

On the Identification of Goals in Stakeholders Dialogs

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Abstract. Contradictions in requirements are inevitable in early project stages. To resolve these contradictions, it is necessary to know the rationales (goals) that lead to the particular requirements. In early project stages one stakeholder rarely knows the goals of the others. Sometimes the stakeholders cannot explicitly state even their own goals. Thus, the goals have to be elaborated in the process of requirements elicitation and negotiation. This paper shows how the goals can be guessed by systematic analysis of stakeholders dialogs. The guessed goals have to be presented to the stakeholders for validation. Then, when the goals are explicitly stated and validated, it becomes easier to resolve requirements contradictions.

1 Introduction

1.1 Goal-Oriented Requirements Engineering

A *goal* in requirements engineering is “an objective the system under consideration should achieve” [1]. Goals build the basis for requirements elicitation process, as they tend to be more stable than single requirements: For example, the goal “air traffic security should be improved” is less likely to change during the project than the requirement “screening procedure X should be applied from now on.”

In early project stages it is normal that the goals or requirements of different stakeholders contradict to each other. This makes it even more important, to identify the goals as early as possible: A conflict in requirements may result from the peculiarities of the intended solutions, whereas a goal conflict is much more fundamental.

1.2 Case Study: Airport Security Screening

The procedure for goal identification, presented in this paper, is evaluated on a small case study on an airport screening system. The case study is just a two-page document, representing an online stakeholder discussion [2]. This document does not contain any explicitly stated requirements.

There are three stakeholders participating in the discussion: a representative of the Transportation Security Administration, a representative of the Federal Aviation Administration, and a representative of the airport screening and security staff. They all agree on the goal that the air traffic security should be improved, but they see different problems and propose different solutions to the common goal. On the total, they write just 4-5 paragraphs each, which is surely not enough to identify all requirements. However, their goals become apparent even in these short statements.

1.3 Outline

The remainder of the paper is organized as follows: Section 2 presents the goals identified as the result of ad-hoc analysis of the case study document. Section 3 shows how the goal identification can be systematized, and, finally, Section 4 summarizes the whole paper.

2 Goals are not Always Explicit: Ad-Hoc Identification of the Goals in the Case Study

In the ideal world every stakeholder could explicitly state her goals and identify contradictions to other stakeholders' goals. The small case study, treated in this paper, shows that this is not the case in the real world. In the stakeholders dialog the goals are mostly implicit, they manifest themselves in proposals that a stakeholder makes and in objections to the proposals made by others. For example, in the case study the FAA officer opens the discussion with the statement that "We have to ban on airplane passengers taking liquids on board *in order to increase security following the recent foiled United Kingdom terrorist plot.*" In this case the goal is explicitly stated, introduced by the phrase "in order to". The reaction to this statement shows the goal of the airport screening staff, rather indirectly: "Technologies that could help might work well in a lab, but when you use it dozens of times daily screening everything from squeeze cheese to Channel No. 5 you get False Alarms... *so it is not quite ready for deployment!*" The actual goal is the applicability of the screening techniques in day-to-day operation, not the problem of distinguishing squeeze cheese from explosives.

In the case study we can identify the goals by permanently asking the question, why a certain statement was made by a discussion participant. In this way we can identify the following goals of the stakeholders:

- Goals of the Federal Aviation Administration:
 - improvement of security: "We have to ban on airplane passengers taking liquids on board in order to increase security following the recent foiled United Kingdom terrorist plot"
 - effectiveness: "We are trying to federalize checkpoints and to bring in more manpower and technology"
- Goals of the Transportation Security Administration:
 - improvement of security
 - * pro-active thinking: "We have yet to take a significant pro-active step in preventing another attack everything to this point has been reactive"
 - * consistency in regulations: "I think that enforcing consistency in our regulations and especially in their application will be a good thing to do"
- Goals of the airport screening and security staff:
 - applicability of the rules in everyday operation: "Technologies that could help might work well in a lab, . . . , so it is not quite ready for deployment", "It's not easy to move 2 million passengers through U.S. airports daily"
 - cost effectiveness for the airlines: "I mean an economic threat is also a threat"

- consistency in rules: “There are constant changes in screening rules - liquids/no liquids/3-1-1 rule”

These goals are not contradiction-free. By analyzing the document it is possible to identify following contradictions:

- proactive thinking, which is a TSA goal, vs. cost effectiveness, which is an FAA goal. Actually, this is not necessarily a contradiction, but it sounds like a contradiction in the dialog.
- responsibility for the security checks: airlines become responsible, which is an FAA goal, vs. the authority currently performing the checks remains responsible.
- acceptability of false positives: acceptable for FAA, not acceptable for the screening staff

Probably due to the fact that each stakeholder considers his own goals as obvious, no one ever explicitly states them. Instead, each stakeholder presents solutions that seem adequate to him and explains why he thinks the solutions proposed by others are problematic. This observation about indirect goal statements will be used in the next section in order to systematize and potentially automate the identification of goals.

3 Case Study, Systematization of Goal Identification

In the previous section we identified the goals by close inspection of the text. Now we want to systematize the inspection procedure. To systematize the analysis, we apply two observations to every paragraph:

- Phrases like “have to”, “in order to”, or similar, directly show the goal. The negation of such a phrase shows the current state of affairs, that should be improved.
- If the first sentence of the paragraph does not contain any of the above phrases, it states the reason why the previous paragraph is problematic. In this case, the negation of this sentence shows the stakeholder’s goal.

3.1 Evaluation of the rule application

Table 1 shows the results of the application of the above rules to the case study. The application was performed manually by adhering to the rules as strictly as possible. This means that in some cases not the first sentence of the paragraph but the first meaningful one was taken into consideration. For example, statements like “come on”, “well. . .”, “we can deal with it” were ignored, as they do not contribute to the identification of the goals. For this reason Table 1 sometimes lists other than the first sentence of the paragraph.

It is important to emphasize that the negations listed in Table 1 were not constructed by purely syntactical deletion or adjoining of “not” at some position in the sentence. Such syntactical negations had to be generalized. For example, “It’s not easy to move 2 million passengers. . .”, statement from paragraph 4, was negated to “It should be easy to move 2 million passengers. . .” and then generalized to “The screening system has to

	Sentence	State of the art/Goal	Evaluation
1	We have to ban on airplane passengers taking liquids on board in order to increase security following the recent foiled United Kingdom terrorist plot.	State of the art: we do not ban passengers taking liquids, terrorist plot like in the UK is possible. Goals: ban passengers taking liquids, increase security	
2	Technologies that could help might work well in a lab, but when you use it dozens of times daily screening everything from squeeze cheese to Channel No. 5 you get False Alarms ...	Goals: technologies should work not only in the lab, without false alarms	Goal correctly identified
3	Generating false positives helped us stay alive; maybe that wasn't a lion that your ancestor saw, but it was better to be safe than sorry.	No goal identifiable	—
4	It's not easy to move 2 million passengers through U.S. airports daily.	Goal: the screening system has to handle 2 million passengers daily	Goal correctly identified
5	We can deal with it. What if you guys take frequent breaks?	No goal identifiable	—
6	Sounds good though we do take breaks and are getting inspected.	No goal identifiable	—
7	We have yet to take a significant proactive step in preventing another attack everything to this point has been reactive.	State of the art: We do not take proactive steps. Goal: We have yet to take pro-active steps	Goal correctly identified
8	On each dollar that a potential attacker spends on his plot we had to spend \$1000 to protect.	Goal: we should not spend too much on the screening procedure, it should remain affordable	Goal correctly identified
9	We need to think ahead. For instance, nobody needs a metal object to bring down an airliner, not even explosives.	Goal: identify other types of objects to be banned	Goal correctly identified
10	Airlines need to take the lead on aviation security.	Goal: Airlines need to take the lead on aviation security, not FAA.	FAA Goal correctly identified
11	Sir, a lot of airlines are not doing well and are on the Government assistance.	Goal: Airlines should not be responsible for additional cost-intensive tasks.	Goal correctly identified
12	I think that enforcing consistency in our regulations and especially in their application will be a good thing to do.	State of the art: regulations are inconsistent Goal: regulations should be consistent.	Goal correctly identified
13	Ok, we had very productive discussion	No goal identifiable	—

Table 1. Application of the hypothesis to the case study

handle 2 million passengers daily”. In a similar way, “On each dollar that a potential attacker spends on his plot we had to spend \$1000 to protect” was negated to “On each dollar that a potential attacker spends on his plot we should not spend \$1000 to protect” and generalized to “The screening procedure should remain affordable”.

It is easy to see that Table 1 contains all the goals identified by ad-hoc analysis in Section 2. However, it is necessary to bear in mind that the case study was rather small and that both analysis runs, ad-hoc and systematic, were performed by the same person, which makes the results potentially biased. Thus, to properly evaluate the rules for goal identification, a controlled experiment or computer implementation of the procedure is necessary.

3.2 Possible Implementation

To implement the introduced procedure for goal identification, it is necessary to solve two problems:

- It is necessary to define what a meaningful sentence is, in order to analyze the first meaningful sentence of every paragraph.
- Negation is not always possible by simple deletion or adjoining of “not”. Furthermore, negated sentences have to be generalized.

The first problem is relatively simple from the point of view of computational linguistics: We could eliminate sentences without grammatical subject, like “come on” and “well...”, as well as questions, like “What do you suggest?” in the case study document. This would work for most paragraphs of the considered case study.

The second problem, the negation, is much more difficult. To cope with the grammatical negation, we can try to translate every sentence to discourse representation structure (DRS) [3, 4]. DRS can be translated to first-order logic, thus, when performing negation on the DRS level, we would obtain a logical negation. On the DRS level we could negate different pieces of the DRS, which would correspond to the negation of different clauses of the sentence. Then, we would have to present different negations to the user in order that she selects the correct one. In this way we can get, for example, from “On each dollar that a potential attacker spends on his plot we *had to* spend \$1000 to protect” to “On each dollar that a potential attacker spends on his plot we *should not* spend \$1000 to protect”. However, even when we have the grammatical negation, we have to generalize it. For example, in the case study we had to generalize “On each dollar that a potential attacker spends on his plot we *should not* spend \$1000 to protect” to “The screening procedure should remain affordable”. This is impossible without profound knowledge of the world, so-called common sense.

4 Summary

In this paper a method for identification of stakeholders’ goals by analyzing stakeholders’ dialogs was introduced. This method bases on two key assumptions:

- Sentences containing certain keywords directly represent the goal.

- Otherwise, if the sentence is the first meaningful sentence of the paragraph, its negation represents the goal.

This strategy for goal identification is very similar to the strategy proposed by van Lamsweerde [5], consisting of three rules:

- Sentences containing certain keywords directly represent the goal.
- Asking the “why” question for already identified goals helps to identify more abstract goals.
- Asking the “how” question for already identified goals helps to identify more concrete goals.

The second rule used in this paper, the negation rule, can be seen as an application of the why-rule to the dialog: We are just asking the question, why a particular statement was made. One of the reasons to start a new dialog segment is stakeholder’s disagreement with the previous proposal. In this case the negation of the first statement shows the reason for the disagreement, which is some goal of the stakeholder.

Explicit goal identification is important for several reasons. Goals serve to achieve requirements completeness and pertinence, managing requirements conflicts, etc [1]. The presented approach is especially suitable to manage requirements conflicts when negotiating requirements: In the Win-Win negotiation approach [6] requirements conflicts are resolved in such a way that the *goals* of every stakeholder remain satisfied. In the case of goal conflicts such a resolution is impossible. Thus, identification of goals and goal conflicts, as in the presented paper, contributes to the identification of potential problems early in the development process.

References

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