LOWER LATENCY IN GROUND STATION NETWORKS OPENS FOR NEW REMOTE SENSING APPLICATIONS

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The purpose of this paper is to highlight the relation between latency and ground station architecture, and how that potentially can open for new remote sensing applications. Total system latency is defined as the time from the decision to task a satellite to take data over an area of interest, until this data is delivered to the end user. The ground station latency is a part of the total system latency, where other factors as request handling, data processing and data delivery play important roles. Satellite missions can be classified in three categories:

1) One-contact per orbit missions. This is a typical Earth Observation mission, collecting images during the orbit and in need of emptying the on-board storage during the contact.
2) Low-latency missions requiring more than one ground station contact per orbit, such as Earth Observation for security or disaster monitoring, meteorology and SAT-AIS. The low-latency network requires a multi-ground station network, where each station has a specific geographical coverage.
3) The latency tolerant mission category has a more flexible contact profile.

There is a need to design ground station networks according to latency requirements, for example for most EO missions Southern Hemisphere stations are very valuable for latency reduction.

For an EO system, a model for the total system latency starts with a decision to use the system and ends with a decision based on the outputs of the system. The system referred to here, is the whole system, including satellites, ground segment, processing equipment and user interface.

Total latency is made up of the following parts:

- Generation and reception of user requests
- Creation of satellite data request and scheduling of satellite
- Scheduling of ground station and uploading of satellite commands
- Acquisition of target area by the satellite
- Scheduling of ground station and downlink of payload data
- Data transfer from ground station to processing facilities
- Processing of data to required level and generation of user product
- Distribution of product.

Today only dedicated meteorological and military systems have sub-hour latency. The total system latency for commercial and governmental systems is in the order of days, but can with help of coordination of all parts of the total latency drivers, be reduced to hours. This is not satisfactory for many upcoming applications, and improvements are needed in all contributing steps. This article discusses the contributors related to the ground station architecture, and how newly developed technologies can further improve latency.

When the time from user request to actual image acquisition shortens, then then likelihood of catching an image of an on-going short-lived phenomena increases. And when the time from image acquisition to user analysis of the phenomena shortens, then the possibility to take action based on the analysis increases. Lower latency is a parameter as important to the development of valuable remote sensing applications as is the invention of new analysis algorithms or the use of new spectral bands.