Current Activities on Non-Terrestrial Networks

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1 New Research Directions on Non-Terrestrial Networks

Non-terrestrial networks (NTN) based on constellations of satellites with low or medium orbits are developing very fast all over the world. NTNs already constitute one of the most creative domains of communication networks research and engineering worldwide, in a broad set of domains including data communications through universal Internet access, IoT data harvesting, and Earth observation and sensing.

More generally, 6G will feature the integration of 2D cellular networks and several types of 3D NTN networks. The latter comprise, beyond Low Earth Orbit (LEO) or a Meadium Earth Orbit (MEO) networks, UAV networks, or mixes of LEO, MEO and geostationary (GEO) constellations. The former will comprise several types of cellular organizations (e.g. multi-tier).

Many new questions were analyzed at the system level by S.K. Jhawar, A. Balkrishnan, P. Martins and F. Baccelli: the technical questions concern achievable throughput, handovers, association, scheduling and routing. Economic questions on interactions and interference between 5G terrestrial networks and these non-terrestrial networks.

A new NTN platform was also developed by P. Martins lately.

2 Ongoing NTN Industry Projects

A 3 year collaborative project entitled "5G MmW" funded by BPI started mid 2024 with the company "Constellation Technologies" (now UNIVITY) on the design and launch of a LEO constellations using MmW and aimed at complementing terrestrial 5G MmW radio access. The partners are IMT (F. Baccelli and P. Martins), Onera and Greenerwave. Discussions with other industrial partners like Kineis are also underway.

3 International Projects

A STAR Hubert Curien project started in 2024 for fostering the scientific collaboration between France and South Korea on these questions. This project is based on a strong

collaboration with a group of young faculty in communications in South Korea. The universities involved are KAIST and Sungshin University.

A SNS project on the matter was initiated in 25 by stalled due to the last minute defection of Cap Gemini.

4 Workshops, Conferences

A one day workshop on System Level Analysis of Non-Terrestrial Networks will be organized at the forthcoming EUCNC & 6G Summit to be held in Poland in June 2025 `https://www.eucnc.eu/`. The Program Committee was composed of F. Baccelli, C.S. Choi (Hongik University, South Korea) and T. Riihonen (U. Tampere, Finland).

Invited lectures were given on the matter by P. Martins, A. Balakrishnan and S.K. Jhawar at EUCNC 26 in Poznan and by A. Balakrishnan and S.K. Jhawar at IEEE Mascots in Paris. Keynote lectures were (or will be) given on the matter by F. Baccelli at WIOPT 25 (Linköping, Sweeden) and NCC 26 (Hyderabad, India).

5 Plans

The plans discussed at the meeting are based on the assets listed above and are the following:

- Expand the quite novel research directions on the dynamics of LEO constellations.
- Initiate a new line of resarch on the interplay between stochastic geometry analysis and the platform developed by P. Martins.
- Deepen the interaction with Univity.
- Develop interactions with IRIS 2, if possible.
- Structure a national project on the matter, if possible.