IAF SPACE COMMUNICATIONS AND NAVIGATION SYMPOSIUM (B2)
Near-Earth and Interplanetary Communications (6)

Author: Mr. Andreas Freimann
University Wuerzburg, Germany

Mr. Tobias Thiel
University of Würzburg, Germany
Prof. Klaus Schilling
University Wuerzburg, Germany

CONTACT PLAN BASED ROUTING IN DISTRIBUTED NANOSATELLITE SYSTEMS

Abstract

The technological evolution of small satellites in recent years has led to an increasing interest of universities and companies in the development of multi-satellite systems based on low-cost nanosatellites. A few of those distributed systems have already been launched and offer services for earth observation and communication applications. Therefore, the development of algorithms for efficient communication in this kind of distributed system is currently gaining attention in the scientific community. Taking advantage of the predictability of the dynamic topology of satellite networks in routing algorithms and multiple access schemes are interesting challenges. These algorithms will contribute to the evolution of nanosatellite based systems by an increase in performance and efficient usage of the limited resources of nanosatellites. The orbital movement of satellites can be calculated with sufficient accuracy for days in advance. Due to the relative movement of satellites in low earth orbits and ground stations a dynamic topology with intermittent connectivity results. Delay-Tolerant Networks can make use of the predictability of the contact times by calculating store-and-forward routes using so-called contact plans. Contact plan design has been an active research topic looking to optimize communication paths in Delay-Tolerant Networks. Existing contact plan design algorithms are based on simplified interference models and have only been evaluated in satellite systems with few nodes. We introduce an interference aware contact plan design algorithm and compare its performance to existing approaches by simulation and evaluation of real world scenarios. Detailed models of satellite constellations and formations have been integrated in our OMNeT++ based simulation tool to allow for evaluation of novel algorithms in arbitrary application scenarios. We compare our approach to an existing contact plan based approach and to a well-known random access protocol in different satellite scenarios and provide a detailed discussion of the simulation results.