20th SYMPOSIUM ON SMALL SATELLITE MISSIONS (B4)
Generic Technologies for Nano/Pico Platforms (6B)

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GAMANET: DISRUPTING COMMUNICATIONS AND NETWORKING IN SPACE

Abstract

The growing popularity of small satellites and an increasing demand on flexibility gave birth to a new wave of distributed missions, based on multiple platforms or multiple building blocks. These include formation flying, fractionated spacecraft or satellite networks, which have in common the fact that the missions are not relying on a single satellite but on several elements that interact and exchange data with each other. Traditional communication systems are not designed to cope with this type of mission requirements and therefore disruptive communication and networking solutions are needed to address the new market demand.

Under this new type of missions falls QB50, which intends to launch a network of 50 CubeSats into a Low-Earth Orbit to study the low thermosphere. Taking advantage of this opportunity, TEKEVER and the University of Porto, from Portugal, are proposing a novel experiment to join CubeSats and Ground Stations in a seamless communications network, bringing the networking capability to the QB50 mission. The GAMANET experiment is based on the flexibility of Software-Defined Radio (SDR) and the robustness of mobile ad hoc networks (MANETs), two promising terrestrial technologies that are just starting to be used in space. GAMANET will deliver each individual CubeSat a unique set of benefits that no traditional communications system is able to provide: increased ground coverage, by having access to ground links from all other satellites in the network; higher downlink and uplink capacity and reliability, combining communication resources from all satellites; or improved positioning precision, combining GPS and ISL data from all network nodes. It also enriches the scientific value of QB50, since GAMANET allows for instance synchronisation between satellites or the collection of data during re-entry. For all this, GAMANET presents a disruptive space communications and networking concept, targeting small satellite platforms to enable distributed missions and address their needs.

In this paper, the concept is presented in more detail and an analysis of the target mission scenarios is also included, with a special focus on the QB50 mission. A detailed view of the GAMANET architecture and specifications is provided, as well as a deeper analysis of the technologies involved and their applicability to space. Finally, and since the project is entering its critical design phase, preliminary development

and performance results are presented as well, together with an overview of activities towards its launch, in 2015.