

Report from the Working Group on Requirements Engineering Patterns

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The special interest group on requirements engineering of the German Informatics Society has established a working group on “Requirements Engineering Patterns” (WGREP). The objective of the group was to investigate the applicability of the concept of patterns for collecting and exchanging requirements engineering (RE) experience with special emphasis on project teams which are in the process of adopting RE. The group consisted of ten members from academia and different industries. This article presents a brief overview of the work and the results of the working group. A full account can be obtained from WGREP’s final report [1], and the identified RE patterns are also accessible through an online pattern repository [2].

Introduction

For practitioners it is not uncommon to encounter project teams or environments with no or only little experience in requirements engineering. Especially in small and medium enterprises introducing and gaining acceptance for RE activities is a prevalent challenge. Methods and tools for handling this task are available, but they are difficult to access for newcomers or “part time” requirements engineers who need advice in a specific project situation. A collection of RE patterns could bridge the gap between existing RE knowledge and its successful application in different kinds of projects by improving its accessibility.

Why Patterns?

Patterns are an established and well-known format for exchanging experience. They have been used in several disciplines for capturing engineering knowledge and for providing rules for generating successful engineering solutions (see e.g. the patterns home page at <http://hillside.net/patterns>). Patterns provide proven practical experience from projects, contrary to knowledge from academic reasoning alone. They are thus expected to be relevant, reliable and applicable, meaning

- Relevant: patterns shall refer to “typical” project situations which are “frequently” encountered by the intended target group.
- Reliable: patterns shall provide guidelines which have proven successful under several comparable circumstances.
- Applicable: patterns shall be written in an instructive and intuitive way and contain guidelines which the project leaders can implement within their responsibility.

The requirements engineering patterns are intended for project teams which are in the process of adopting RE. It is assumed that those teams have a basic background in RE (e.g. from text books), but need to build up practical knowledge from projects.

An Example

In a COTS-based software development project, a specification has been written for selecting the COTS components. When the specification has been signed and was used for customization, gaps and inaccuracies became apparent, and it turned out that the specification’s level of detail has been fine for component selection, but was insufficient for implementation. The project leader was caught in a dilemma: on one hand, it was necessary to suspend the implementation work and improve the specification first; on the other hand the approaching project deadline was requiring continued implementation.

A pattern helped the project leader, recommending:

IF	an agreed specification is available,
BUT	the specification needs clarification,
THEN	detail the specification by providing test cases
TO	create a verifiable specification

The pattern has been derived from accounts of different project leaders who have successfully chosen this approach in comparable situations. It allowed the project leader to overcome the difficulties with the specification while continuing the implementation work.

RE Pattern Structure

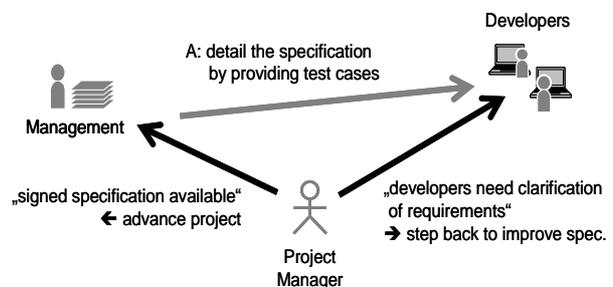


Figure 1: Patterns resolve conflicts

Figure 1 illustrates the RE pattern structure for the example from the previous section. The dilemma can

be visualized as the project manager being torn apart by two opposite forces, the necessities to advance the project and to repeat the specification phase. The proposed action compensates for the forces by pointing out a way to perform the required specification work in the ongoing project.

Generalizing this idea, RE patterns are intended to help to solve problems which originate from two conflicting forces. It is proposed that the essence of an RE pattern could be captured in a “pattern vector”,

$$P = (T, F^{\leftarrow}, F^{\rightarrow}, A),$$

where T is an RE task, F^{\leftarrow} and F^{\rightarrow} are the two conflicting forces which create the problem, and A is an action compensating for the forces [3].

The pattern vector can be used to create a generic pattern statement using

IF F^{\leftarrow} BUT F^{\rightarrow} THEN A TO T .

The recommendation of the previous section has been produced according to this model, and the requirements engineering pattern collection obtained by WGREP underlines the general nature of the approach [1]. In addition, the pattern vector can be used for filtering a pattern database, thus enabling access to patterns e.g. for specific tasks T or conditions F . This approach is demonstrated in the online requirements engineering pattern repository, REPARE [2], which contains the full versions of the RE patterns.

Procedure for Discovering RE Patterns

WGREP has formalized the procedure for eliciting, recording and comparing RE experience from different projects. It is built on four major activities (Figure 2):

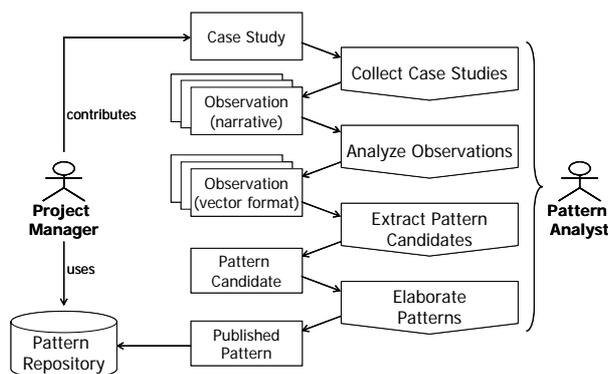


Figure 2: Discovering Patterns

1. In the first step, case studies are collected from real world projects. Case studies contain project leader’s accounts of important events and experiences from projects.
2. Next, the case studies are analyzed and reorganized into a set of observations. Observations describe events in the format of the pattern vector.

3. To identify patterns, the entire set of case studies is searched for identical observations from different projects. Those observations are marked as pattern candidates.
4. The pattern candidates are elaborated into the pattern description, which is then published in the central pattern repository.

Results

After a one year period, WGREP has completed its intended program and achieved its goals. The group has successfully developed and demonstrated a format for describing RE patterns and an RE “pattern mining” procedure. Fourteen case studies have been collected which contain more than eighty observations, and an initial set of seventeen RE pattern candidates has been identified. About half of the candidates have been elaborated into patterns and are available for review by external readers.

Expressing RE experience in terms of pattern vectors turned out to be of great value to the participants in the process. For example, when the group analyzed an observation for the conflicting forces, it often revealed different underlying problems than the observer has originally assumed. In addition, the comparison with similar situations in other projects helped the participants to reflect and optimize their own way of work.

The proposed method has been successfully used to conduct RE pattern workshops at the RE04 conference and at the annual meeting of the SIG RE in the GI. The workshops began with some of the attending RE experts reporting case studies from their experience, with the pattern vector being used for structuring the reports and the subsequent discussion. In both workshops, the vector format has enabled the participants to rapidly identify meaningful pattern candidates.

Acknowledgement

The results presented in this article have been obtained in collaboration with the other WGREP members: Thorsten Cziharz (Sophist GmbH), Heinrich Dreier (innovative systems GmbH), Ralf Fahney (independent consultant), Dorina Gumm (U Hamburg), Frank Houdek (DaimlerChrysler), Jan Ittner (method park), Dirk Janzen (Harman/Becker), Barbara Paech (U Heidelberg).

References

- [1] K. Lappe et al., *Requirements Engineering Patterns – An Approach to Capturing and Exchanging RE Experience. Final Report from the WGREP, DESY 2004, Hamburg, Germany.*
- [2] REPARE, The Requirements Engineering Pattern Repository, <http://repare.desy.de/>
- [3] L. Hagge, K. Lappe, *Sharing Requirements Engineering Experience Using Patterns*, IEEE Software, 1(2005).