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CONCEPTUAL DESIGN OF THE SPACE SUPER COMPUTING

Abstract

A space mission of Space Super Computing (SCC) represents a comprehensive utilization of various orbital man-made spacecraft to construct an infrastructure for massive observation data real-time processing in LEO&NEO or beyond. The mission can bring various benefits to the future human space expedition: high scientific return, evaluation of in-suit satellites resources utilization, satellites networking in LEO or beyond, formation flying and technological promotion for inter-satellites and ground-satellites communications.

This paper conceptually delineates the SSC from the architecture and functionality views. The SCC foresees a space super computational platform composed of the following modules: 6 or 8 computational satellites constellation (CSC) as distributed computing platforms, 3 relay satellites in GEO as the inter-CSC date relaying paths, the laser based inter- and intra- satellites communication links and 2 layers networking (2LCN). Each CSC will be constructed by one or two central computing satellites and dozens of small satellites formation flying around the central ones. Hierarchically, the architecture of the computational small satellites with a concern of modularity and reliability and the high-performance processing SoCs (System on Chip) are also covered in this paper. Toward the SCC, the on-orbit spacecrafts, such as remote sensing satellites and relay satellites, can be connected into a network in space. The ground station tasks are sent to SCC, which will be partitioned and distributed among CSCs. The corresponding crude sensing data observed by satellites is transferred into SCC in a shortest path manner through outer layer path of 2LCN, depending on the location and flying-by time of the observational satellites. Data exchange between CSCs using inner layer of 2LCN. Since the massive sensing data is no longer transferred and stored in ground stations, the available information can be extracted in less power dissipation and less time and sent to ground with lower bandwidth. The required techniques progression are reviewed and analyzed in here. The SSC will be an expedition to utilize various man-made resources in space and the first infrastructure for anywhere and anytime connecting and processing in space. The challenges of increasing the interests of monolithically utilization on exploration and exploitation on space resources and inspiring new generations about science, technology and space has been accepted.