

Post-doc proposal

Radio Environmental Maps: network implementation and performance evaluation

Subject description:

The Radio Environmental Map [1][2] is a promising concept for storing radio environmental information that can be used to enhance radio resource management in wireless networks. The concept of REMs has been first proposed by the Virginia Tech team [1]. They define REM as a database that contains information on the radio environment, including geographical features, available services, spectrum policies and regulations, location and activities of radio devices, past experiences etc. This database can be located anywhere in the network with different possible architectures: centralized, distributed or hybrid. Related with the architectural aspects, the amount of signalling overhead needed to disseminate the REM is of concern and treated in [4]. The REM proposed as such, has been mainly considered for IEEE 802.22 WRAN scenarios and applications [4][5][6] where the focus is on opportunistic spectrum access on TV whitespaces.

Our conception of REM is more general than the existing database approach described above. We define REM as an intelligent entity which stores incoming environmental data but also *interpolates* this data to benefit from the spatial correlation that exists in the data. The concept of collecting geo-localized information on the radio environment and constructing a *map* using this information has also been investigated and developed further by other research groups [2][7][8]. In these works, REMs have been handled in a more general Cognitive Radio (CR) context than TV whitespaces and it is considered as a mean to represent spatio-temporal characteristics of the radio environment by using concepts and tools from spatial statistics, like point processes, spatial random fields, pair correlation functions, point interaction models, spatial interpolation techniques, etc.

Post-doc activity:

The post-doc work will be a part of the Orange Labs contribution to the FP7 Faramir European project [9]. The post-doc activity will investigate two axes related to the REMs construction and exploitation.

REM Construction: The REM information is built based on the terminals' measurement data, combined with location information and reported to a functional entity. This entity exploits this information to build a complete map by interpolating the geolocalized measurements. Because measurement reporting is costly in terms of signalling overhead and battery consumption, the main challenge while building a REM is to find the optimal trade-off between the REM quality, i.e. the REM information accuracy and the measurements requested from the terminals.

Performance evaluation of REM use cases: In cellular networks, the REM can be used to improve the network performances [3], or to minimize the operational costs. We have identified several use cases where using REMs may improve the network management and optimisation. This task will give a quantitative performance evaluation of the REM introduction for identified radio resource management use

cases in terms of implementation costs and enhancement of key performance indicators.

Candidate profile:

The candidate is required to have a PhD degree on wireless telecommunications, preferably with knowledge on the 3GPP LTE standard and also on probability theory. Knowledge on spatial statistics is a plus.

Place of work:

Orange Labs
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Contract duration:

1 year

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References:

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