

25th IAA SYMPOSIUM ON SMALL SATELLITE MISSIONS (B4)  
Small Satellite Operations (3)

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THE GROUND SEGMENT API: PROPOSING A UNIFIED INTERFACE FOR THE SPACE  
OPERATION ECOSYSTEM**Abstract**

cubesats and small satellites are revolutionizing the space business by its applications and sheer numbers. The intention of launching big constellations of medium sized satellites within the next decade is following a similar fast-paced approach with respect to that of the cubesat development cycle. In this fastly progressing business, not only the space segment needs to be prepared for future needs, so is the ground segment. It poses new challenges to the ground segment and the satellite operations teams are preparing their ground segment for the specific requirements. Within the current operations ecosystem, many solutions are available and hardly any of them are interoperable. The Ground Station API (Application Programming Interface) is a proposal to harmonize and unify the interfaces. It is meant to be analogous to APIs used in software development or other standardization processes like the cubesat form-factor. In this way, telemetry and tele-commands can be transmitted between the existing “gated systems” and sharing the assets shall be easier.

This paper describes the current situation of the ground segment for cubesats and smallsats with an emphasis on communications. The data-hungry requirements of constellations and future swarms are already leading to groundstations networks in classical radio-frequency bands with many nodes. Future optical groundstations will even increase the number of nodes and systems. During the work on the Distributed Ground Station Network (DGSN) it became obvious that even the most essential meta data of groundstations were not available. The situation made it difficult to collaborate with and sharing the stations when even the station’s location, status and parameters were unknown.

It will be shown how Internet-of-Things approaches for data transfer and authentication can be implemented to allow an improved scheduling for receiving signals as well as commanding the transmission of tele-commands from the stations. A handover of telecommands from one system to another system is currently not proceeded in the cubesat community, but it is essential with respect to scaling. The last aspect will be services like cloud based data-storage, satellite-tracking and telemetry analysis.

The DGSN was started as part of the Small Satellite Design studies at the Institute of Space Systems (IRS) at the University of Stuttgart. It took part in the Google and ESA Summer of Code campaigns in 2013-2017 as well as the NASA Space Applications Challenge. The DGSN is now a doctoral dissertation research at the Institute for Photogrammetry (IFP) at the University of Stuttgart.