A Case Study in Stakeholder-oriented Goal-modeling Framework

Jipeng Wu Eryu Ding Bin Luo

Software Institute
Nanjing University

ICSESS Presentations, 2014

Outline

Outline

Why We Need SoF

- We applied goal methods in a RE process.
  - Goal Methods are
    - diverse, but discrete and fragmental
    - rely on a certain context
  - Goal methods includes: goal modeling, goal specification, goal analysis(formal or informal, validation, verification, elaboration, conflict management)
  - We do need these methods, they are the core of goal-based RE, but they are not enough to compose a complete RE process.
  - RE process, more precisely speaking, the early phase of RE process is our research target.
  - "It is unwise to apply goal-based requirements methods in isolation". [Potts, 1997]
  - RE process
    - consistent and monolithic
    - not reply on a certain context. Because it is context itself.

Why We Need SoF

- To guide a RE process, we presented a possible solution ——SoF(Stakeholder-oriented Goal Modeling Framework).
- On this abstraction level, the most important RE concerns are:
  - Goal Methods Selection–>is about How to integrate proper goal methods.
  - Goal Indentification–>How to identify initial goals.
  - Goal Validation–>is about How to ensure that a correct goal reasoning result accords with true requirements of stakeholders.

Features of SoF

- Initial goals acquition couples goals and scenarios together
  1. to convene scenario-based interviews with stakeholders
  2. a structured scenario description text in nature languge to organize the interview results
- Goal modeling is the basis of elaboration reasoning and stakeholder-involved validation. It combines KAOS goal model with RWS annotated goal tree model together.
- Less important details
  1. goal specification
  2. design of validation interviews

Outline

KAOS

- KAOS [van Lamsweerde, 1995]
  1. Although KAOS is a complete RE approach, we are concerned only with its goal model.
  2. KAOS goal model defines some meta-concepts—goal, action, agent, entity and event, which can be visualized as nodes.
  3. The edges between nodes capture the semantic links between such abstractions.
     1. Two basic link types——AND/OR.
     2. Extended link types: Contributes(+), ContributesStrongly(++), Conflicts(-), and ConflictsStrongly(–).

RWS

- Real World Scenes [Haumer, 1998] , a scenario-based approach
  1. Current system should be captured in the form of rich media(e.g., taking photos, recording videos). The observation results are called Real World Scene.
  2. The observation results should be linked to goals, in order to elaborate and validate goals in the follow-up work.
  3. RWS annotated the goal model with views of stakeholders(1.agree, 2.not agree, 3.add more goals and 4.no position), which facilitates review and validation and finally conforms the goal model to the real world scene.

Outline

SoF Elaboration Activity

1. SoF combines requirements acquition, requirements elaboration reasoning and requirements validation as one atomic activity, which is called *SoF Elaboration Activity*.
2. Each successful *SoF Elaboration Activity* includes the following phases:
    1. interview with stakeholders, updating *"Scenario Description"*
    2. elaborating goal models
    3. validation interview
3. Before all the steps of the *SoF Elaboration Activity* of one requirement have been finished, it is not allowed that the *SoF Elaboration Activity* of another requirement is initiated.
4. SoF introduces a mechanism against requirements change. It allows stakeholders to send change requests at any time in the SoF process, which is the only legal way to interrupt SoF Elaboration Activities.

Activity Diagram of SoF Process

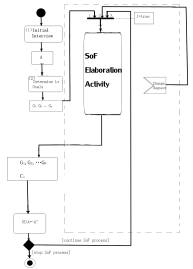

Figure : Activity Diagram of SoF Process

Detailed Activity Diagram of SoF Process

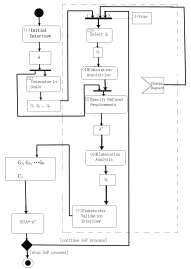

Figure : Activity Diagram of SoF Process

SoF adopts a traditional way, conducting a interview, to acquire requirements. It is insufficient to rely only on stakeholders' knowledge and judgment. Thus it is necessary to find a way to specify the description of scenarios of future system from stakeholders and help stakeholders to obtain a consensus.

Detailed Activity Diagram of SoF Process

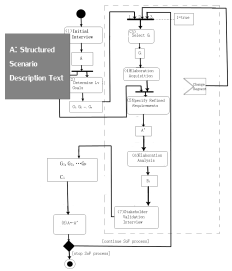

Figure : Activity Diagram of SoF Process

The first initial interview generates a brief structured specification, describing high-level goals in the form of scenarios. This specification is updated after requirements acquisition phase of each *SoF Elaboration Activity*. Each update is a basis of subsequent goal refinement and goal validation.

Detailed Activity Diagram of SoF Process

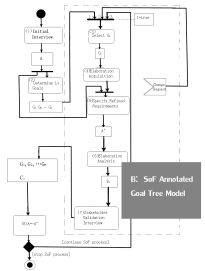

Figure : Activity Diagram of SoF Process

1. The goal model adopted by SoF is named after *SoF Annotated Goal Tree Model*. It is based on KAOS and extended by introducing annotations for stakeholder evaluation.
2. Because SoF Elaboration Activity is atomic, SoF Annotated Goal Tree Model and Structured Scenario Description reaches the same level of completeness and relevance, which is the precondition of Elaboration Reasoning and Validation.
3. In addition, only the goals that have passed stakeholder evaluation are allowed to be a basis of elaboration, the atomicity of SoF Elaboration Activity also ensures the quality of elaborations.

Outline

Why is a Scenario Description Needed?

- A summary of stakeholder interview. It records stakeholders' expectations of the future system.
- A readable document for stakeholders. Scenarios are used to organize complex requirements.
- A basis of subsequent goal refinement and goal validation.

How to Write and Maintain a Scenario Description?

- There are various and unlimited ways to write a scenario description.
  1. Formal or Informal
  2. In Nature Language or Algebraic Language.
  3. Flat text or specific data structure.

  The grammar and structure of such structured description can be defined by requirements developers. The main purpose is to organize readable documents from requirements fragments in accordance with their scenarios for the convenience of modification of subsequent work and requirements evaluation.

Initial Interviews Related Work

1. Questions designed by RE developers. The initial interview poses questions about the background, problem domain, workflow of all possible scenarios of the future system.
2. Doucumentation Requirements developers are responsible for combining information fragments obtained from the interview together to generate a structured specification.
3. Maintainance In the subsequent *SoF Elaboration Activities*, more details will be added in the structured specification of scenarios.

Example of a Possible Implementation of Scenario Description


ScenName: ProjectManagement
Concerns: Manager of Technology Department as AB, Project Manager as AI.
ScenDescription:
(Event 1) → EventName: Creating a new Project.
→ TriggerEvent: The company wins a bid.
→ Action: (1) AB fills in the properties of the project.
(2) AB confirms to save the new project data.
(Event 2) → EventName: Selecting Development Team.
→ TriggerEvent: Event 1
→ Action: (1) Before making a choice, AB shallad look through information of developers to make sure that they are properly-qualified.
(2) AB selects project manager and developers from a list provided by the future system, which creates a new team.
(3) AB confirms to save the data of a team responsible for a project.
(Event 3) → EventName: Editing Project State
→ TriggerEvent: A periodic timeout event
→ Action: (1) AI Edits the progress and other information of his current project.
(2) AI Confirms to save the new state of project.
(Event 4) → EventName: Querying Project State
→ TriggerEvent: AB wanna to know about current progress of a common project.
→ Action: (1) AB selects a project.
(2) AB looks over the project state information presented by the future system.

Figure : Structured Scenario Description

This description specifies possible events, trigger events of these events and concrete actions of stakeholders in these events in nature languge. It is a specification of a scenario which have passed one *SoF Elaboration Activity* and have been enriched with some details.

Example of a Possible Implementation of Scenario Description

1. In this example, stakeholders describe the scenario: "how a technical manager manage projects."
2. This scenario includes four events:
   1. *create a project*
   2. *select development team*
   3. *edit project info*
   4. *and query project progress*

   details of these events are specified in the form of triggering events and action description.
3. Informal but Informative,
   1. It used in goal validation interviews because its readability.
   2. Goal elaboration should not directly use this informal description, but the information provided by it helps the reasoning of *SoF Annotated Goal Tree Model*.
   3. For example, they can decompose the high-level goal, *improve efficiency of project management*, to several child goals supporting this goal since they have the knowledge of what contributes to the efficiency of project management.

Outline

Design of Annotated Goal Tree Model

1. Form:
   1. KAOS Goal Model (top-down decomposed)
   2. RWS Annotation (for stakeholder validation)
2. A goal reasoning tool:
   1. Goal Refinement Reasoning
   2. Goal Confict Management
   3. Requirements Evaluation
3. A documentation of goals
4. A communication material in validation interviews

1. The annotations can be used to organize more structured evaluation interviews and actively engage stakeholders in such interviews.
2. After high-level goals determined in an initial interview, the subsequent activities, such as goal elicitation, conflict resolution and requirements evaluation, will be executed based on *SoF Annotated Goal Tree Model*.

2 types of Goal Tree Models

1. Pass the Validation Interview: a basis of the next *SoF Elaboration Activity*
2. Not Pass the Interview: a driven model for communication with stakeholders and control of requirements changes.
3. Goal validation phase of *SoF Elaboration Activity* can be further decomposed according to the design of annotations of *SoF Annotated Goal Tree Model*.
    1. relevance validation
    2. success validation
4. –>We designed a comparatively simpler annotation in this case because there are no complex stakeholder constituents or serious interest conflicts. The annotation of *SoF Annotated Goal Tree Model* can be modified if more complex evaluation process design is required.

SoF Annotated Goal Tree Model adds the following two types of marks:

- The mark "relevance" is used to record whether a goal has passed relevance validation.
- The evaluation is based on stakeholders perspectives and latest structured specification based on scenarios.
- If the goal is irrelevant to the future system, it is marked with No, otherwise it is marked with Yes.
- Goals cannot enter the next step of success validation until it passes the relevance validation.
- The mark "agreed" is used to record whether a relevant goal has passed success validation.
- The evaluation is based on stakeholders perspectives on the practical significance, constraints and cost of the evaluated goal.
- If a it does not agree with stakeholders' expectations, the goal should be still denied.

Goal Elaboration–>Image!!

Figure : SoF Annotated Goal Tree(Validated,Level 1 Elaboration)

1. In Fig.3 we presents a high-level goal G_1—"To make technical department manager make better decisions when build project teams".
2. By asking Why/How questions we get child goals supporting G_1: $G_{1.1}$ and $G_{1.2}$.
    1. $G_{1.1}$ is "To provide better support of information on developers and project managers for techinical department manager".
    2. $G_{1.2}$ is "To provide a mechanism allowing developers to reply with feedback to the manager's decisions".
3. These two goals were validated as child goals supporting their parent goal in different aspects, and thus successfully passed relevance validation. Stakeholders agreed that these two goals are consistent with their expectations. The goal tree was allowed to be further refined after each goal had passed both validations.

Further Elaboration

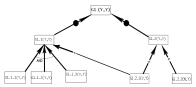

Figure : SoF Annotated Goal Tree(Validated,Level 2 Elaboration)

In this Fig, we get a complete *SoF Annotated Goal Tree Model* that has been further elaborated. To emphasize the grammar, we omit detailed description of each goal in Fig.4 and represent each goal only with its indexed symbol.

Further Elaboration

- Here lists the detailed description of each goal that is not mentioned above.
  1. $G_{1.1.1}$ is "Project managers input information of developers".
  2. $G_{1.1.2}$ is "To access information of developers".
  3. $G_{1.1.3}$ is "Project managers should update information of developers periodically".
  4. $G_{1.1.1}$ $G_{1.1.2}$ $G_{1.1.3}$ work together to support their parent goal.

  If any of them fails to pass the evaluation, the whole elaboration plan fails.

Further Elaboration

1. $G_{1.2.1}$ is "To provide an instant messaging platform for technical department managers, project managers and developers".
2. $G_{1.2.2}$ is "To publish decisions made by technical department managers and allow developers and project managers to reply asynchronously".
3. $G_{1.2.1}$ does not conflict any other goal, and facilitates $G_{1.1}$ because the establishment of communication platform contributes positively to technical department managers' knowledge of developers' information. Thus $G_{1.2.1}$ passed both validations.
4. $G_{1.2.2}$, although had passed the relevance validation, however, failed to pass the success validation because stakeholders believe that asynchronous communication is not practical and efficient enough to ensure the timeliness and richness of feedbacks.

Summary

- Against requirements nondeterminism.–>Acquire more complete and relevant requirements in practice of projects with requirements nondeterminism.
- Ensuring the quality of each step of elaboration.–>The atomicity of SoF Elaboration Activity also ensures the quality of elaborations.
- Consistency between goal models and stakeholders' conceptual models.–>Each step of SoF activities is stakeholder-centered, which ensures that stakeholders' description of future system consists with goal models. With such consistency, SoF provides a reasonable context for KAOS Goal reasoning.

- Outlook
  - Difficulty in validating the effectiveness of my proposal.
  - Cost Problem.
    1. The development cost is relatively higher because recursively executing SoF Elaboration Activities results in considerably frequent communication between and among requirements developers and stakeholders
    2. collection and management of raw data from stakeholders
    3. ubiquitous involvement of stakeholders –>We should decide whether a project is adaptive in applying SoF methods at the beginning of each project. Some projects with relatively constant and determinate requirements are not supposed to apply SoF methods.