CUBESAT GROUND STATION NETWORK

FEATURES

- Simple operation for all users via standard web browser GUI
- Predicts contact opportunities, taking account of compatibility and availability of ground stations and satellite channels
- Manual or automatic booking of contacts, according to ground station policy (configurable per satellite)
- Near real-time distribution of acquired telemetry data products
- Event log for audit trail and fault management
- Optional automation interface based on exchange of XML files

With a wide range of low-cost components for CubeSats and Ground Stations available off-the shelf, space is becoming more accessible to new players all over the world, inspiring new applications and new approaches to mission operations.

One of the many remaining challenges facing the mission designer is the limited opportunity for line-ofsight communications with the ground. The volume and timeliness of the payload data return is limited by the geometry of the low earth orbit and location of ground station(s). This is known as the "downlink bottleneck":

Data return = bandwidth x contact time

The Ground Station Network addresses this by facilitating the sharing of cooperating ground stations among multiple missions, to extend the total contact time.
Telespazio VEGA have developed a new software solution to implement such a network. It is based on a simple booking system that enables ground stations to offer their services to more missions, and for those missions to take advantage of the extended contact times available. The scalable, web-based architecture provides a robust and extensible platform for an orchestrated network with optimized, automated operations.

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CONCEPT OF OPERATION

1. Set Up
MC enters details of their satellite, including orbit TLE and communications channel characteristics and transmission schedule. SO enters details of their Ground Station, including location, availability, compatibility and policy for each satellite channel.

2. Booking
MC can request booking of specific contacts. SO can accept (or reject) bookings, manually or automatically, as well as generate their own. This basic mechanism may be extended with automated booking, e.g. to orchestrate the network for optimum utilization of resources.

3. Contact
SO is responsible for executing the Booking, by any means, whether manual or automatic. This entails tracking the satellite, acquiring the data (e.g. telemetry frames) and uploading the respective products.

4. Data Product
MC can then retrieve the acquired data product files from their private repository.
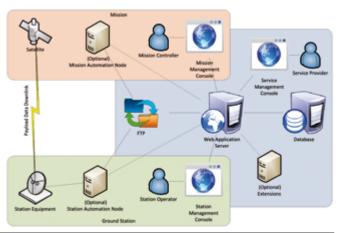
STATION OPERATOR

(SO) is responsible for operation of one or more ground stations. Their user interface with GSN is a web-based Station Management Console. The interactive timeline shows the potential contacts with supported satellites, with the facility to accept bookings and upload acquired data product files. SO is responsible for fulfilling all accepted bookings, but the system does not care how this is achieved. An optional Station Automation Node can receive booking instructions; execute them by controlling the station equipment during the satellite pass, and upload the data.

MISSION CONTROLLER

(MC) is responsible for the operation of one or more satellites. Their user interface with GSN is a web-based Mission Management Console. The interactive timeline shows potential contacts with all cooperating ground stations, with the facility to manage bookings and download the resulting acquired data product files. An optional Mission Automation Node can retrieve and process the data. It is assumed that the mission will have separate arrangements to uplink commands and transmissions schedules.

SERVICE PROVIDER

The software is designed to support a robust and reliable service, managed by a Service Provider who deploys and controls the system infrastructure, exposing interfaces via the public internet. The system infrastructure consists of a standard JEE-compliant Web Application Server and Database running the main application software, linked to a FTP repository for exchange of booking details and data products. The Service Provider creates user accounts for Mission Controllers and Station Operators, and grants them appropriate access to the system in accordance with an applicable service level agreement (SLA). A secure web-based Service Management Console provides comprehensive facilities to monitor all use (and abuse) and performance of the system.