Minimizing Latency by Using Existing Global Ground Networks

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Abstract: It takes a Low Earth Orbiting satellite approximately 100 minutes to orbit the Earth. With a Ground Station near one pole it is possible to achieve a contact with this satellite on each orbit. However, for a number of applications 100 minutes is not an acceptable latency as disaster will have developed (disaster monitoring), clouds will have moved (Meteorology), threats may have developed further (Security) and polluters may have left the crime scene (oil pollution monitoring). In principle the problem is that satellites are too slow!

Adding satellites in a constellation is one solution; however it is much more expensive than adding ground stations. Another ground station near the opposite pole will reduce the latency to about 50 minutes and satisfy a number of applications like Meteorology. However, for some aspects this is not fast enough (security, oil spill monitoring, disaster monitoring etc.).

The world is not fairly distributed. About 75 percent of the land mass lie north of the equator, and 80 percent of the world's population, 85 percent of the capital and 90 percent of the conflicts are in these areas.

As optical satellites usually record their descending passes it makes sense to locate stations on the Southern tip of the land masses, receiving the data shortly after it has been recorded by the satellite.

Commercial networks of stations near both poles and along the Southern fringe of the globes land mass exist. This results in a reduced latency for land applications. Broad communication lines (>155 MBit) are in place to many of these stations and data can be received anywhere in the world by adding a single Internet port.

This paper explains the logic and logistics of distributing ground stations around the globe with the focus on minimizing latency and thus opening for cost and time effective enhancements for remote sensing applications.