

23rd IAA SYMPOSIUM ON SMALL SATELLITE MISSIONS (B4)
Highly Integrated Distributed Systems (7)

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AN OVERVIEW OF PERFORMANCE ANALYSIS FOR ROUTING ALGORITHMS IN DISTRIBUTED
SATELLITE SYSTEM**Abstract**

Distributed satellite system, mainly consisting of the constellation and cluster-flying satellites, has been researched for many years, and more and more such kind of satellites has been launched into space. Based on the concept of F6, ANTS, L5SWS, etc., this paper supposes there exists a comprehensive distributed satellite system in the future, each member in this system shares its personal information, e.g., position, velocity, computing service or even power, to extend the performance of the whole satellite system. Network communication with high-performance is the foundation of this distributed system, and the routing algorithm is one of the key technologies in network communication, for providing some suitable strategies of transmitting data from one to the others.

Distributed satellite network is much different from the traditional network, due to its mobility, wireless, energy limitation, etc. For the purpose of better data transmission performance, a suitable data routing algorithm is necessary in this complicated network, to establish a robust communication network, combined energy efficiency, and QoS. Various kinds of routing algorithms have been researched so far, e.g., Directed Diffusion, Rumor, GPSR, LEACH, TEEN, TinyOS Beaconing. But little research has been done in applying these algorithms to the distributed systems in space, which is dynamic in 3-dimensional, and much different from sensor networks on the ground. So, this paper is going to evaluate the most used algorithms' performance, depending on some key network features, such as, throughput, end-to-end delay, packet drop rate, etc.

The testing scenario of distributed satellite system is already been established, consisting of an 8-satellite Walker-delta-2 constellation in MEO, three clusters of formation-flying and free-flying satellites in LEO. Every chosen routing algorithm is applied to the scenario to verify its capability of inter-satellite communication. Diverse kinds of satellites in the distributed system show unique requirements for the data transmission performance, which leads to some constraints that the applied algorithms must meet, e.g., low latency data transmission. Also, besides the measurements of the chosen routing algorithms, this paper presents some improved approaches upon analyzing the testing results.

This paper consists of five parts. The first part introduces the development and superiorities of distributed satellite system. The second part briefly analyzes the properties of each algorithm, which would be assessed by the following part. The next part focuses on the routing algorithms' performance evaluation in the testing scenario and some improvement measures. The concluding part comes out with a concise conclusion.