High frequency communication over twisted pair using software defined radios

To keep up with emerging technologies, telephone companies (Telco's) are forced to offer higher data rates over twisted pair cables than ever before. To achieve such high performance, the distance between the access point in the street and the customer premises equipment is shortened. This enables the use of higher frequencies for communication. Current technologies like VDSL2 use frequencies up to 17 MHz. In future technologies, even higher frequencies will be used, e.g. up to 500 MHz in XG.Fast.



Fig 1: Small UTP binder

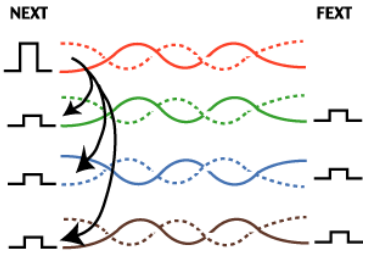

Fig 2: The crosstalk problem

Twisted pair access networks have a very specific topology. A cable binder containing a large number of twisted pair is connected to the access point in the street and branches out to a number of customers. This topology exhibits a major drawback. In the binder, the twisted pairs are subject to mutual electromagnetic coupling, which results in crosstalk. Every twisted pair in the binder thus disturbs the communication process of its neighbors. This crosstalk is the main limiting factor for the performance of twisted pair access networks.

While there are many techniques available that help to alleviate the crosstalk problem, unfortunately the crosstalk problem gets much more severe at the high frequencies that will be used by future technologies. It is uncertain whether the existing techniques will still work for these high frequencies. The goal of this proposal is to investigate how these problems translate to practice. To this end, a test bed will be built - using software defined radios (SDR)[1] which are connected by unshielded twisted pair (UTP) cables - that implements an OFDM (DMT) based transmission scheme. This test bed will be used to compare the performance of different existing crosstalk cancellation algorithms, at a frequency of about 400 MHz.

Your work

First, the test bed will be realized and the existing crosstalk cancelation algorithms will be studied. When the test bed is fully operational and the different algorithms from literature are understood, the direct- and crosstalk channels will be characterized and the algorithms will be analyzed in practice.

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Number of students: 2 Work load: literature 30% - implementation 50% - validation 20%

[1] Software-defined radio (SDR) is a radio communication system where components that have been traditionally implemented in hardware (e.g. mixers, filters, amplifiers, modulators/demodulators, detectors, etc.) are instead implemented in software. The SDR's that will be used in this project are programmed in LabVIEW.