

PhD Thesis: Study and application of multi-user transmission systems for the indoor power line network

These

DeadLine: 07/07/2009

marie.lebot@orange-ftgroup.com

Global context and state of art

This study is dedicated to indoor power line communication (PLC) systems. Within the Orange Labs, it has a direct link with the general studies that are carried out in the field of digital communications and also with their application in an in home network scenario. However, up to now, our investigations for power line transmission have been limited to the single user case, the goal being uniquely to increase throughput, using efficient advanced multi-carrier modulation schemes to get a better use of the PLC channel specificity, and robustness, using powerful error correcting codes and signal processing tools to fight against the impulsive noise.

The aim in this PhD proposal is to extend our research to the multi-user case in order to integrate this context which will become the more and more frequent situation in the future. If the industrial PLC products are not really fully optimized for the multi-user case, on the research side many works have already started on this topic.

Objective of the thesis/Expected results/Scientific and technological challenges

A major difficulty for a telco operator to find the right positioning with respect to PLC in the indoor environment is related to the absence of a widely accepted telecommunication standard. For instance the future IEEE P1901 standard will include no less than 3 distinct physical layers using different types of multi-carrier modulations and error correcting codes. The goal in this PhD thesis is to propose multi-user systems that can be adapted for all the multi-carrier modulation schemes that are likely to be used in the future. If, in the OFDM case, OFDMA is a well-known access technique in the radio context, it has not yet been envisioned in practice for the indoor PLC network. Concerning the access solutions using different modulation schemes, as the one based on OFDM/OQAM which is at the centre of our own research, or the Wavelet OFDM, at the basis of the HD-PLC solution proposed by Panasonic, or, also, Filtered Multi-Tone (FMT), studies are only at their beginning.

The expected results from this thesis are, from one hand, a comparative analysis of the performance provided by these different systems in the case of typical multi-user configurations in indoor PLC and, from the other hand, the establishment of working multi-user rules: modulation/demodulation, resource allocation, that could be applied in a generic way to the set of all the multi-carrier modulation schemes that can be of interest.

It is known that in the single user case OFDM alternatives can be beneficial in providing an increase throughput. In the multi-user case, these alternatives (OFDM/OQAM, WOFDM, FMT) can not only increase complexity but also create Mutual Access Interference (MAI). The scientific and technological challenges will be to show how to cancel or to use all the interferences related to these different advanced multi-carrier modulation schemes.

Proposed methodology

To efficiently contribute to the proposed PHD study, a knowledge corresponding to a graduate degree level in digital communication and digital signal processing is mandatory together with the ability to use the present state of art software (C/C++, matlab). Complementary skills related to the PHY and MAC layers of existing wired or wireless systems will be appreciated.

Location: The thesis will take place at Orange Labs, Rennes, France

Supervisors: Marie Le Bot, Pierre Siohan

<http://gdr-isis.org/rilk/gdr/Kiosque/poste.php?jobid=3334>