Organisation and communication problems in automotive requirements engineering

Bibliographic data

This paper was published in 2016 by Springer and was written by Grischa Liebel, Matthias Tichy, Eric Knauss, Oscar Ljungkrantz and Gerald Stieglbauer. It goes under the name "Organisation and communication problems in automotive requirements engineering".

Theme of the paper

The paper approaches the theme of **automotive requirements engineering**. It aims to identify problems or challenges in automotive requirements engineering in terms of communication and organisation structure and possible solution approaches to those issues.

Synthesis of the paper

Requirements need to be **communicated** and **coordinated** as to **manage the rapid increase in software size and complexity in the embedded systems domain**. Within this area, the **automotive industry is particularly interesting** given some characteristics that distinguish it from other areas: vehicles used under greatly **varying conditions**; **high demands on compatibility of subsystems** due to vehicle projects usually not starting from scratch but actually evolving from existing specifications; automotive projects follow a **unique design flow with multi-tiered suppliers**; and projects are **very cost sensitive** considering that the high degree of safety critical functions and the large production volume greatly influence the costs of errors made during development.

In order to **determine the existing issues and solution approaches in automotive requirements engineering with respect to communication and organisation structure**, the authors conducted a case study with workers in the fields of embedded software engineering, systems engineering and application software engineering from an automotive car manufacturer and an automotive supplier. They found seven challenges that were formerly tested and confirmed by means of a survey: **Lack of product knowledge in early stages**; **lack of context knowledge regarding requirements on low levels of abstraction**; **unconnected abstraction levels**; **insufficient communication and feedback channels**; **lack of common interdisciplinary understanding**; **unclear responsibilities and borders**; and **insufficient resources for understanding and maintaining requirements**. These problems were clearly multi-layered and could not be sorted into single categories as they were often somehow connected to each other.

Within the solutions proposed by the interviewees and existing literature, there seemed to exist two seemingly contradicting **trends**: the **shift towards agile or stricter processes**. This might be explained due to the different areas studied since introducing **agile processes could be easier within those that focus mainly on software engineering**, while **in systems engineering stricter processes could prove more advantageous or even imposed by standards**. However, even in the latter, many practitioners advocated a change towards agile processes. Another explanation would be that the **two trends complement each other considering that an increase in agile processes calls for stricter**

processes on other organisation levels as to cope with the increased levels of informal communication and interaction.

The authors' suggestions, although there are not any ideal solutions, are to **introduce agile processes** as only a few requirements are written down at an early stage, providing **cross-disciplinary specification summaries** with the most important requirements, performing repeated **workshops for requirements clarification** in addition to **integrated collaboration mechanisms** or the creation of cross-team communities of practice, **knowledge codification**, **job rotation** and cross-role requirements reviews.

Although difficult, it is important to establish communication channels outside the fixed organisation structure. Future work could include the extension of this case study by other cases in the automotive domain to get a deeper understanding of the found issues and extending the list of possible solutions and examining in which situations each solution was indeed appropriate.

Questions and reflection

After having read the paper, I wonder if the challenges that were identified by the authors at the time are still the same nowadays or if they have somehow been tackled or even heightened with the evolution of the automotive industry.

I think about how much cars have changed throughout the last few years, how we went from a mechanical device on four wheels that was simply designed to take us from one place to the other to smart cars with calls via Bluetooth, electricity as fuel instead of gas, GPS, autonomous driving and so on. I feel like this kind of complexity that has been added with time must create even more challenges in requirements engineering. In this line of thought, I think it would be very interesting to redo the work done in this paper to confirm whether or not the added complexity in terms of requirements has heightened the issues that were already mentioned and if the proposed solutions can still prove useful now.

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