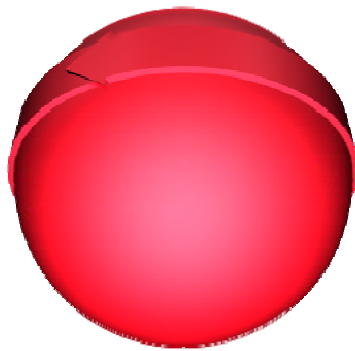


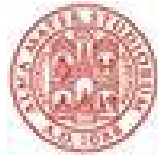


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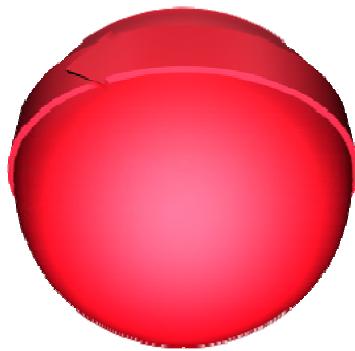


Societies in Open Distributed Agent spaces



ALMA MATER STUDIORUM
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SODA



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Contents

1	Introduction	2
1.1	The Meta-model	2
	Bibliography	6

1

Introduction

SODA (Societies in Open and Distributed Agent spaces) [4, 2, 1, 3] is an agent-oriented methodology for the analysis and design of agent-based systems, which adopts the Agents & Artifacts (A&A) meta-model [5], and introduces a *layering principle* as an effective tool for scaling with the system complexity, applied throughout the analysis and design process. Since its first version [4], **SODA** is not concerned with *intra-agent* issues: designing a multi-agent system with **SODA** leads to defining agents in terms of their required observable behaviour and their role in the multi-agent system. Then, whichever methodology one may choose to define the agent structure and inner functionality, it could be easily used in conjunction with **SODA**. **SODA** concentrated on *inter-agent* issues, like the engineering of societies and environment for multi-agent systems.

SODA is organised in two phases, each structured in two sub-phases called steps: the *Analysis phase*, which includes the Requirements Analysis and the Analysis steps, and the *Design phase*, including the Architectural Design and the Detailed Design steps. In this way the requirements analysis and the architectural design are now part of the **SODA** process and they do not require the ad hoc approach as in the first **SODA** definition. An overview of the methodology structure is shown in Figure 1.1: each step is practically described in terms of a set of relational tables, listed in the figure.

1.1 The Meta-model

The meta-model that represents the abstract entities adopted by **SODA** is depicted in Figure 1.2.

Requirements Analysis. Several abstract entities are introduced for requirement modelling (see Figure 1.2 “requirements analysis” part): in particular, *requirement* and *actor* are used for modelling the customers’ requirements and the requirement sources, respectively, while the *external-*

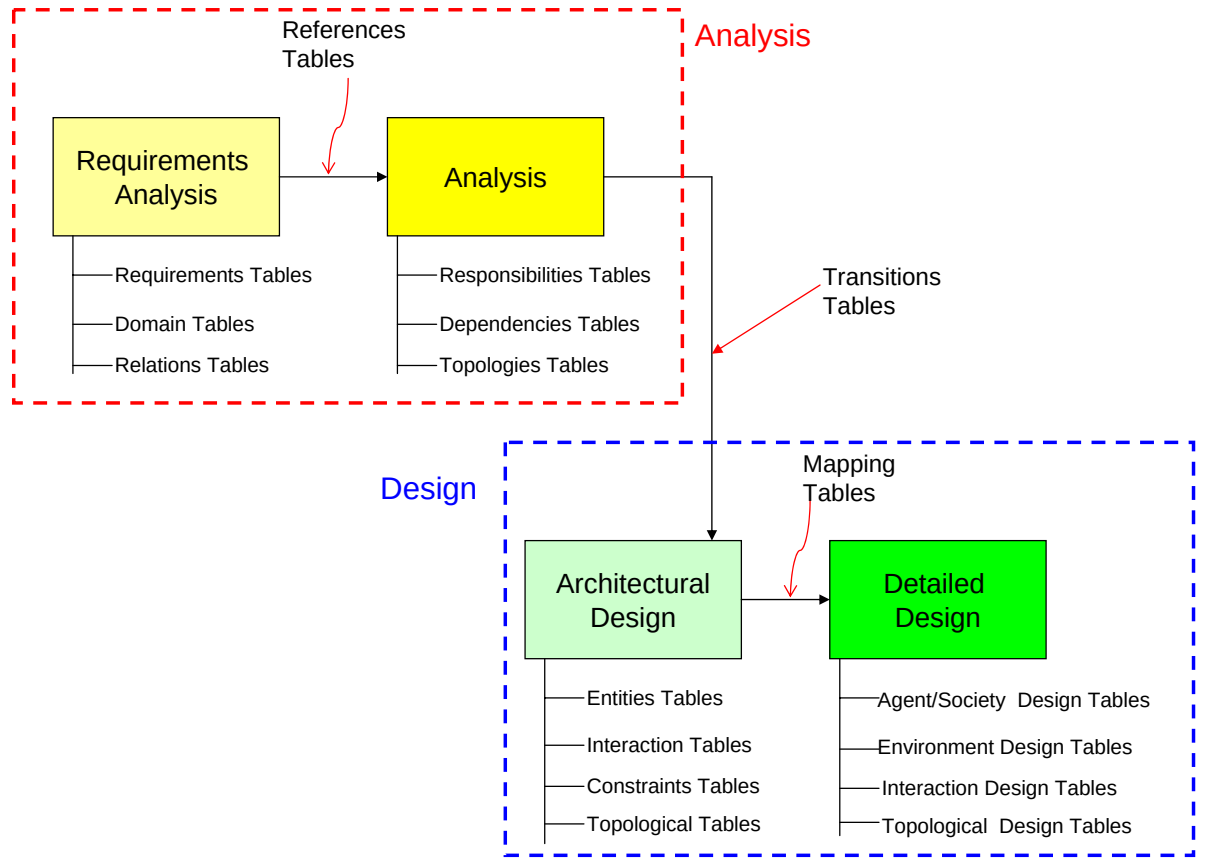


Figure 1.1: An overview of the **SODA** process

environment notion is used as a container of the *legacy-systems* that represent the legacy resources of the environment. The relationships between requirements and legacy systems are then modelled in terms of suitable *relation* entities.

Analysis. The Analysis step expresses the abstract requirement representation in terms of more concrete entities such as *tasks* and *functions* (see Figure 1.2, “analysis” part). Tasks are activities requiring one or more competences, while functions are reactive activities aimed at supporting tasks. The relations highlighted in the previous step are now the starting point for the definition of *dependencies* (interactions, constraints, etc.) among the abstract entities. The structure of the environment is also modelled in terms of *topologies*, i.e. topological constraints over the environment.

Topologies are often derived from functions, but can also constrain / affect task achievement.

Architectural Design. The main goal of this stage is to assign responsibilities of achieving tasks to *roles*, and responsibilities of providing functions to *resources* (see Figure 1.2, “architectural design” part). To this end, roles should be able to perform *actions*, and resources should be able to execute *operations* providing one or more functions. The dependencies identified in the previous phase become here *interactions*, i.e. “rules” enabling and bounding the entities’ behaviour. Finally, the topology constraints lead to the definition of *workspaces*, i.e. conceptual places structuring the environment.

Detailed Design. Detailed Design is expressed in terms of *agents*, agent *societies*, *artifacts* and *aggregates* (see Figure 1.2 “detailed design” part). Agents are intended here as autonomous entities able to play several roles, and the resources identified in the previous step are now mapped onto suitable artifacts. In the meta-model the artifact is reported specifying its “type” derived from the following taxonomy [6]:

- *Individual artifact* handles the interaction of a single agent within a MAS, and essentially works as a mediator between the agent and the MAS itself. Since they can be used to shape of admissible interactions of individual agents in MAS, individual artifacts play an essential role in engineering both organisational and security concerns in MAS.
- *Environmental artifact* brings an external resource within a MAS, by mediating agent actions and perceptions over resources. As such, environmental artifacts play an essential role in enabling, disciplining and governing the interaction between agents and MAS environment.
- *Social artifact* rules social interactions within a MAS—even though indirectly, since it technically mediates interactions between individual, environmental, and possibly other social artifacts. Social artifacts in **SODA** play the role of the coordination artifacts that embody the rules around which societies of agents can be built.

In **SODA** a society can be seen as a group of interacting agents and artifacts when its overall behaviour is essentially an autonomous, proactive one; it can be seen an aggregate when its overall behaviour is essentially a functional, reactive one.

The *workspaces* defined in the Architectural Design step take now the form of an open set of artifacts and agents—that is, artifacts can be dynamically added to or removed from workspaces, and agents can dynamically enter (join) or exit workspaces.

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