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DEVELOPMENT AND INTEGRATION OF A DATA OPERATIONS AND RECONFIGURATION INTERFACE

Abstract

Spacecraft operations are commonly supported by extensive ground segments, consisting of many redundant hardware and software components in a variety of configurations. Ground segments and spacecraft are equally complex systems of systems, so easy maintenance and configurability are crucial for operational success. Traditionally, a mission's central monitoring and control system (MCS) is mainly used to interact with spacecraft, while most ground systems are monitored using numerous applications. Especially in a multi-mission environment with a large variety of spacecraft as in the German Space Operations Center (GSOC), this poses a challenge. Concepts for ground segment maintenance and configuration differ significantly between projects, despite them requiring execution of similar basic tasks. In the past, this led to a zoo of project specific scripts and reconfiguration tools, often requiring engineers to manually interact with affected systems. The Data Operations and Reconfiguration Interface (DORI) is the current development of an ongoing effort at GSOC to integrate monitoring and command capabilities for data systems into the existing MCS. By adding an abstraction layer, DORI introduces a homogeneous ground telemetry and telecommand (TMTC) interface utilizing the ECSS PUS standard. Through assignment of a dedicated "ground subsystem" APID and integration of packet definitions into the central Mission Information Base, operators are able to monitor and control all mission aspects through one MCS. The EDRS-C satellite project requires fourfold redundancy of all TMTC chains, with context-dependent configurations for operations and simulation in addition to a complex multi-layer data archiving solution. The desire to frequently rotate chains and contexts poses a challenge to system engineers. Manual reconfiguration of the entire MCS is error prone and time consuming. A project specific "Reconfigurator" is already foreseen in the EDRS-C ground segment, however this software cannot be reused for other missions at GSOC. In an effort to reduce long-term cost and risk, EDRS-C will be one of the first projects to utilize DORI in an operational context. This paper presents the concept of DORI and provides an in-depth description of underlying components, highlighting design considerations due to the GSOC multi-mission approach and lessons learnt from an extensive prototyping phase. Further, this work describes the integration of DORI into the EDRS-C ground segment. First experiences are discussed in detail before concluding with an outlook into future developments concerning EGS-CC interoperability.