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SMALL SATELLITE MISSIONS SYMPOSIUM (B4)
Space Systems and Architectures Featuring Cross-Platform Compatibility (7)

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AN OPEN MODULAR CUBESAT FRAMEWORK FOR AAUSAT3

Abstract

Purpose: To simplify subsystem development and enhance the quality of the complete system, AAUSAT3 - the next student satellite from Aalborg University - is based on a new developed, standardized software framework. The mission objective is to evaluate the possibility of receiving Automatic Identification System (AIS) messages in space. AIS is a mandatory data exchange protocol designed to enhance safety at sea, by requiring ships to automatically broadcast information such as name and position at a fixed interval. The satellite is a 1U CubeSat containing seven subsystems which communicate on an internal bus topology network.

Methodology: The subsystems are based on three different architectures to fulfil processing and memory requirements, while complying to the power limitations of the satellite. Software is implemented on the open source operating systems FreeRTOS or uClinux depending on architecture. The subsystems communicate on an internal CAN-bus using the connection oriented protocol stack CubeSat Space Protocol (CSP). To allow subsystem developers to abstract from the architecture specific details, a standardized software framework with support for Remote Procedure Calls (RPC) is implemented on top of CSP. This has the advantage of encapsulating the low-level network code and separating it from the application to reduce errors caused by differences in architecture. Furthermore, the software framework implements a service layer with a standard interface to functionality common to all subsystems, such as ping and time synchronization.

Results: A fully functional prototype of AAUSAT3 was tested on a stratospheric balloon flight in October 2009, as part of the REXUS/BEXUS programme. The CSP stack and software framework were successfully implemented and tested on four subsystems sharing a common architecture. Having a uniform software structure eased the development and debugging and simplified reconfiguration in the development process. The software framework will be extended to support more architectures in spring 2010, as part of the RPC layer development.

Conclusion: Based on the experience from AAUSAT-II, AAUSAT3 will use a standardized interface and abstraction layer to enhance the robustness of the satellite. A tested modular framework simplifies the construction of subsystems and provides the basis for further extension of functionality on future satellites. A more complete version of the software is planned to be released as open source, for inspiration or implementation on similar student satellites projects.