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Poster: Analysis of Requirements Quality Evolution

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ABSTRACT

A fundamental aspect in the requirements engineering process is to know the quality of a specification, including how the quality evolves over time. This paper introduces an industrial approach for analysis of requirements quality evolution. The approach has been implemented in the System Quality Analyzer tool, exploits quality metrics for requirements correctness, consistency, and completeness, and is based on the storage of quality information in snapshots that are combined and displayed in charts. This can help practitioners to assess the progress and status of a requirements engineering process and to make decisions.

CCS CONCEPTS

Software and its engineering → Software creation and management → Designing software → Requirements analysis

KEYWORDS

Requirements quality, quality analysis, quality evolution.

1 INTRODUCTION

Requirements specifications usually change during their development, as requirements are added, modified, and deleted until they are regarded as valid. In this context, requirements quality management aims to analyse if a set of requirements conforms to quality standards. Quality metrics should be used, e.g. about the length or number of sentences of a requirement.

An important aspect in requirements quality management is to know how quality evolves over time. Analysing this evolution allows engineers to asses if and the extent to which the quality standards have been followed, how requirements changes have contributed, and the status of a project. This will ultimately aid in appropriate decision making about the next steps in a project.

Based on the above needs and benefits, we introduce an industrial approach for analysis of requirement quality evolution. The approach has been implemented in the System Quality Analyzer (SQA) tool [3], which supports requirements quality analysis through correctness, completeness, and consistency metrics, typically derived from best practices (e.g. [1]). This is especially relevant for critical systems in domains such as aerospace, automotive, and railway, where the systems must comply with standards (e.g. [2]) that indicate quality properties that must be ensured, including for requirements.

The approach is based on the creation of quality snapshots that store the status of a requirements specification at a given moment. The collection of snapshots will show how quality has evolved during a project, as a result of changes in the set of requirements or in the set of quality metrics to assess. The evolution is displayed in charts to facilitate its analysis.

The main contribution is the provision of a framework to control requirements quality evolution in a project and to access the complete quality information at any point of the project. The automated support eases the analysis of requirements quality evolution when compared to the current largely-manual techniques, such as quality data management in spreadsheets.

2 APPROACH

SQA is the evolution of the Requirements Quality Analyzer tool, which has been and is used by large companies in domains such as aerospace, automotive, defence, energy, and railway. SQA supports the definition, measurement, and management of the quality of diverse system artefacts, including requirements.

Requirements quality is based on three properties: correctness, completeness, and consistency. Correctness metrics assess individual requirements, while completeness and consistency metrics assess a whole specification. SQA provides information about the values of the metrics, the different issues found, and the overall quality of the project composed by the combination of the quality values of the three metric types.

SQA allows a user to save all the information related to the quality of a requirements specification in a snapshot. A snapshot stores all the quality data that the tool provides. Each snapshot consists of (1) each requirement assessment about correctness, completeness, and consistency, and (2) every involved metric in a quality assessment configuration and their functions. SQA also provides the possibility to show all the information of the snapshot and to generate reports to export it.

A requirements quality evaluation report is generated with the different quality values of a set of snapshots (Figure 1). The requirements quality evaluation report shows the evolution of requirements quality, facilitating the analysis of the quality over time. It is possible to import snapshots and to open any of them to show the quality information at a given moment.

The first step of requirements quality analysis in a project is typically correctness assessment. The individual requirements are then changed to improve their quality, and snapshots will be saved to control quality evolution. Once the set of requirements is initially correct, completeness and consistency metrics are applied progressively. These metrics will reveal the issues in the whole specification. The requirements will be modified to increase their quality, and snapshots will be saved. Quality evolution can then be analysed for the individual requirements and for the specification (different chart areas in Figure 1).

This process of saving snapshots while the set of requirements is growing improves quality management because the problems are detected early and the quality manager is aware of the evolution from a project's beginning. The quality manager has the possibility to open different snapshots to compare sets of requirements and to analyse the changes in the specifications and the changes of each quality metric result.

3 DISCUSSION

The analysis of requirements quality evolution is a recent SQA feature, but it has already been shown to customers and feedback has been collected. The customers have had an overall positive opinion, showed great interest in the feature (especially for large complex systems), and indicated situations in their projects in which the analysis of the evolution would be a great help.

It would be interesting to not only analyse the evolution for a single project, but to consider snapshots from different projects to compare their quality, study traceability between them, and assess how the requirements specification maturity evolves. Scheduled snapshots would also be useful.

A concrete complex scenario where the feature would be valuable is the collaboration between an Original Equipment Manufacturer (OEM) and its suppliers. In very large projects, different suppliers are involved and effective communication and interaction with them is a key factor. The OEM could provide the suppliers with requirements metrics, each supplier could analyse the quality and create snapshots, and finally the suppliers could send the snapshots to the OEM. The OEM would then integrate the snapshots to have a general project quality view.

4 CONCLUSION

We have introduced a novel approach to analyse requirements quality evolution. The quality information from different metrics is saved in snapshots and integrated in an evolution view that shows the changes during a project. The approach can support different quality management scenarios, in single or several projects and companies. We still need to further apply it and develop it, e.g. to generate web reports. Machine learning could be used to detect factors and frequent errors that affect quality.

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REFERENCES

[1] INCOSE. 2017. Guide for Writing Requirements.
[2] RTCA. 2011. DO-178: Software Considerations in Airborne Systems and Equipment Certification.
[3] The REUSE Company. 2018. System Quality Analyzer. https://www.reusecompany.com/system-quality-analyzer-sqa

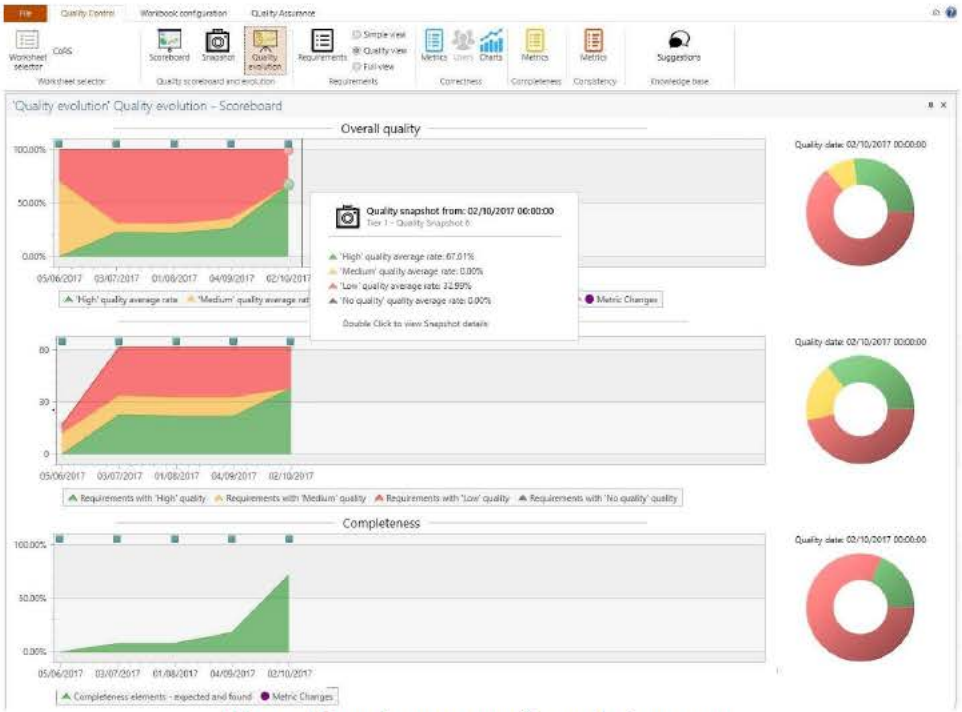

Figure 1: Requirements quality evolution report