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SPACE INTERNETWORKING SERVICE BASED ON DTN FOR INTERPLANETARY INTERNET

Abstract

Space exploration and Internet service are technologies that are currently complementary and make it possible to realize the interplanetary Internet (IPN) that would interconnect stations on the Earth, Moon and other planets in the solar system. As the critical and basic technology for IPN, space internetworking service (SIS) mainly resolves connection issues between heterogeneous subnets in space applications. In future space exploration and IPN, SIS would be able to provide access services for spacecraft, satellite, planets and hence efficiently transfer data back and forth. Because of extreme environmental conditions, such as solar storms and magnetic interferences, large and variable transmission delay, high link error and dynamic toplogy, the existing terrestrial Internet and TCP/IP suite, requiring stable connectivity and short transmission delay, can't be satisfied in SIS.

Delay/disruption tolerant network (DTN) is a general message-oriented overlay network architecture that can be adopted to space networks and used to implement SIS, making DTN a very promising approach for interconnecting space communication system. Starting from the communication technology and architecture of space network and interplanetary Internet, this paper presents the system architecture of SIS based on DTN and then analyzes the key components and working patterns in detail, including protocol stack, security service, message forwarding mechanism. Focusing on the characteristics of SIS, the paper discusses current application needs for space exploration, and proposes a real scenario of Mars exploration. The network simulation platform is founded to verify the effectiveness and advantage of some representative DTN protocol used in SIS. The results show that their performance is acceptable and satisfy the requirement of SIS. This paper ends with the discussion about technical problems and challenges we are facing at present. Through the discussion, we propose some future research directions such as routing and QoS control.