26th IAA SYMPOSIUM ON SMALL SATELLITE MISSIONS (B4)
Constellations and Distributed Systems (7)

Author: Mr. Jos van 't Hof
Delft University of Technology (TU Delft), The Netherlands, josvth@gmail.com

Mr. Visweswaran Karunanithi
Technical University of Delft/Innovative Solutions In Space.BV, Delft, The Netherlands, V.Karunanithi-1@tudelft.nl
Dr. Stefano Speretta
Delft University of Technology (TU Delft), The Netherlands, s.speretta@tudelft.nl
Dr. Chris Verhoeven
Delft University of Technology (TU Delft), The Netherlands, c.j.m.verhoeven@tudelft.nl
Prof. E.W. McCune
Delft University of Technology, The Netherlands, United States, E.W.McCuneJR@tudelft.nl

LOW LATENCY IOT/M2M USING NANO-SATELLITES

Abstract

Nano-satellite IoT/M2M missions are gaining popularity in recent time. Various companies have launched their pilot missions last year in 2018 and all these companies intend to place a constellation in (V)LEO that can communicate with low power sensors on the ground (sometimes remote locations) and relay it back to the end-user who is monitoring these sensors. The present IoT missions are focused on applications where latency in relaying back the sensor data is not very critical. In the future, satellites can play an important role in 5G where the nano-satellite constellation can complement the terrestrial mobile network. Some of the challenges faced by existing terrestrial IMT (International Mobile Telecommunication) envisioned for 5G where satellites have an advantage are: 1) Access to remote locations on land, 2) Access to Maritime data, 3) Larger coverage per cell, 4) Communicate with fast moving objects: trains, aircraft, 5) Collection of weather information from remote locations, 6) Access to locations affected by natural disaster.

This paper discusses two possible architectures of using nano-satellites for low latency IoT/M2M, by presenting information such as, number of satellites needed, number of orbital planes needed, link-budget analysis and communication strategy. The first proposed architecture will comprise of a self sustaining network of nano-satellites that communicate with low power, low data-rate sensors on the ground and relay the data to rest of the nano-satellites in the network using Inter-Satellite Links (ISL), which is downlinked by a nano-satellite that is in the view of a ground station that is connected to IMT. The second proposed architecture will use nano-satellites to communicate with low power, low data-rate sensors on the ground and relay it to satellites that intend to provide internet from space (Mega-constellation). The internet constellations considered in this study for the second architecture are: Starlinks from Space-X, OneWeb, TeleSat and Astrom. Using both these architectures, it can be seen that the latency can be reduced considerably.