Agile Embedded System Development versus European Space Standards

Ville Rantala, Technology Research Center, University of Turku, Turku, Finland

Kaisa Könnölä, Technology Research Center, University of Turku, Turku, Finland

Samuli Suomi, Technology Research Center, University of Turku, Turku, Finland

Minna Isomäki, Technology Research Center, University of Turku, Turku, Finland

Teijo Lehtonen, Technology Research Center, University of Turku, Turku, Finland

ABSTRACT

Agile development methods are widely utilized in software development. There is a growing interest and effort to introduce them to other areas of technology, such as development of space systems. Space systems are typically safety- and mission-critical and therefore their development is strongly regulated and standardized. European Cooperation for Space Standardization (ECSS) has created a collection of standards which are extensively followed mainly in European space projects. In this paper, a review and discussion are presented to find out the conflicts between the agile development and the ECSS standards. The presented analysis and discussion show that the ECSS standards do not fully prevent the utilization of agile methods. However, there are aspects to be taken into account in the development methods, contracts and tailoring of standards.

KEYWORDS

INTRODUCTION

Agile development methods have gained significant popularity in software engineering. They aim to make the product development more efficient and flexible without causing additional strain to the engineers. Agile methods also aim to improve collaboration between engineers and customers so that the product fulfils the actual requirements and the problems may be identified as early as possible during the development process (Larman, 2004).

ECSS standards (European Cooperation for Space Standardization) are commonly used in space projects of the European space industry, mostly organized by ESA (European Space Agency). Many European space projects are distributed among many subcontractors of which many are small and medium enterprises developing embedded systems. Their interest in adopting agile methods in embedded system development raises questions about applicability of agile methods in the projects controlled by ECSS standards.

Utilizing agile methods in the development of complex safety- and mission-critical space systems can be challenging. Predominant standards and regulations can limit the utilization of several product development practices and instruct how the work shall be done. However, concurrent engineering

practices, which share characteristics with agile development, have already been utilized in the European space industry, especially in the early phases of mission projects of European Space Agency.

In this paper, the ECSS standards are reviewed to identify the conflicts that arise when agile methods are applied in embedded system development in complex space system projects. First, the background aspects, including agile development, the ECSS standards and related studies, are presented. Then the utilized research method for systematic processing of the standards is presented. Finally, the conflicting and non-conflicting standards are reviewed and the mitigation of the conflicts is discussed to draw the conclusions.

BACKGROUND

Agile Development

Agile product development originates from software development, but has its roots in the manufacturing industry and lean principles. The common name for agile software development was originally presented in Manifesto for Agile Software Development in 2001, written by 17 supporters of several existent lightweight software development methods. This manifesto consists of four values (Table 1) and 12 principles (Table 2) that formulate the concept of agile development. The manifesto aims to provide advice on how to improve the efficiency and fluency of software development (Beck, et al., 2001).

Table 1. Values of agile software development (Beck, et al., 2001)

We are uncovering better ways of developing software by doing it and helping others do it. Through this work we have come to value:
     1. Individuals and interactions over processes and tools
     2. Working software over comprehensive documentation
     3. Customer collaboration over contract negotiation
     4. Responding to change over following a plan
 That is, while there is value in the items on the right, we value the items on the left more.

Table 2. Principles of agile software development (Beck, et al., 2001)

We follow these principles:
     1. Our highest priority is to satisfy the customer through early and continuous delivery of valuable software.
     2. Welcome changing requirements, even late in development. Agile processes harness change for the customer's competitive advantage.
     3. Deliver working software frequently, from a couple of weeks to a couple of months, with a preference to the shorter timescale.
     4. Business people and developers must work together daily throughout the project.
     5. Build projects around motivated individuals. Give them the environment and support they need, and trust them to get the job done.
     6. The most efficient and effective method of conveying information to and within a development team is face-to-face conversation.
     7. Working software is the primary measure of progress.
     8. Agile processes promote sustainable development. The sponsors, developers, and users should be able to maintain a constant pace indefinitely.
     9. Continuous attention to technical excellence and good design enhances agility.
     10. Simplicity–the art of maximizing the amount of work not done–is essential.
     11. The best architectures, requirements, and designs emerge from self-organizing teams.
     12. At regular intervals, the team reflects on how to become more effective, then tunes and adjusts its behavior accordingly.

21 more pages are available in the full version of this document, which may be purchased using the "Add to Cart" button on the publisher's webpage: www.igi-global.com/article/agile-embedded-system-development-versus-european-space-standards/166683

Related Content

Exploring the Effects of a Mindfulness Program for Students of Secondary School
Clemente Franco, Israel Mañas, Adolfo J. Cangasand José Gallego (2013). *Governance, Communication, and Innovation in a Knowledge Intensive Society (pp. 153-167).*
www.irma-international.org/chapter/exploring-effects-mindfulness-program-students/76602

Linking Folklore to Agricultural Sustainability Accounting in Bangladesh
Mahmood Khan, Dora Marinovaand Vladislav Todorov (2021). *International Journal of Information Systems and Social Change (pp. 46-57).*
www.irma-international.org/article/linking-folklore-to-agricultural-sustainability-accounting-in-bangladesh/275771

Exploring the Meaning of Mobile Learning for Informal Learning: Preliminary and Exploratory Study
Young Parkand Yong-Ju Jung (2013). *International Journal of Knowledge Society Research (pp. 75-83).*
www.irma-international.org/article/exploring-the-meaning-of-mobile-learning-for-informal-learning/89742

E-commerce Taxation Issues: A Balanced Perspective and Options for Resolution
Mahesh S. Raisinghaniand Dan S. Petty (2002). *Social Responsibility in the Information Age: Issues and Controversies (pp. 160-172).*
www.irma-international.org/chapter/commerce-taxation-issues/29243

Adventure Game Learning Platform
Miroslav Minovic, Velimir Štavljanin, Miloš Milovanovicand Dušan Starcevic (2012). *Trends and Effects of Technology Advancement in the Knowledge Society (pp. 13-23).*
www.irma-international.org/chapter/adventure-game-learning-platform/70094