A Visualization Technique for Agent Based Goal Refinement to Elicit Soft Goals in Goal Oriented Requirements Engineering

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Abstract

- For developing any software, it is essential to extract the requirements/goals from the stakeholders correctly. But this is difficult task as the stakeholders are not fully aware of their requirements/ goals.
- To address this challenge we propose a visualization technique involving maximum participation of stakeholders where the goals are elicited in group sessions iteratively.
- The elicited goals are compiled through a software program called Activity Card Compiler. The methodology is used by a team of student and News reporter, for Goal Elicitation for the development of a Web Based News Application

This Presentation…

- Briefly Review the GORE concepts
- Introduction to SCRUM – the Agile Software Development Method
- Propose an Agile Visualization Technique for Agent Based Goal Refinement to Elicit Soft Goals
- The Agile Visualization Technique - POSTER
- Analysis of the Technique.
- Results and Conclusion.

GORE

- GORE = Goal- Oriented Requirements Engineering
- Axel van Lamsweerde delivered a keynote talk on GORE at RE'04 in Kyoto, Japan
- His talk reviewed the history and key ideas of GORE and described some of the on-going research and industrial experiences of the KAOS project.
- John Mylopoulos delivered a keynote talk on GORE at RE'06 in Minneapolis, USA
- His talk was on two applications of these ideas: one is development method called TROPOS and the second addressed the design of high variability home application software.

GORE concepts

- Requirements are defined in terms of goals.

Dardenne et al focuses on three types of goals:

* Achievement goal,
* Maintenance goal
* Soft goal.

- Regev and Wegman define the underlying principles of GORE from the principles of General System Thinking and Cybernetics.

GORE concepts

- Regev and Wegman submit an overview of goal concept definitions from KAOS, GBRAM and GRL

	KAOS	GBRAM	GRL
Goal	"a nonoperational objective to be achieved by the composite system"	"targets for achievement which provide a framework for the desired system."	"a condition or state of affairs in the world that the stakeholders would like to achieve."
Achievement Goal	a property that "holds in current or some future state"	"objectives of an enterprise or system [..] satisfied when the target condition is attained."	Not used
Maintenance Goal	property that "holds in current and all future states."	"goals which are satisfied while their target condition remains constant or true."	Not used
Softgoal	Not used	Not used	A goal for which "there are no clear-cut criteria for whether the condition is achieved."
Belief	Not used	Not used	"represent design rationale."
Constraint	Not used	place a condition on the achievement of a goal	place a condition, positive or negative, on the achievement of a (hard) goal

Soft Goals

- The soft goals are that which demands for iterative RE process as they are difficult to achieve because the definition itself is unclear.
- For example "higher profits", "higher customer satisfaction" specify qualities a socio-technical system should adhere to. Such qualities do not have any agreed upon definition. Therefore, they are often contradictory.
  Such qualities are usually represented as Soft Goals.
- Initial Goals may be contradictory so the analysis must facilitate active participation of all stakeholder for eliciting maximum requirements/goals.

Soft Goals contd…

A soft goal is defined in Goal Oriented requirement Language as:

"A condition or state of affairs in the world that the actor would like to achieve, but unlike the concept of hard goal, there are no clear cut criteria for whether the condition is achieved and it is up to subjective judgments and interpretation of the developer to judge whether a particular state of affairs in fact achieves sufficiently the stated soft goals."

- Soft Goals can be thought as "fuzzy goals" with no clear cut criteria for satisfaction.

Why the Visualization Technique ?

- GORE research focuses on the development of methods. However the existing goal oriented methods have the following problem:
- No powerful method available involving active participation of stakeholders, which clearly describes the activities for identifying/extracting the soft goal quickly.
- There is room for improvements by understanding the different goals described in the GORE concepts.

SCRUM - the Agile Software Development Method

- Ken Schwaber proposed this method in OOPSLA '96
- He focuses on the need for making the development environment maximum flexible and to have appropriate control
- Complexity = f (development environment variables+ target environment variables)
- As the complexity of the project increases, the greater the needs for controls.
- Many of the development processes are uncontrolled and the success rate of these processes are very poor.

The three SCRUM phases: Pre-Sprint, Sprint and Post-Sprint.

- In pre-Sprint phase the planning is done with currently known backlog.
- In Sprint phase new release functionality is developed with constant respect to the variables of time, quality cost and competition.
- In the post-Sprint phase the activity related to the release of a new version/ software is prepared.

Figure -1

An Agile Visualization Technique for Soft Goals Elicitation

- In pre-Sprint phase the analyst prepares an initial goal list.
- Sprint refers to the activities of developing, wrapping, reviewing and adjustment during the elicitation of Soft Goals.

- In the post-Sprint phase the final Goal list is released for software development.

Pre sprint event

- An initial list of achievement and maintenance goals is prepared by analyst after examining "Objectives of Enterprises", "Corporate Policies", "Corporate Vision", and "Mission Statement"

Pre sprint ----contd.

Pre sprint ----contd.

- Analyst enters Goals and the priority values in the Activity card Compiler
- Prioritized Goal list(B) is generated from the Activity card Compiler

Sprint event

- The activities in the sprint session are: Develop Wrap, Review and Adjust.
- After each sprint session an output is generated from the Activity Card Compiler.

Develop

- Activities involved in elicitation using Agent Based Goal Refinement.
- Stakeholders identify agents responsible for achievement of a goal.
- Goal refinement process decomposes a goal into sub-goals so that fewer agents are responsible for the goal.

Develop- An Example

Wrap

- Removes the associated agents and forms the Activity card.
- Stakeholders connect the decomposed sub-goals to its predecessor goal/goals with a directed arrow.
- Assign Priority values to each goal.

Review

- Each activity card is reviewed by all the stakeholders taking one card at a time.
- Stakeholders presents total no. of sub-goals, name of sub-goals, priority value of sub-goals
- Analyst enters all these data in the activity card compiler.

Adjust

- Stakeholders gets a new list of Goals, accordingly they adjust their activity card.
- Stakeholders updates their own Activity card with the additional Sub-goals which are missing.

The Agile Visualization Technique

Analysis of the Technique

Activity card of Stakeholder-1

Activity card of Stakeholder-3

Activity card of Stakeholder-2

- **Stakeholder-1 elicits 6 sub-goals, stakeholder-2 elicits 5 sub-goals of which only one is common goal with respect to stakeholder-1, stakeholder-3 elicits 6 sub-goals of which five are common goals with respect to stakeholder-1 and 2, but one goal is new /unique. i.e. altogether 11 goals have been elicited form a set of 3 initial goals.**

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Table 1: Compilation of three Activity cards with link to its Predecessor

Predecessor Goals are: A0, A1 and A2 having priorities 1,2, and 3 respectively				
Name of Sub Goals	Stakeholder-1	Stakeholder-2	Stakeholder-3	Link with predecessor
B1	3	Not elicited	Not elicited	A0
B2	4	Not elicited	4	A0, A0
B3	2	Not elicited	1	A0,A1, A0,A1
B4	5	Not elicited	3	A1,A1
B5	1	Not elicited	Not elicited	A1,A2
B6	6	5	5	A0,A2, A0
B7	Not elicited	4	Not elicited	A0
B8	Not elicited	1	Not elicited	A0, A1
B9	Not elicited	3	Not elicited	A1
B10	Not elicited	2	2	A1,A2, A1,A2
B11	Not elicited	Not elicited	6	A2
Total Elicited Sub-Goals=11	6	5	6	

- **The compilation table of all three activity cards of stakeholders (3). Eleven (11) sub-goals are identified from an initial list of three (3). We mark Links of the sub-goal to their parent goal.**

Contd...

Table 2: Compilation of three activity cards and prioritization of elicited sub-goals

Predecessor Goals are: A0, A1 and A2 having priorities 1,2, and 3 respectively					
Name of Sub Goals	**Stakeholder-1**	**Stakeholder-2**	**Stakeholder-3**	**Link with predecessor**	**Priority**
B1	3	6	7	A0	**8**
B2	4	6	4	A0, A0	**3**
B3	2	6	1	A0,A1, A0,A1	**1**
B4	5	6	3	A1,A1	**4**
B5	1	6	7	A1,A2	**5**
B6	6	5	5	A0,A2, A0	**7**
B7	7	4	7	A0	**10**
B8	7	1	7	A0, A1	**6**
B9	7	3	7	A1	**9**
B10	7	2	2	A1,A2, A1,A2	**2**
B11	7	6	6	A2	**11**
Total No. of Elicited Sub-goals=**11**	**6**	**5**	**6**		

- All three activity cards are manually compiled. The sub-goals that are not elicited by a stakeholder is assigned with his/her lowest priority value.
- Sum of all priority values are taken and then priority is set in the ascending order. If sum value for two sub-goals are equal then the sub-goal with more no. of links to its predecessor gets the higher priority.

Activity Card Compiler Output

- Activity Card Compiler output, after Sprint-1(pass-1); The inputs are the data from three Activity Cards (prepared by three stakeholder).
- The output matches with manually compiled table-2 for our example.

Activity Card of All Stakeholder after Sprint-1

- Stakeholder-1 gets five (5) additional goals (about which he did not have any clue) from his peers for the next Sprint.
- Similarly, Stakeholder-2 gets six (6) additional goals from his peers and Stakeholder-3 gets five (5) additional goals from his peers

Results in a Web Based Application

Total No. of Goals elicited from the Pre-sprint session:10

No. of Stakeholder	Sprint Session-1	Sprint Session-2	Sprint Session-3
Stakeholder-1	18	56	86
Stakeholder-2	16	45	89
Stakeholder-3	19	66	90
Stakeholder-4	11	69	87
Stakeholder-5	14	68	96
Stakeholder-6	15	50	95
Stakeholder-7	17	49	86
Stakeholder-8	17	46	88
Stakeholder-9	20	66	90
Stakeholder-10	22	70	98
Total Elicited goals	* 34	* 86	* 104

- The experimental results of the technique involving a group of 10 members.
- Thirty four unique sub-goals are identified after the first sprint; eighty six after the second and hundred and four goals are identified after the third sprint session.

Conclusion

- The Agile Visualization Technique elicits goals from the stakeholders through their active participation in group sessions.
- The resulting goals from Activity Cards are combined together using the Activity Card Compiler. The output is presented back to the stakeholder for adjustment.
- Through this technique each stakeholder is exposed to goals elicited by their peers which promotes creativity and the discovery of further goals.
- By prioritizing the goals, the attention of the stakeholder is systematically brought to the goal which needs most refinement and thereby making the process agile.

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- A comparative analysis of this technique with the previously available GORE techniques is presently taken up.
- Issues concerning to session time is needed to be checked. Although the session time in our experimental application is encouraging in comparison to the traditional techniques that are available.

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