20th SYMPOSIUM ON SMALL SATELLITE MISSIONS (B4)
14th UN/IAA Workshop on Small Satellite Programmes at the Service of Developing Countries (1)

Author: Mr. Claas Ziemke
Private, Germany, claas.ziemke@gmx.net

Mr. Gautam Akiwate
College of Engineering Pune, India, gautam.akiwate@gmail.com
Dr. Toshinori Kuwahara
Tohoku University, Japan, kuwahara@astro.mech.tohoku.ac.jp
Mr. Alexander Brandt
Private, Germany, alexander.brandt@googlemail.com

ONE SATELLITE PER COUNTRY - AN OPEN-SOURCE SMALL-SATELLITE REFERENCE ARCHITECTURE FOCUSED ON THE NEEDS OF DEVELOPING NATIONS

Abstract

In the recent years four trends can be observed in the space community. The first is the trend towards the usage of commercial off-the-shelf components for space applications. This started in the academia and has now gathered considerable pace in the industry. The second trend, especially at universities, is the implementation of standardized "CubeSat" missions. These missions are primarily used for educational purposes but scientific missions and an ecosystem of dedicated subsystem vendors are slowly emerging as well. The third trend is the new space race between the developing nations. More and more of these emerging space-faring nations start to run their own domestic satellite programs, often starting at universities, often with a minimal financial budget. The last trend is not restricted to the space community but originates from the so called "Hacker and Maker" scene. It is the emergence of professional quality community projects. In the space sector, this trend reaches back to amateur radio operators who put the first amateur satellite into orbit. Key factor for the success of these community projects is the availability and even more important the openness of the developed systems for collaboration, re-use and modification. In recent publications open-source space projects at the service of developing nations have been proposed and the motivations to implement such projects have been described. This paper focuses on the technological challenges and general implementation principles of an open-source small-satellite bus, rather then describing the reasons to implement this project. Taking into account the trends described above, the proposed architecture will focus on the usage of commercial off-the-shelf components. This leads to a world-wide availability of the used hardware, even in developing nations, as consumer electronics typically are not subject to any import or export regulation. The proposed reference architecture uses a modular "building-blocks" approach in order to make division of labour, adaptability and interchangeability of the parts possible. Clean-cut interfaces and open standards are another design principle. Because only electrical interfaces and standardized electronic components are described in this architecture, it does not restrict the possible mission to the "CubeSat" or any other particular form factor. The general outline of the architecture as well as the road-map towards an implementation is described. One of the main targets of this project is to enable developing nations, universities and communities of dedicated amateurs to adapt the reference architecture to their specific needs and to help them implementing small-satellites successfully.