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NEXT GENERATION FLIGHT & GROUND SOFTWARE FRAMEWORK FOR FAST MISSION TIMELINES

Abstract

Flight and ground segment software in university space missions is often developed only after hardware has matured sufficiently towards flight configuration and uses bespoke codebases to address key subsystems in power, communications, attitude, and payload control with little commonality. This software process is often hardware specific, highly sequential, and costly in staff/monitory resources and, ultimately, development time. In 2015 the Surrey Space Centre started development on a common software framework and methodology to allow it to support the rapid development of multiple missions with differing mission types. The framework uses a combination of open-source embedded and enterprise tools such as the FreeRTOS operating system coupled with auto-generated flight software via python scripts and a database of commands.rapid development templates used to auto-generate C and Python scripts offline from 'message databases'. In the flight software, a 'core' packet router thread forwards messages between threads for inter process communication (IPC). On the ground, this is complemented with an auto-generated PostgreSQL database and web interface to test, log, and display results from initial development all the way though to on orbit operations. Over the past four years the framework has been used successfully on several missions including Alsat-1N, Inflatesail, and RemoveDebris. The framework allowed rapid development and longer testing periods whilst lowering the resources and costs required. Key to this was streamlining the development of TM/TC interfaces across both ground and space segments to deliver early initial functionality resulting in a greater level of support for testing and debugging the entire satellite system. This paper reviews the benefits that the framework brought to the recent missions and the limitations of the system. Recently focus as changed at the SSC towards the next generation framework to allow for much more flexibility for future missions. This new framework allows the concept of packet routing through and between different subsystems, whilst allowing flexibility of using and interfacing to many different protocols that is inherent in university and research CubeSats. An enhanced TM/TC database and web application is used to allow more cooperative working and synchronisation between system engineers, and the developers of the various ground and space systems. In addition a changed workflow is used switching the focus from the mission control system as a support to the flight software, being at the centre of the development process.