

IAF SPACE COMMUNICATIONS AND NAVIGATION SYMPOSIUM (B2)
Mobile Satellite Communications and Navigation Technology (3)

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A SATELLITE SYSTEM WITH GROUND, AIRBORNE AND SPACE SUBSCRIBERS: A
CONCEPTUAL SOLUTION AND MODELING OF TRAFFIC

Abstract

A concept of a packet routing satellite system with three subscribers' segments – ground, airborne and cosmic (remote sensing and research spacecraft) is proposed. Three problems of implementing of the internet technologies in satellite networks are solved: 1) dynamic topology; 2) dynamic composition of nodes; 3) monitoring of current location of the subscribers (subscriber tracking). The network comprises low-, medium- and high orbital segments. The space vehicle is stabilized and implements intersatellite program-controlled communication lines of optic or phased array beams. By applications, the communication devices are divided into six types. A spacecraft establishes connections within the same segment (to the left and right of its orbital plane, and ahead and behind it in the same plane) and connects with vehicles of other segments (above and below). Switching of communication lines from one spacecraft to another is determined (the topology changes at discrete moments of time). All communication lines of the current topology are maintained even if they do not carry any data (communication devices aim at the current location of the transmitter or receiver, and when no data is transmitted, control signals are sent). The network exists permanently, like a landline network. A notion of the load state of a node is introduced: the volume of the buffers of the nodes is divided into levels of filling; the load state corresponds to the number of filled levels. Each node holds current information about the network by: 1) calculating current topology; 2) obtaining current information on the load state of nodes. Service data on updated values of orbital parameters and the load state of nodes ascend towards the nodes with the highest altitude via the communication lines with the use of multiple address routing, and therefrom are broadcast by radio by the principle of data transmission in navigation systems. "Tracking" of subscribers is implemented with the use of the database of current location of subscribers stored in the nodes of one of the upper segments. Among the network segments we can distinguish those adapted for data exchange with the ground, airborne and space subscribers. All segments transmit traffic from all subscribers with considering its division into priority classes and adaptation of segments to the subscribers of a particular class. Algorithms of functioning of the network aimed at solving the three above-mentioned problems are proposed. A simulation model of the network has been developed.