IAF SPACE COMMUNICATIONS AND NAVIGATION SYMPOSIUM (B2)
Advances in Space-based Communication Systems and Services, Part 1 (2)

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A STUDY ON ADOPTING NETWORK SLICING TO MULTILAYERED SATELLITE AND TERRESTRIAL INTERCONNECTED SYSTEMS

Abstract

In this paper, we propose a network slicing concept of multilayered satellite and terrestrial interconnected (STI) systems and show the effectiveness of our proposed slicing concept in numerical simulations.

There is a growing interest in a seamless interconnection of non-terrestrial networks (NTN) and terrestrial networks such as 5G. In the NTN, there will be various communication nodes deployed with different orbits or altitudes, such as geostationary Earth orbit (GEO) satellites, non-geostationary orbit (NGSO) satellites, and high-altitude platform stations (HAPS). Since the NGSO satellites move around the Earth and the communication links between satellites and the ground are affected by weather, each link has different communication qualities, such as delay, throughput, packet loss rate, and jitter, and these quality values vary in time dynamically. Furthermore, these systems will be operated by several different network operators. Even in such a complex environment, the network must be controlled to meet the end-to-end requirements of traffics.

We propose a network-slicing concept of multilayered STI systems to manage the network effectively. First, we describe a definition of the network slice. In this concept, several network control functions are needed, such as topology control, route control, and resource control. The topology control function determines a set of pairs of nodes that establish links under an assumption of the limited number of optical interfaces. The route control function determines a traffic route from the source to the destination node in the established links. Finally, the resource control function, including quality of service (QoS) control and congestion control, determines the amount of resources allocated to each traffic on the link. In our proposed concept, we utilize these network control functions to manage the network slice in the STI systems. Furthermore, we show the effectiveness of our proposed slicing concept using numerical simulations.