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REPLACING THE TDP-1 MISSION PLANNING SYSTEM – MORE THAN JUST ANOTHER TECHNICAL DEMONSTRATION PROJECT

Abstract

Never change a running system? No, of course this does not apply to the ground segment systems and components of spacecraft missions with a lifetime of several years and the requirement updates and amendment necessities coming up throughout such a project's operational phase. Especially for the payload operations of an experimentally probed instrument and its environment periodic adaptations are commonly expected. However, replacing the complete Mission Planning System (MPS) comprising well-proven, robustly running software after seven years of operation might not be so usual. Nevertheless, this is what we are currently implementing at the German Space Operations Center (GSOC) for the TDP-1 mission.

TDP-1 is a Laser Communication Terminal (LCT) by TESAT, which served as a precursor to the EDRS Space Data Highway and is still used to demonstrate and explore the capabilities and future possibilities of the optical communication terminal itself together with the embedded and updateable onboard software used for its operation. TDP-1 is one of four Technical Demonstration Payloads on the Alphasat I-XL geostationary satellite operated by Inmarsat. DLR GSOC is responsible for the operations of this terminal, including the planning of its link sessions (between the geostationary and low-earth-orbiting satellites, e.g. some of the Sentinels, as well as to an optical ground station) and the surrounding operational needs, considering constraints of the main and its counter terminals and on-ground activities, visibilities, etc. The ground segment at GSOC comprises a tool suite performing the necessary functionality automatically, supported by operations experts for handling contingencies or short-notice modifications of the plans and command sequences which are routed to the different control centers incorporated in the execution process.

The paper will give an overview of the TDP-1 MPS and its responsibilities, as well as the reasons beyond changed requirements and requests for novel features that led to the decision to completely migrate the software to a new tool suite. Both the old and the future version's set-up, design concepts and functional solutions will be presented. In its current implementation, the planning relies on the generic GSOC Plato library for modelling and resolving planning problems incl. its extensive meta-language XML-configured algorithm suite which is invoked and accomplished by project-specific input-, output- and workflow-organizing components. In contrast, the new version is based on our novel Reactive

Planning Framework, including a configurable generic suite of components, defined interfaces for the project-specific extensions, an elaborate concept for persistence of information and interaction of the components and relying on the completely new, reworked version of Plato in Scala, Plains. The Reactive Planning Framework already serves as the basis for another major GSOC MPS currently under system integration test. It is foreseen to be further extended and generalized to do so for all future projects at GSOC enabling fully-automated as well as supporting interactive planning and scheduling systems.

Besides the comparison and description of these designs and the way towards the new MPS, it will be addressed which benefits were identified for this radical approach and are expected to arise from the re-use of the Reactive Planning Framework for the TDP-1 project, as well as for the other missions served by it, now and in the future. Finally, as the implementation of the new system shall be finished by mid of 2021, the paper will also present the lessons learnt from the process, together with the evaluation how the surrounding ground segment and overall project management approach supported this big migration step and its risks.