

Challenges and Opportunities in the Definiton of a Software Reference Architecture

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IAF SPACE OPERATIONS SYMPOSIUM (B6)
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CHALLENGES AND OPPORTUNITIES IN THE DEFINITION OF A SOFTWARE REFERENCE
ARCHITECTURE: COMPARISON OF PACKET UTILIZATION STANDARD AND MISSION
OPERATIONS

Abstract

Closed or “monolithic” system architectures have been the dominant paradigm in missions design for the past decades and the concepts laying behind the operations have followed the same principle. As a major inconvenient, such a paradigm requires reinventing the wheel for each new family of spacecraft, with impacts on both cost and time. The Software Reference Architecture (REFA) as a solution for reducing cost and development time constitutes a hot topic for whoever is involved in development process of the control segment. With this respect, Service Oriented Architectures (SOA) are emerging as a better approach to the design of distributed systems, gradually replacing monolithic architectures. This kind of solutions started rising in the ‘90s with the Packet Utilization Standard (PUS) – today defined by the E-70 working group of ECSS – and, despite some misinterpretations at the first use, it is nowadays adopted for any ESA missions. CCSDS Mission Operations (MO) Service Framework is emerging as a new SOA and its first in-orbit-demonstration is still ongoing, made by the ESA owned OPS-SAT mission, launched in December 2019. MO is not only covering issues related to the definition of a generic service model, but it is thought to be a fundamental element of a standard Reference Architecture with the capability needed to re-use across missions. The paper presents the solutions adopted for implementation of the two different sets (PUS and MO) of standard services, and it identifies which aspects play a key role when being implemented in a REFA. The analysis provides a 360-degrees view of the subject in terms of interoperability, infrastructure re-use, interfaces standardization, capability in technology migration and, last but not least, maintainability through system evolution. These factors are directly involved in the definition of a standard Reference Architecture that satisfies the requirements needed to be successfully adopted across agencies and private companies. Therefore, the analysis is intended to depict the differences between the two service models. The results of the analysis bring to the identification of which characteristics of PUS and MO better fit a REFA development. Giving an overview of the current paradigms, the paper also proposes further steps in the development of a Service Oriented Architecture.