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IMPROVING SPACE SOFTWARE SYSTEMS BY ENHANCING THE LEGACY MODELS

Abstract

Space software systems are usually employed in several space missions repetitively and, as a consequence, have a long life-cycle. The several technologies related to the development of such software systems cover all the software development life-cycle and are in continuous progress, notably the ones related to the establishment of new techniques to create better models during the analysis and design phases. On one hand this continuous progress helps to deliver high quality critical software systems but, on the other hand, brings the difficult of using the new available technologies to update legacy systems in order to reflect new space mission requirements and hardware obsolescence. These legacy systems are still being employed and, in most of the cases, were designed using old fashioned structured analysis techniques. However, the resulting models of this analysis cannot be disregarded and none of the new analysis techniques mention how to deal with them. This paper describes an ongoing work at the Institute of Aeronautics and Space- IAE to establish a process for enhancing the legacy space software systems models, aiming at not only updating these models according to the new requirements, but also bringing a better understanding of the space systems for validation purpose. The proposed process, similar to those used by some software development organizations, uses UML diagrams to create both functional and behavioral models of the legacy system under analysis, taking into account the several stakeholders, and introduces new incremental improvements by correlating the new models to the old structured and data flow driven models of the legacy system, overcoming the weakness of the structured analysis for the real-time modeling. During the process, we also use the old models as a reference to verify the new ones based on the fact that the operational legacy software system is an implemented image of old models. A study case was developed for the flight control software system of the Brazilian Satellite Launcher bringing excellent results, especially related to the improvement of the validation process, which is very significant for space software systems that are being reused. We seek to replicate this process for large-scale software development projects such as the Launching Preparation Ground System. The effectiveness of the legacy models enhancement process will be measured by collecting metrics across projects in order to determine the efficacy of the validation and further improvements in the application of the process.