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STUDY ON INSTANT DATA SERVICE SYSTEM BASED ON GEO-LEO INTER-SATELLITE LINK

Abstract

During the past 10 years, with the construction of LEO satellite constellations, more and more small satellites have been launched into LEO orbit, which have brought heavy pressure to the conventional ground station for TTC and mission planning and scheduling. Considering the GEO satellite has the advantages of orbit station keeping and a wide coverage region on the earth. Therefore, through the fast inter satellite link between in-orbit GEO commercial satellite and LEO small satellites, the massive small satellites can be operated and managed without ground station infrastructure supporting. This paper presents the instant data service system study based on GEO-LEO Inter-Satellite Link, which is joint project between Beihang University and China Telecom. TianTong Sat is a GEO mobile communication satellite which supply S-band commercial communication service. QX-1 Sat is a LEO small satellite for remote-sensing and IoT mission. Firstly, it established an inter satellite link model and simulated the satellite coverage range, ISL length, ISL visibility and data transmission between GEO and LEO satellites on condition the given orbit parameters. It also analyzed the results with conventional ground station methods. Secondly, it gives the instant data service system design. The system architecture has been divided three layers. 1) space section (TianTong Sat and LEO Sat) , 2) ground application section(types of user IoT nodes), 3) cloud service section. it based on Tianyi public cloud service. Thirdly, the S-band high dynamic ISL transceiver has been developed. It described the technical solution. And give the key hardware and software function design which is based on Loongson platform+ strong real-time operating system (QX -OS). The tailored ISL protocol has been designed in order to reduce core network access time. Lastly, the system simulation and the ground testing were conducted. The results showed that the instant data service system solution was satisfied. It has a broad prospects for LEO small satellite application.