Smart Data Node In The Sky (SDNITS), Communications System Architecture

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Abstract: The design of the telecommunications network to serve the high data producing, spatially diverse satellites so that the high volume of data is conveniently and efficiently transferred to the desired location on ground a system of satellites must be defined. The system consists of multiple satellites in different orbits; these orbits may be circular, elliptical or geo-synchronous in nature. Each of the satellites in the network generates high data volume that needs to be transmitted to the ground station in near real time to be distributed to the users. Each satellite's orbit must be selected so that it supports the maximum science data generation and at the same time helps communications between the satellite and ground. These satellites embody the high data volume science satellites of the future.

A master satellite that has direct or indirect communications links with all the science satellite will be placed in an orbit that may be circular, elliptical or geo-synchronous. The actual optimal orbit selection involves many parameters of the system. The master satellite gathers the data from all these science satellites and transmits it to the ground station in a predetermined manner. The data transmission from these science satellites to the master could be simultaneous or the master satellite may solicit their transmission on an individual basis. This master satellite is called Smart Data Node In The Sky (SDNITS).

In this paper we will discuss: the steps for adequately designing such a complex telecommunications system SDNITS; algorithm development for this process; specifications to be levied on the interfacing subsystems; type of the system e.g., the usual Radio Frequency system or a laser communications system. Within the Radio Frequency system, usual residual or suppressed carrier system or a spread spectrum system would be needed etc. Preliminary design parameter values such as the power amplifier rating, antenna size and slewing, Doppler frequency and rate, ground station antenna slewing and acceleration, visibility times at the ground station and for satellite-satellite communications and overall system performance are also presented in this paper.