

6.1 The “Identify and document the interaction protocols” fragment

Consider the Gaia process represented in Fig. 6-1. and particularly the Analysis phase.

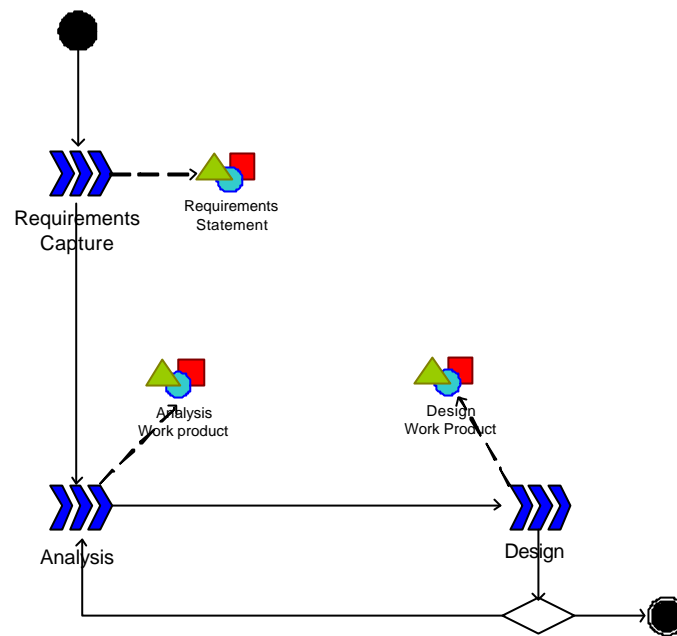


Figure 6-1. Gaia complete process

Within this phase we perform the activities specified in Fig. 6-2. In this context we can identify our fragment (red oval).

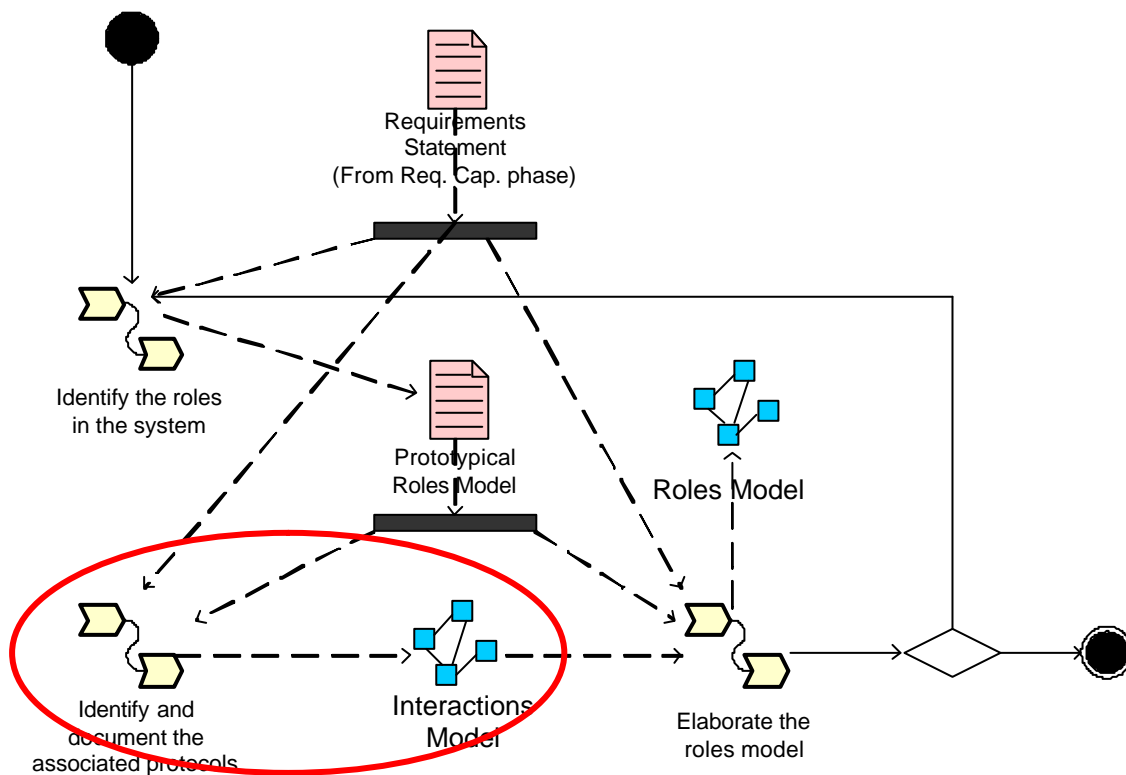


Figure 6-2. Gaia Analysis phase

Consider the work definition “Identify and document the associated protocols” and the consequent outcome (UML model “Interactions Model”). This is a fragment whose aim is to identify and document the patterns of interaction that occur in the system between the various *roles*.

The process that is to be performed in order to obtain the result is represented in Fig. 6-3 as a SPEM activity diagram.

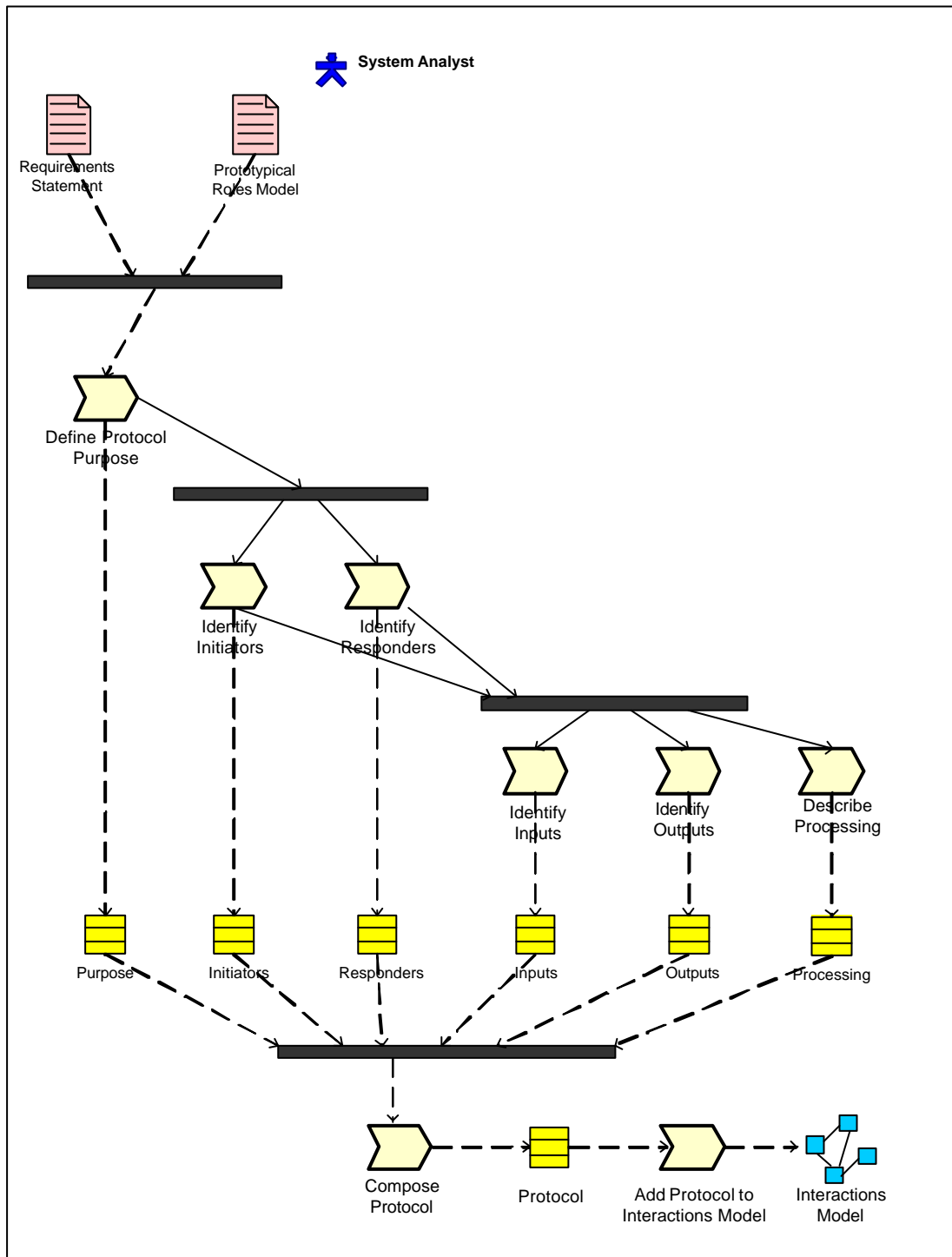


Figure 6-3. The Identify and Document the Interaction Protocols Fragment - Procedural aspects

6.1.1 Notation

The “Interactions Model” consists of a set of protocol definitions, one for each type of inter-role interaction. According to the notation presented in [1] a protocol can be defined using the diagram showed in Fig. 6-4 where:

- initiator indicates the *role(s)* responsible for starting the interaction;
- responder indicates the *role(s)* with which the initiator interacts;
- inputs detailed the information used by the role initiator while enacting the protocol;
- outputs detailed the information supplied by/to the protocol responder during the course of the interaction;
- processing describes any processing the protocol initiator performs during the course of the interaction.

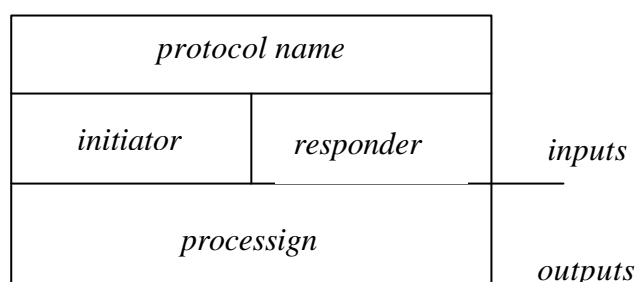


Figure 6-4. The Protocol Definition diagram

As an illustration consider the FILL protocol presented in [1] and showed in Fig. 6-5. This states that the protocol FILL is initiated by the role COFFEEFILLER and involves the role COFFEEMACHINE. The protocol involves COFFEEFILLER putting coffee in the machine named coffeeMaker, and results in COFFEEMACHINE being informed about the value of *coffeeStock*.

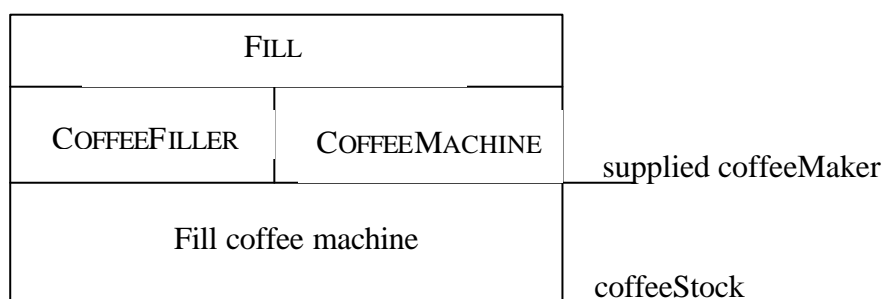



Figure 6-5. TheFill Protocol Definition

6.1.2 Deliverables

This fragment produces a set of protocol definitions expressing using the diagram showed in Fig. 6-4.

The overall output of this fragment is the interactions model (considered as a set of protocol definitions). The following figure illustrates the relationship between this fragment outcome and the MAS meta-model.

(The symbol:  represents an element of the MAS model)

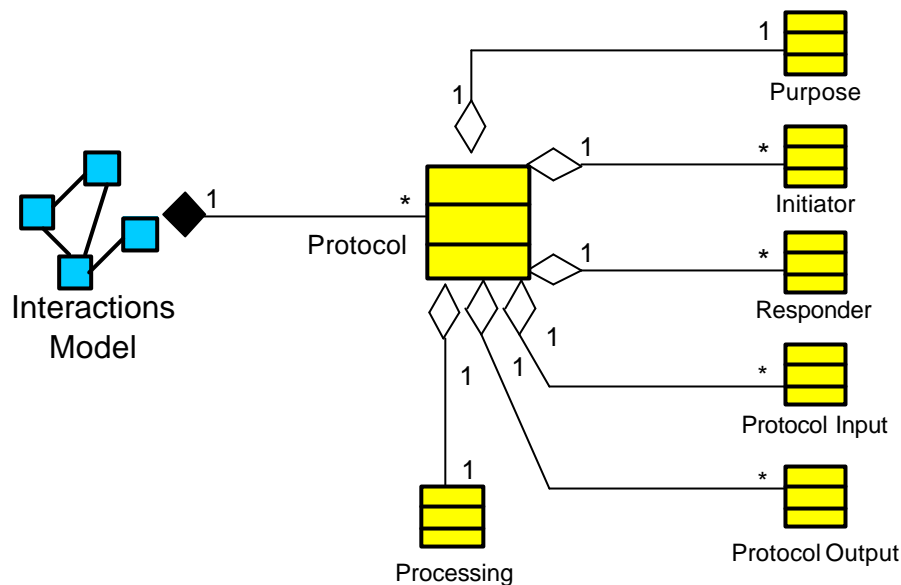


Figure 6-6. Structure of the Identify and document the interaction protocols fragment work-product with respect to the MAS meta-model

6.1.3 Preconditions

Inputs, output and elements to be designed in the fragment are detailed in the following table.

Input	To Be Designed	Output
Requirements Statement	Protocol Definitions	Protocols (MAS Meta-model component)
Prototypical Roles Model		

In order to design protocols we need to capture the system's organisation. An organisation can be seen as a collection of roles, that stand in certain relationships to one another, and that take part in systematic, institutionalised patterns of interactions with other roles. To identify this patterns of interactions (protocol) we need the System Requirements and a Prototypical Roles Model describing the key roles that occur in the system, each with an informal, unelaborated description.

6.1.4 Relationships with the MAS meta-model

The final result is the protocol that is an element of the MAS metamodel (see Fig. 6-6.)

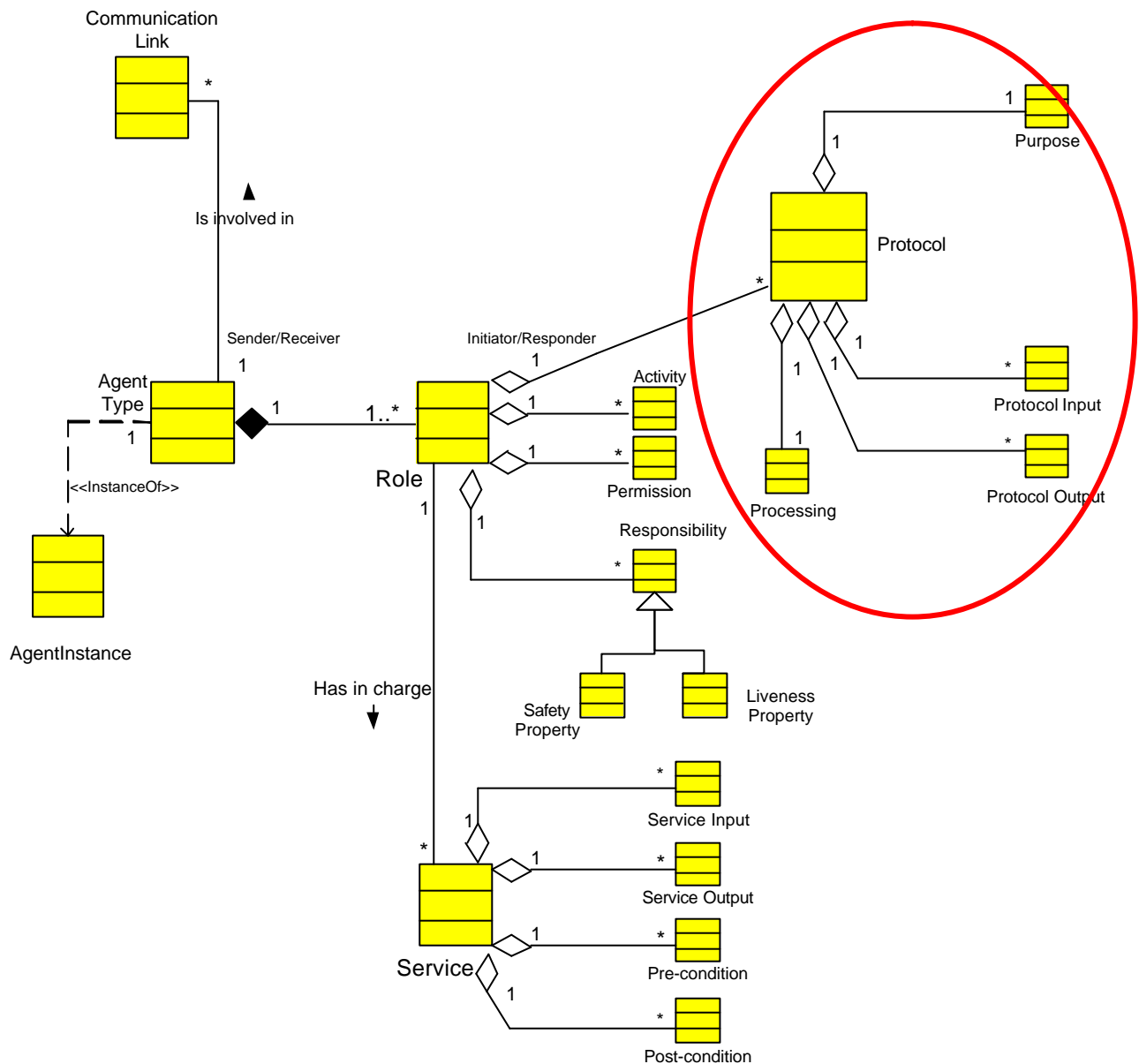


Figure 6-7. The MAS meta-model adopted in Gaia

6.1.5 Guidelines

- 1) The strategy of identification of the protocols is out of the scope of this fragment and it is left to the analyst;
- 2) The implementation details, such as the sequence of execution steps and messages exchanged, are out of the scope of this fragment. They are referred to the following stages.

6.1.6 Glossary

“Identify and document the interaction protocols” fragment uses this list of model element:

Role – A portion of the social behavior of an agent that is characterized by some specificity such as a goal, a set of attributes (for example responsibilities, permissions, activities, and protocols) or providing a functionality/service.

Protocol – patterns of interaction that occur in the system between the various *roles*.

6.1.7 Composition guidelines

The only inputs for this fragment are the system requirements descriptions (text document) and the prototypical roles model (text document). The roles model and interactions model are closely related with one another. This fragment, belonging to the analysis phase of the Gaia methodology, can be reused as part of the analysis phase, probably with predilection for the final stages of the analysis process, or possibly in the early stages of the design process. In any case it can be reused when the organizational structure of the system is defined.

6.1.8 Aspects of fragment

The aim of this fragment is mainly to identify and describe the interactions required to accomplish the roles. In it more attention is paid to the nature and purpose of the interaction than to the implementation details. Interactions designed with this fragment are supposed to be static. As a matter of fact the organisation structure of the system is considered static, in that inter-agent relationships do not change at run-time.

6.1.9 Relationships with other fragments

This fragment is related with the “identify the roles in the system” fragment and with the fragment devoted to the requirements capture phase (Gaia does not deal with this phase; it considers the requirements statement as an input for the methodology).

6.1.10 Summary

The “Identify and document the associated protocols” fragment aim to identify and document the patterns of interaction that occur in the system between the various *roles*.

It is important to highlight the fact that Gaia encourages a developer to think of building agent-based systems as a process of *organisational design*. As a consequence the objective of the analysis stage and therefore of the present fragment is to develop an understanding of the system and its structure. This understanding is captured in the system's *organisation*. An organisation is viewed as a collection of roles, that stand in certain relationships to one another, and that take part in systematic, institutionalised *patterns of interactions* with other roles.

This fragment can be used in the definition of a customized methodology to formalize the patterns of interactions, involving roles, known at analysis time. It deals with the description of the *interaction model*. This model consists of a set of *protocol definitions*, one for each type of inter-role interaction; where a protocol can be viewed as an institutionalised pattern of interaction. The protocol definition is a simple table detailing the purpose of the protocol, the role initiating the protocol (initiator), the role in charge of responding to it (responder), the input and output information processed in the protocol, as well as a brief textual description of the type of information processing taking place during the execution of this protocol.

7 Glossary

TBD

8 Annexes

References

- [1] M. Wooldrige, N. R. Jennings and D. Kinny, The Gaia Methodology for Agent-Oriented Analysis and Design, Autonomous Agents and Multi-Agent Systems, volume 3, pp 285-312, Kluwer Academic Publishers, The Netherlands, 2000.
- [2] D. Coleman, P. Arnold, S. Bodoff, C. Dollin, H. Gilchrist, F. Hayes, and P. Jeremaes, Object-Oriented Development: The fusion Method. Prentice Hall International: Hemel Hempstead, England, 1994.
- [3] M. Cossentino, G. Hopmans, J. Odell. FIPA Standardization Activities in the Software Engineering Area.