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IMPLEMENTATION OF DYNAMIC ROUTING ALGORITHM FOR SPACE NETWORKING USING COTS OBCS

Abstract

Skoltech is working on a swarm satellite application to detect Gamma Ray Bursts autonomously. Coordinated observations of GRB are required for a robust identification, especially given noise levels in individual detectors, such observation requires a network that allows data transfer between satellites in orbit through inter-satellite communication and ground stations. One of the challenges in LEO satellite networks is the development of efficient routing algorithms. Here we describe a dynamic routing algorithm for a small LEO satellite constellation (ex. CubeSats) which can be used to build a simple computer network in space.

We propose a dynamic routing algorithm which is a function of time and orbit parameters (ex. Inclination and eccentricity). This algorithm updates the routing table dynamically based on satellite path prediction and time to optimize global coverage. Each node has a static node number (similar to IP address), network map is built in terms of available nodes (ex. Satellite or Ground station) corresponding to the current geographical position (which is a function of time). The routing table contains TLE elements of all satellites in it, and that database is updated dynamically. Each node is able to select the fastest path for the data packet at any moment time and use it for transmission. This algorithm can be applied as firmware or as a part of a Linux based operating system (ex. Kubos Linux).

The goal of this algorithm is to allow distributed system to work autonomously and provide real-time data transfer also can extend worldwide web to space by making ground stations work as gateways between satellites and also it can run on any COTS OBC (ex. ISIS computer, cube computer or Beaglebone black) also on any Linux distribution. We implemented our algorithm on Kubos Linux on Beaglebone black OBC. This algorithm can include more than 100 nodes, Kubos Linux allows the algorithm to run as a background application without disturbing the main mission applications, The novelty in our work is that we provide a dynamic routing algorithm which is ready to run on COTS OBCs with optimized run time and low complexity.