Paper ID: 13781
oral

63rd International Astronautical Congress 2012

16th SYMPOSIUM ON SMALL SATELLITE MISSIONS (B4)
Space Systems and Architectures Featuring Cross-Platform Compatibility (7A)

Author: Mr. Claas Ziemke
Institute of Space Systems, Universität Stuttgart, Germany, ziemke@irs.uni-stuttgart.de

Dr. Toshinori Kuwahara
Tohoku University, Japan, kuwahara@astro.mech.tohoku.ac.jp

THE LAIKABOARD – PROPOSAL FOR A GENERIC, MODULAR AND DISTRIBUTED OPEN SOURCE SATELLITE ON-BOARD DATA HANDLING SYSTEM

Abstract

The ARM architecture is a 32-bit reduced instruction set computer architecture. Because of the relative simplicity it is suitable for low power applications. As a result, the ARM architecture has become dominant in the mobile and embedded electronics market, as low-cost, small microprocessors and microcontrollers. The aforementioned features also makes it suitable for the space-sector where simplicity means robustness and power efficiency is crucial. On the other hand the contemporary ARM based integrated circuits are manufactured with very small structure sizes which makes them susceptible to radiation. A great number of ARM based single-board computers exist and are used for gaming, kiosk application, machine control and hobbyist projects. One of the most prominent such computers is the BeagleBoard. It was designed with open source software development in mind and as a way of demonstrating the OMAP3530 system-on-a-chip. The board was developed by a team of IT engineers as an educational board that could be used in colleges around the world to teach open source hardware and open source software capabilities. It is sold to the public under the Creative Commons share-alike license. In this paper it is proposed to develop a single-board computer for space application based on the tried and tested BeagleBoard design. It is developed as a generic, modular and distributed satellite on-board data handling system. Many university and amateur satellite projects start with the development of an on-board computer because commercial satellite on-board computers are too expensive and often fall under export regulations. Most space-engineering courses do not focus on software engineering and electronics hardware development, but rather on thermal, structural, systems-engineering and mission design. Thus the availability of a generic and open on-board computer can lead to a great speed-up in the initial development of a satellite project. Furthermore a generic single-board computer with the low power consumption of the BeagelBoard can be used not only for the central on-board computer but also as an interface for hardware peripherals. This will lead to the possibility of reusing software parts in every device and the distribution of software functionality between the different parts of the system, which again leads to a more robust system. First steps of the project are porting the real-time operating system RTEMS to the BeagleBoard and analyzing the design in order to find the parts of the design most susceptible to radiation or are otherwise not usable in a space-craft.