2023-06750 - Research Internship - Performance Analysis of Emerging Technology for Terrestrial to Satellite Internet of Things

Level of qualifications required: Master’s or equivalent
Function: Internship Research
Level of experience: From 3 to 5 years

About the research centre or Inria department
The Inria research centre in Lyon is the 8th Inria research centre, formally created in January 2022. It brings together approximately 300 people in 16 research teams and research support services.

Its staff are distributed at this stage on 2 campuses: in Villeurbanne La Doua (Centre/INSA Lyon / UCBL) on the one hand, and Lyon Gerland (ENS de Lyon) on the other.

The Lyon centre is active in the fields of software, distributed and high-performance computing, embedded systems, quantum computing and privacy in the digital world, but also in digital health and computational biology.

Context
This work will take place in the Inria Agora research team in Lyon, in conjunction with the ANR STEREO national research project. The internship student will be supervised by Dr. Juan Fraire (Inria Agora) and will work closely with Prof. Alexandre Guittion (Université Clermont Auvergne) and Dr. Oana Iova (Inria Agora, INSa Lyon).

Assignment

Context
Recent years have witnessed the surge of several new technologies that enable long-range communication (up to tens of kilometers) with extremely low-power consumption (18mA at 7dBm). These networks play a major role in the Internet of Things (IoT), where they enable architectural alternatives with degrees of scale and flexibility hitherto impossible, including space-terrestrial communication. The most representative technologies for long-range networks are LoRa [1] for terrestrial communications, and LR-FHSS [2] for space-terrestrial communications, combined with the LoRaWAN [3] protocol, a breakthrough technology for smart object data collection that has gained global momentum.

Assignment
ISM bands are portions of the radio spectrum reserved internationally for industrial, scientific, and medical (ISM) purposes, and are free of use. However, devices communicating in these bands have to deal with interferences from all the technologies and networks deployed on this ISM band, and users have no regulatory protection. If any type of Quality of Service (QoS) is needed, companies need to pay a licensing fee to acquire portions of the radio spectrum for the exclusive right to transmit on an assigned frequency within a certain geographical area. In exchange, the company can be assured that nothing will interfere with their devices’ transmissions.

While most of the technologies developed for the Internet of Things are either to be used in the ISM bands or in licensed bands, LR-FHSS has the special characteristic that it can be deployed in any type of band, as long as the company has at least 120kHz of spectrum available. This project aims to compare the performance of LR-FHSS in ISM bands vs. licensed bands.

Bibliography

Main activities
The student will have to:

- Characterize the differences between ISM and licensed bands in terms of bandwidth, maximum transmit power, etc.
- Characterize the differences in deployment of LR-FHSS in different types of bands (ISM vs. licensed).
- Evaluate in simulation the performance of LR-FHSS in a single network deployment.
- Evaluate in simulation the performance of LR-FHSS in the presence of multiple co-located networks, and characterize how the performance is impacted by intra-technology interference.
- Evaluate in simulation the performance of LR-FHSS in the presence of multiple co-located technologies, and characterize how the performance is impacted by cross-technology interference.

Skills

General Information
- Theme/Domain: Networks and Telecommunications
- System & Networks (BAP E)
- Town/city: Villeurbanne
- Inria Center: Centre Inria de Lyon
- Starting date: 2024-01-01
- Duration of contract: 6 months
- Deadline to apply: 2023-11-11

Contacts
- Inria Team: AGORA
- Recruiter: Fraire Juan Andres / juan.fraire@inria.fr

About Inria
Inria is the French national research institute dedicated to digital science and technology. It employs 2,600 people. Its 200 agile project teams, generally run jointly with academic partners, include more than 3,500 scientists and engineers working to meet the challenges of digital technology, often at the interface with other disciplines. The Institute also employs numerous talents in over forty different professions. 900 research support staff contribute to the preparation and development of scientific and entrepreneurial projects that have a worldwide impact.

Instruction to apply
- Deadline to apply: 2023-11-11
- Duration of contract: 6 months
- Town/city: Villeurbanne
- Inria Center: Centre Inria de Lyon
- Recruitment Policy: As part of its diversity policy, all Inria positions are accessible to people with disabilities.

Warning: you must enter your e-mail address in order to save your application to Inria. Applications must be submitted online on the Inria website. Processing of applications sent from other channels is not guaranteed.
Required Skills
Applicants studying for a Computer Science or Telecommunication Engineering degree are encouraged to apply. Background in mathematics and wireless networking as well as practical skills with programming languages (e.g., C/C++, Python) are welcomed. Fluent English level is mandatory, French language is not mandatory but welcomed. We look for empathic proactive and self-driven students.

Benefits package
- Partial reimbursement of public transport costs
- Social, cultural and sports events and activities

Remuneration
Gratification at €4.05 per hour