

# Goal-oriented Requirements Discovery Sub-process

Self-Adaptive Systems (SAS) can adapt their own behavior in response to context information or changes in the environment and also in response to their own behavior. The interest in requirements engineering for SAS has grown in recent years, but despite this, some works involving requirements specification of these systems do not guide requirements elicitation. Goal-oriented requirements engineering (GORE) modeling languages are widely used to specify requirements for SAS. There are GORE modeling languages specifically proposed for the SAS domain and each of them presents a fixed and small set of concepts. Ontologies can be used to overcome the limitation of concepts, since they can help in the representation of concepts within a domain, as well as in the communication and specification of requirements. The purpose of this thesis is to provide a richer set of SAS concepts to guide the elicitation and specification of requirements for such systems. An ontology for SAS is proposed, as well as a process to guide the use of the ontology for eliciting and specifying requirements for SAS. The unique core ontology for requirements for SAS in literature does not cover all main concepts that SAS involves, like the modeling dimensions and a feedback loop.

The sub-process requirements discovery has five sequence activities to discover the goal-oriented requirements of a self-adaptive systems. We introduce the sub-process as a guidance for elicitation for SAS requirements. There is no goal-oriented requirements elicitation guide for SAS on literature (to the best of our knowledge). The specification approaches proposed to SAS do not explicit how to elicit the goal-oriented requirements, they just allow the specification of SAS on a predefined group of characteristics, without making it clear how the characteristics were found. It is not our purpose to discover goal-oriented requirements for SAS in an automatic way. We intend to guide the requirements engineer on the goal-oriented requirements discovery activity on this kind of system, facilitating the activities on requirements elicitation for SAS phase, rendering them on practical and organized activities. For this, we propose a guide that can be followed through some activities. The sub-process presents five activities to be followed and performed. These activities present guidelines to requirements engineer. Each sub-process activity presents:

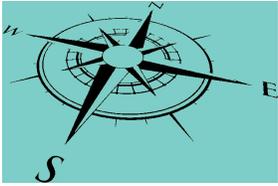
- a name;
- an objective;
- a description;
- expected results;
- a set of questions (in order to facilitate the performing of the activity);
- concepts and competence questions of Onto4SASGORE ontology (that the activity was based on).

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### Vision

Self-Adaptive Systems (SAS)

### Mission

To provide a richer set of SAS concepts to guide the elicitation and specification of requirements for such systems.

## Activity 1. Goals

*Find the goals of the system.*

Name: Define the goals of the system. Objective: With this activity, we aim to find the goals of the system. Description: The engineer should answer a set of questions to the system description based on some concepts of Onto4SASGORE and some competence questions by using the knowledge offered by information present in Table 16, in order to discovery all goals of the system. Expected results: In the end of this activity, the requirements engineer will obtain the goals of the system. Questions:

### 1.1. Main Goal

*Determine the main goal.*

1. What is the main goal of the system?

### 1.2. Secondary Goals

*Determine the secondary goals.*

2. What are the secondary goals of the system?

### 1.3. Characteristics

*Determine the characteristics of each goal.*

3. What are the characteristics of each goal?

### 1.4. Functional Goals

*Determine the functional goals.*

4. What are the functional goals of the system?

### 1.5. Non-Functional Goals

*Determine the non-functional goals.*

5. What are the non-functional goals of the system?

### 1.6. Constraints

*Identify the constraints.*

6. What are the constraints of the system?

## Activity 2. Characteristics

*Find the sensors and effectors of the system.*

Name: Identify the physical characteristics of the system. Objective: In this activity, we intend to find the sensors and effectors of the system. Description: Some systems may have a software or service actuating as a sensor or effector, not necessarily a physical component. Therefore, this activity involves mechanism or resource concepts from the ontology. The requirements engineer should answer the set of questions based on the system description and according to the Onto4SASGORE concepts. Expected results: The identification of the sensor(s) and effector(s) of the system. Questions:

### 2.1. Sensors

*Identify the sensor.*

1. What is the sensor of the system?

### 2.2. Effectors

*Identify the effector.*

2. What is the effector of the system?

### 2.3. Resources

*Identify the resources used.*

3. What are the resources used by system?

### Activity 3. Context & Environment

*Find the context to be considered by the system and the characteristics from the environment where the system is operating.*

Name: Identify the context and environment characteristics of the system. Objective: In this activity, we can find the context to be considered by the system and the characteristics from the environment where the system is operating. Description: With the Onto4SASGORE ontology and the description of the system, the requirements engineer will answer the set of questions of this activity. Expected results: In the end of this activity, the requirements engineer will have the context and environmental information of the system. Questions:

#### 3.1. Contexts

*Identify the contexts.*

1. What are the contexts considered by the system?

#### 3.2. Users

*Identify the users.*

2. What are the users of the system?

#### 3.3. Environment

*Define the environment.*

3. What is the environment where the system is operating?

## Activity 4. Adaptation & Change

*Find all goal-oriented requirements related to adaptation and change of the system.*

Name: Define the goal-oriented requirements related to adaptation and change of the system. Objective: In this activity, we intend to find all goal-oriented requirements related to adaptation and change of the system. Description: To accomplish the objective, the requirements engineer will answer the questions of this activity based on the system description and the Onto4SAS ontology. This activity also involves goal, mechanism and effect concepts. Expected results: After performing this activity, the requirements engineer will have the information about the adaptation of the system. Questions:

### 4.1. Actions

*Identify the actions.*

1. What are the actions of the system?

### 4.2. Effects

*Identify the effects.*

2. What are the effects by action?

### 4.3. Changes

*Identify the changes.*

3. What are the changes of the system?

### 4.4. Causes

*Identify the cause.*

4. What is the cause of the change?

### 4.5. Mechanisms

*Identify the mechanisms of change.*

5. What is the mechanism used to perform a change?

## Activity 5. Interfaces

*List the goal-oriented requirements related to interface of the system.*

Name: Identify the interface characteristics of the system. Objective: In this activity, we intend to list the goal-oriented requirements related to interface of the system. The objective of this activity is identifying to whom or to what the system communicates or interacts, as well as the communication interface to realize it. Description: The requirements engineering will identify all the actors of the system based on the system description and guided by the Onto4SASGORE. He or she will answer the questions for this activity using the Onto4SASGORE concepts and competence questions ... Expected results: Find the actors of the system. Questions:

### 5.1. Actors

*Identify the actors.*

1. Who are the actors of the system?

### 5.2. Inputs

*Identify the inputs for each action.*

2. What is the input of each action of the system?

### 5.3. Outputs

*Identify the outputs of each action.*

3. What is the output of each action of the system?

## Administrative Information

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