Public Abstract

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Transport, Network, and Data Link Layer Protocol Designs to Improve Geo-Stationary Earth Orbit Satellite Data Set Transmission Performance

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Geo-stationary earth orbit (GEO) satellites are wireless transmission media that provide near-earth Internet and Intranet data communication, but are limited to low Megabits per second transmission rates and small messages. They can provide communication infrastructure to rural earth locales, are not affected by terrorist events and natural disasters that render terrestrial channels unusable, and can replace terrestrial communication infrastructure. In this thesis, we present new designs for a transport layer data transmission protocol, a network layer routing strategy, and a data-link layer medium access control strategy. Through simulation, we show that our designs permit earth stations to transmit large data sets at high transmission rates over GEO satellites in less time than the Transmission Control Protocol variant Reno and frequency division multiplexing. Specifically, a 20 MB data set is transmitted in 1971 seconds by 64 of 128 earth stations over a hybrid network containing a GEO satellite and a terrestrial channel. The GEO satellite is configured with an 155.520 Mbps transmission rate, a 280 ms transmission delay, and 1.0e-04 bit error rate, and the terrestrial channel is configured with a 56 Kbps transmission rate, a 70 ms transmission delay, and zero bit error rate. Compared to TCP Reno and frequency division multiplexing over a GEO satellite with similar characteristics, which requires 6157 seconds of transmission time, our designs decrease transmission time by 67.86%. Our designs can be used by organizations that wish to transmit large data sets quickly over GEO satellites that exhibit large bandwidth delay products and large bit error rates.