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Author: Mr. Andrew Nicol
University of Cape Town, South Africa

SATELLITE-TO-SATELLITE COMMUNICATIONS RELAY CONSTELLATION

Abstract

Communications between a satellite and its' earth based ground station are an intrinsic aspect of a satellites operational function. Satellite communications typically require each satellite to have their own link to a ground station. With available radio spectrum being a limited resource, regulation has resulted in satellites needing to make use of frequency sharing techniques for their transmissions. Satellites without a geostationary orbit have only a small window, often just a couple of minutes, in which they can communicate with their ground station. In addition, a satellites communications subsystem commonly consumes the majority of its' power budget, sometimes as much as three-quarters, even at low earth orbits.

Satellites without coverage of their ground station or those requiring uninterrupted communications have been limited to relay implementations using ground based infrastructure to perform the interconnect between the satellite and its' final destination, in some cases making use of additional satellites to achieve the relayed transmission. With satellite often streaming raw, unprocessed data; the requirements and overheads can be quite costly and adds to the congestion of the ground based networks.

This paper addresses the option of establishing a satellite constellation for the provision of communications relay facilities to academic, scientific and amateur satellites by means of a satellite-to-satellite mesh network topology. The establishment of the satellite constellation may be achieved using a new dedicated network of satellites with their express purpose to provide these communications facilities, and/or alternatively by defining protocols and methodologies that may be incorporated into new satellite projects to extend the network.

An offering of this nature would provide networked satellites with uninterrupted global communications coverage irrespective of their orbit. To optimize the constellations capabilities and keep congestion and latency to a minimum, the network would enact load balancing, prioritization, weighted shortest paths, as well as store and forward techniques taking into account the moving orbital positions relative to the destination ground station. The uninterrupted access to networked satellites provides operators with the ability to perform immediate actions such as attitude corrections should the satellite need to be repositioned to point at a celestial event or earth based disaster, alternatively more critically evasive maneuvers may be performed such as collision avoidance or mothballing to ride out a solar storm. With the constellation providing shorter range communications facilities, satellites making use of the system would require less power allowing for focus on streamlined functionality.