SPACE COMMUNICATIONS AND NAVIGATION SYMPOSIUM (B2)
Interactive Presentations (IP)

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OPPORTUNITIES OF AN OPEN-SOURCE GLOBAL SENSOR NETWORK MONITORING THE RADIO SPECTRUM FOR THE (NEW) SPACE COMMUNITY

Abstract

With highly distributed and internet-connected systems, global community driven sensor networks become possible and offer new opportunities for existing monitoring services to augment and expand their mission goals. The mission statement for the Distributed Ground Station Network, a novel network concept of small ground-stations and connected via the internet for performing automatic scans for satellite and other beacon signals, was initiated as “measuring everything”. It was selected due to the usage of Software Defined Radio systems, which allows an operation beyond the main task of an open service for satellites realizing this worldwide broadband RF-spectrum analyser.

During the European Space Agency (ESA) Summer of Code in Space 2014 (SOCIS), further possible fields of application of the DGSN were investigated. It was evaluated, that the RF-spectrum is not only an important limited resource for space exploration and services, but also for terrestrial services. The permanent and global monitoring of it would allow to have direct value to the general public and its regulatory committees like the International Telecommunications Union (ITU), and it would provide indirect and basic research of artificial and natural phenomenons, which can be measured by its influence on certain bands of the RF-spectrum.

For achieving this, it was proposed to commission the network of ground stations in multiple phases which ultimately lead to the capability of fully track satellite and beacon signals. The ongoing first phase consists of the deployment of a sensor network with low-cost software defined radio devices for a ground based monitoring of the radio spectrum between 50 MHz and 2 GHz. During the testing phase it is intended to integrate it with the existing Constellation infrastructure, a globally distributed network of 60,000 PCs, which could serve as sensor nodes.

This paper describes the development undertaken that enables the global monitoring of the RF-spectrum and the navigation services as a citizen science project. It starts with the critical mission points and architecture drivers and will conclude the integration in the overall system of the Distributed Ground Station Network and its benefit for the new space community. It will put an emphasis on the open-sourcing of software and hardware for the sensors and post-processing, due to several reasons like personal data-security and fostering creative use of this data. Furthermore, it is an official project of the NASA Space Applications Challenge 2015 to involve the community in the development and big-data analysis.