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LCNS – ADVANCED DELAY TOLERANT NETWORK TESTBED

Abstract

Moon exploration is emerging as the next global strategic priority in space exploration with highly ambitious governmental and commercial missions over the coming decades for a permanent return of mankind to the Moon. The Moonlight's Lunar Communications and Navigation System (LCNS) is an ESA program proposing the development of new Comms (Communication) and Nav (Navigation) European capabilities and services to be provided to those many missions on and around the Moon through a dedicated infrastructure that is to be deployed. Telespazio is Prime Contractor of a large consortium including small companies and research institutes. An important capability of the Moonlight system is the interoperability with other Space Agencies, in particular NASA in the context of the ARTEMIS program.

The LCNS architecture is composed by a dedicated satellite constellation around the Moon and an Earth Ground Segment that allows the control and planning of the whole mission and the provisioning of the communication and navigation services. Moreover, Communication and Navigation User Terminals will be developed during the project. This system will become an important enabler for the potential of the future Lunar missions, providing high-rate and low latency communications, better and safer landing and navigating capabilities, and less on-board complexity. This will allow more science per mission as well as create opportunities for missions with smaller budgets. The paper address three different topics as below summarized:

1) Provide the overview of the Moonlight's LCNS Communication Services and architecture.

2) Analyze the enabling trends and technologies concerning the space internetworking emulations, focusing on what has been done and what needs to be developed for a seamless integration within an End-to-End System Simulator.

3) Presents the testbed architecture used for advanced simulations of complex Space Internetworking scenario focusing on the real-time network data relay services, a core service of LunaNet v.5 [3].

This paper aims to present a comprehensive and unique analysis of the available space internetworking testbed and the latest findings coming from such innovative testbed.

Keywords: Moonlight, LCNS, Lunar Communication Service, Delay Tolerant Network, CCSDS, CFDP, AMS, BSS, LTP, TCP, UDP, Wireshark, CORE.