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MULTI-ORBIT GEO-LEO SATELLITE SYSTEM BASED ON THE 5G-NR ARCHITECTURE. LEGA SATELLITE SYSTEM

Abstract

The 3GPP Group is working on introducing the satellite component into the 5G architecture. However, the satellite component is currently assigned only for connecting remote service areas to the core network as the backbone or providing connectivity to subscribers in remote areas to the 5G terrestrial network. In both variants, the 5G system relies on the terrestrial segment that hosts the core network, and a network of cloud data centers that provide information services to consumers. This approach does not fully reflect the potential inherent in satellite systems and restricts the propagation of the 5G service area. The network of inter-satellite links is the basis of the LEO data network. The payload of the LEO satellite is equipped with an SDN router to provide distribution of the data flow inside of the LEO data network and to the geostationary satellites. In addition, the LEO satellites are equipped with onboard computing modules to support fog and edge computing for Internet-of-Things services. The LEO satellites could be designed based on the current LEO satellite design approach or the Distributed satellite architecture. A segment of the base network and cloud data centers could be placed in the geostationary orbit. Interconnection between the LEO and GEO segments will be provided by satellite-repeaters of the LEO and GEO segments. The several specialized LEO satellites-repeaters are included in each of the LEO orbital planes. The GEO satellite serves approximately one-third of the Earth's surface and can support connection with LEO satellites above that part of the Earth's surface. Three GEO satellites-repeaters will provide the connection with the entire LEO satellite constellation. The software-defined networking and network function virtualization are the technology-basic for this. The GEO satellite-cloud data center and GEO satellite-core 5G-NR network are connected to the satellite-repeaters by a geostationary data transmission network. The GEO satellite - core 5G network is the intelligence of the satellite network and provides all functions of the satellite 5G-NR network control in control and data planes. The proposed architecture allows for the improvement of the 5G-NR satellite-based system and develops the system which will be independent of the level of the ground infrastructure. The proposed solutions are not an alternative but complement the existing systems. At the same time, the quality of services and reliability of their provision will not depend on the state of terrestrial telecommunications infrastructure.