J Aeronaut Aerospace Eng 2016, 5:2(Suppl)
http://dx.doi.org/10.4172/2168-9792.C1.014

2nd International Conference and Exhibition on
Satellite & Space Missions
July 21-23, 2016 Berlin, Germany

Intelligent peer to peer mesh satellite-extraterrestrial deep space network: Interplanetary communication and data collection based on semantic artificial bee colony algorithm using autonomous cooperative agents

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NASA's Deep Space Network (DSN) is a network of satellites, antennas, and interplanetary probes. While effective, the current two-way communication link used for probe control and data collection, has some limitations. This paper dicusses how to scale and improve the current Deep Space Network by integrating a new peer-to-peer mesh satellite architecture based on Artificial Bee Colony Algorithm (ABCA) using autonomous cooperative agents. This paper is divided into three parts. First, the architecture is discussed. It is composed of a new central semantic routing algorithm between satellites, a data forwarding mechanism, and a winter cluster resiliency scheme. Second the interaction, responsibilities, and cooperation between autonomous software agents that govern each satellite is discussed. Finally the integration of this infrastructure with the existing DSN infrastructure is discussed.

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Mission operations optimization: Is capital investment needed to increase throughputs and profits?

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Maximization of resource utilization in satellite industry can be achieved through application of Operations Research and Optimization methodologies. More than 25% percent increase may be reachable even without capital investment. This talk presents two scheduling problems arising in Satellite Mission Operations. Planning and image acquisition scheduling for an outward-looking satellite that monitor's resident space object and space debris is a complex optimization problem. With several hundred thousands of pieces of space debris in the Earth orbits, tracking the debris for advanced planning of satellite Manoeuvres to avoid collisions is becoming very important. The other planning problem deals with rapid scheduling performed on-board optical satellite that could provide enhanced and more accurate cloud avoidance in image acquisitions. Scheduling problems in satellite industry are characterized with rich set of constraints and complex optimization cost functions and may be called rich scheduling problems. State-of-the art optimization methodologies including metaheuristics provide means of generating close-to-optimal solutions in a reasonable time and within realistic operational scenarios. Similar methodologies have potential to increase throughput of communication satellites and provide better service for larger number of high priority customers.

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