Proposition de recherche doctorale

Physical layer-based geocasting using multidimensional modulations and antenna arrays

Mots clés :
- Directeur de thèse : julien SARRAZIN
- Co directeur de thèse : philippe DE DONCKER
- Co-encadrant(s) :
- Unité de recherche : Laboratoire d'électronique et d'électromagnétisme
- Ecole doctorale : École Doctorale Informatique, Télécommunications, Électronique de Paris
- Domaine scientifique principal: Sciences et technologies de l'information et de la communication

Résumé du projet de recherche (Langue 1)

The unbounded nature of the wireless medium makes wireless communications unsecure since signals can be easily intercepted by malicious users. This naturally raises privacy issues that are becoming more and more important considering the expected massive number of user connections considered by 5G. Mobile communications, and especially 5G, often need access to personal data (e.g., position, identity, etc.) to offer the appropriate service a user needs and for the network to differentiate accordingly the quality of service. Different services/users naturally require different features (e.g., data rates, latency, etc.) but also different security levels. To offer security in wireless communications, key-based cryptographic approaches can be implemented at the network layer. However, key distribution within the network is difficult to implement practically, especially with 5G being an open heterogenous network platform to handle the large spectrum of applications (e.g., remote health care, Internet of Vehicle, IoT). Furthermore, the computational capabilities of IoT nodes are typically limited and key-based security using encryption/decryption algorithms may be too demanding. Consequently, recent years have witnessed a growing interest towards physical-layer security (PLS). PLS usually takes benefit of the propagation channel in order to precode the data to be transmitted in such a way that only the legitimate user can retrieve the data. Malicious users receive degraded waveforms that avoid correctly estimating the received symbols. Several approaches have been presented by different scientific communities, namely, information theory, signal processing, digital communications, and antennas and propagation and typically use antenna arrays and channel state information at the transmitter in order to maximize the SINR at the legitimate user location. This technique relies therefore on the randomness nature of the channel to ensure a certain degree of secrecy. It is also possible to inject artificial noise (AN) to further enhance the security of the transmission. The AN is orthogonal to the data at the receiver location but degrades significantly the data at any other locations, thereby jeopardizing any attempt from a malicious user to retrieve the data. The goal of this PhD is to investigate and optimize PLS techniques thanks to a deep analysis of the propagation channel statistics in order to ensure high level of security in various scenarios.

Informations complémentaires (Langue 1)

- The PhD candidate will work at the L2E lab (http://www.l2e.upmc.fr/en) of Sorbonne University (www.sorbonne-universite.fr/en), located in Paris, France, with co-supervision from Philippe De Doncker from the Opera lab (http://opera.ulb.ac.be/opera/) of the ULB University (http://www.ulb.ac.be/ulb/presentation/uk.html), located in Brussels, Belgium, where regular stays will be organized.
- The candidate should hold a Master Degree in Electronics, or equivalent. A high degree of self-motivation and excellent communication skills are expected.
- Duration: 3-year program, starting from September 2018 onwards
- Application deadline: 11th May 2018