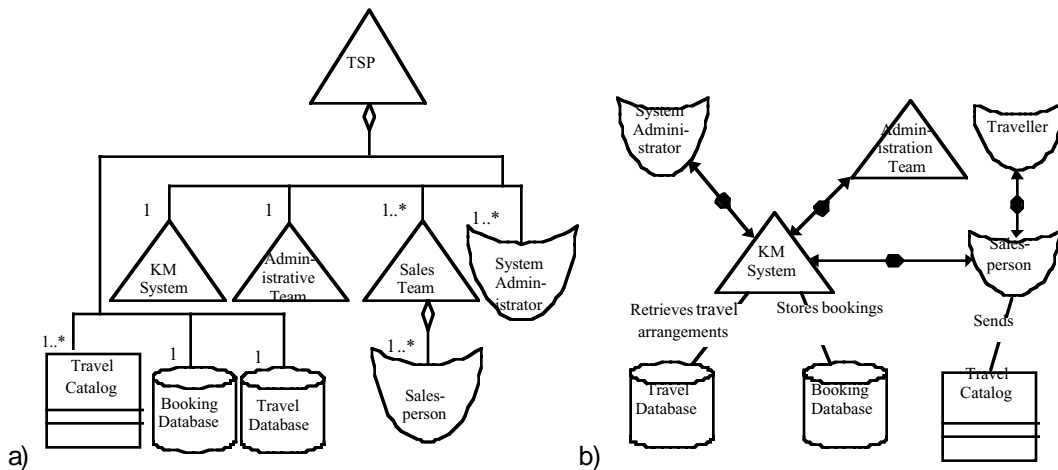


Figure 2: Examples of organization diagrams: a) structural relationships, b) acquaintance relationships

2.2 Goal/Task View

This view shows goals, tasks, and the dependencies among them. Goals and tasks can be linked by logical dependencies to form graphs that show e.g. that achieving a set of sub-goals implies that a higher level goal is achieved, and how tasks can be performed to achieve goals. Figure 3 shows examples of goal and task diagrams.

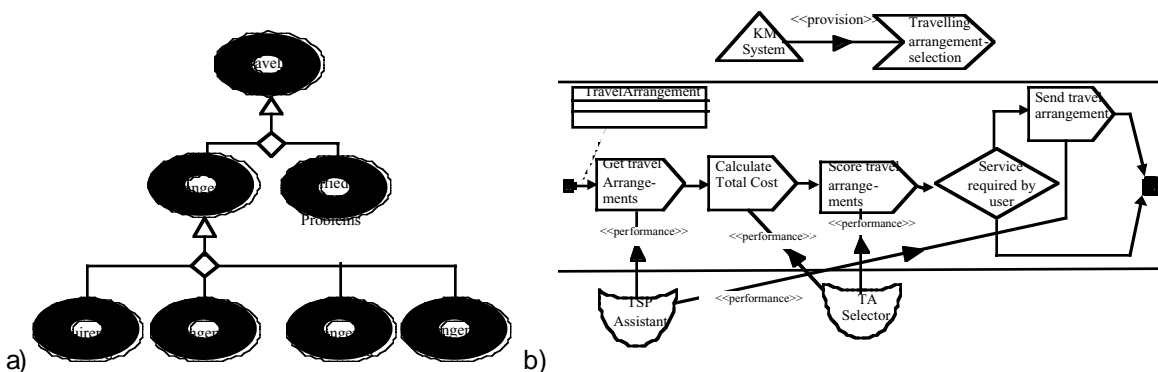


Figure 3: Example of a) goal implication diagram, b) workflow diagram

2.3 Agent/Role View

This view focuses on the individual agents and roles. For each agent/role it uses schemata supported by diagrams to its characteristics such as what goals it is responsible for, what events it needs to sense, what resources it controls, what tasks it knows how to perform, 'behavior rules', etc. Figure 4 shows examples of agent/role diagrams.

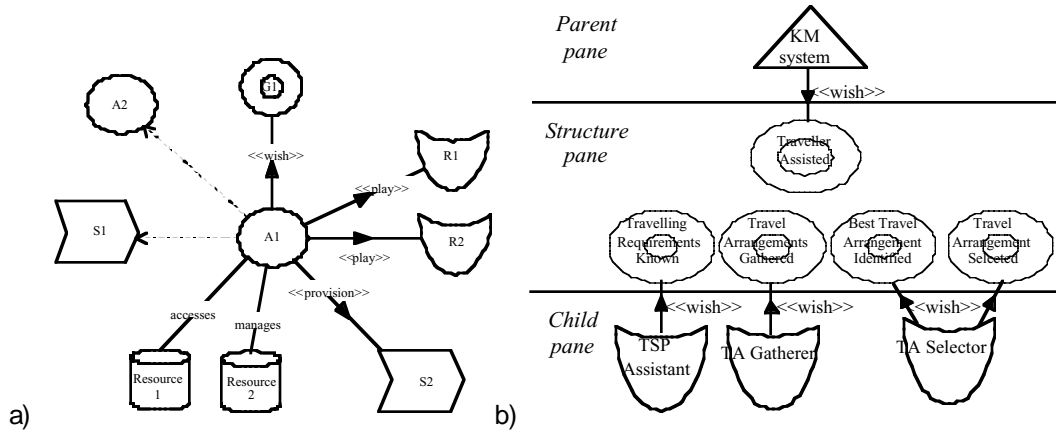


Figure 4: Example of a) agent diagram, b) delegation structure diagram

2.4 Interaction View

This view shows interactions, bounding of interaction participant roles into concrete agents/roles, the relevant information supplied/achieved by each participant, the events that trigger the interaction, and other relevant effects of the interaction (e.g. an agent becoming responsible for a new goal). Figure 5 shows an example of interaction diagram.

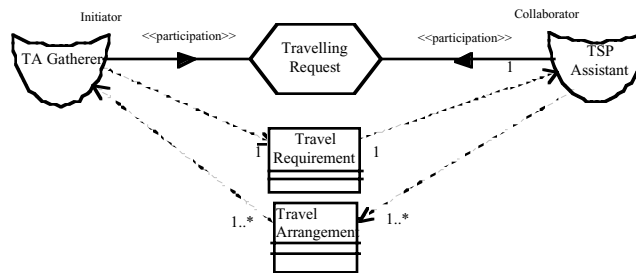


Figure 5: Example of interaction diagram

2.5 Domain View

This view shows the domain specific concepts and relations that are relevant for the system under development. MESSAGE uses UML class diagrams for this purpose.

3 Unification Considerations

Even if the MESSAGE modeling language uses UML metamodel as the basis, unfortunately it does not define UML profile. However, if accepted loosing of certain notational features, UML profile for MESSAGE modeling language could be defined relatively easily.

MESSAGE modeling language represents one of the best today's agent-oriented modeling languages. It is applicable in a number of domains and MAS architectures, it complexly covers all crucial aspects of MAS applications, its modeling constructs are defined at appropriate abstraction level, and finally, its notation and metamodel are described properly.

Recommendation: To use the MESSAGE modeling language, its metamodel and notation, as one of important sources for development of FIPA AUML.

4 References

- [Mes99] MESSAGE web site
<http://www.eurescom.de/public/projects/P900-series/p907/>
- [Mes01] MESSAGE metamodel web site
<http://www.eurescom.de/~public-webospace/P900-series/P907/MetaModel/index.htm>