Open Thesis / Project

Exploring Non-Terrestrial Networking Using off-the-shelf IoT Devices

Thesis Type

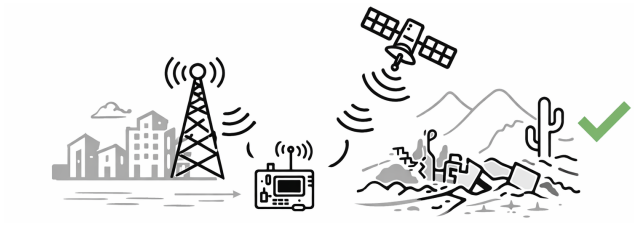
Master Project / Master Thesis

Motivation

Falling launch costs and large low-earth orbit (LEO) constellations are driving a new phase of connectivity: non-terrestrial networking (NTN). By extending established ecosystems such as cellular and LoRa beyond terrestrial infrastructure, NTN promises global communication for embedded devices even in remote environments. Cellular satellite services are already commercially accessible and recent LoRa chipsets introduce LR-FHSS modulation and S-Band/L-Band support to enable low-power satellite links, indicating support is rapidly moving toward off-the-shelf IoT hardware.

Despite this progress, the ecosystem remains fragmented and practical performance characteristics are not yet well understood. Development platforms such as Nordic's nRF9151-SMA-DK [1] for cellular NTN and Semtech's LR2021 evaluation kit [2] for LoRa satellite communication illustrate the technical potential, but questions regarding coverage, building penetration, latency, reliability, and energy consumption remain largely unanswered.

The goal of this thesis/project is to survey available devices, select a good candidate, and experimentally evaluate real-world behaviour to assess the readiness of NTN for constrained devices.



[1] `https://tinyurl.com/RF9151-SMA-DK`

[2] `https://tinyurl.com/LR2021-EVK`

Goals and Tasks

Within this context, students can explore several directions and perform different tasks, such as:

- Understand the fundamentals of NTN, including cellular and LoRa-based satellite communication technologies;
- Survey available hardware platforms, development kits, and service providers enabling satellite connectivity for constrained IoT devices;
- Design and implement an experimental setup to access at least one NTN service using suitable evaluation hardware (e.g., nRF9151-SMA-DK or LR2021 EVK);
- Experimentally evaluate real-world performance with respect to coverage, building penetration, latency, reliability, and energy consumption.

Target Group

- Students of ICE/Telematics;
- Students of Computer Science;
- Students of Digital and Electrical Engineering.

Required Prior Knowledge

- Basic knowledge of wireless communication;
- Solid skills in Python and C programming;
- Experience with micro-controllers and with embedded development.

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