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Author: Mr. Pedro Rodrigues
Tekever, Portugal

Mr. André Oliveira
Tekever, Portugal
Mr. Ricardo Mendes
Tekever, Portugal

SDR-BASED AD HOC SPACE NETWORKS (SASNETS)

Abstract

When talking about communications, terrestrial technologies are far more advanced than those applied in space. Motivated by the global mobile communications market, permanently seeking new products and development areas, these technologies experience an unparalleled evolution. Therefore, spin-in of terrestrial technologies should be seriously pursued to provide the technology push that can lead space markets beyond the current state of the art. However, the innovation motors of these technologies are usually Small and Medium Enterprises (SMEs), with small research teams and limited resources, that have difficulties to space qualify their products on their own. How could then a SME have a low-cost, speedier access to space? At TEKEVER SPACE, a Portuguese SME, we believe the solution is to have an inexpensive standardized platform, which would allow companies to easily validate their products in orbit and be competitive in the space sector. A strong candidate is the Cubesat concept, which has been mainly used for academic purposes, but can open a new door to small enterprises willing to spin-in their technology.

Under the framework of the QB50 initiative, TEKEVER is proposing, in collaboration with Portuguese universities, to design and build a Cubesat to validate two state of the art communication technologies that have already been successfully developed for terrestrial applications: Software Defined Radio (SDR) and ad hoc networking. The SDR concept enables the development of various waveforms using a common hardware platform, which can result in tremendous mass and volume savings, while increasing flexibility to a point where a radio system could be completely modified by just sending a command from ground. Ad hoc networks are especially interesting since they don't require an infrastructure, dedicated management or monitoring. Their self-discovery, self-organization and auto-configuration capabilities guarantee the autonomy required for future space missions using flexible distributed architectures, like formation flying or planetary surface exploration. Ultimately, a mobile ad hoc space network can enable lower communications costs and latencies between satellites, space vehicles and astronauts or satellites and ground stations.

In this paper, we explain how the concept of ad hoc networking based on SDR can be applied in Space, identify its advantages and disadvantages, explore different application scenarios, discuss the viability of Cubesat platforms for validating these and other technologies and present results from on-ground testing and research that clearly show the remarkable potential of these technologies for future space missions.