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Physical-Layer Multicasting for Digital Subscriber Line (DSL) Systems

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Workload: LITERATURE:30%, IMPLEMENTATION:40%, VALIDATION:30%

DESCRIPTION

Digital subscriber line (DSL) access networks have a very specific topology. A cable binder containing a large number of twisted pairs 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. For downstream transmission, i.e. transmission from the access point in the street to the customer premises, crosstalk can be relieved by coordinating signals by means of so-called vectoring and precoding based transmission schemes.

For some applications, there is a group of users that are interested in the same data of common interest. Examples are live streams of sporting events, IPTV, video conferencing, and real-time feeds of continuous data such as stock prices. Physical-layer multicasting takes advantage of this common interest, by transmitting data simultaneously to all users in the group, employing one common precoding vector to achieve a high SNR for all users. As in this case the transmitted symbol stream is the same for all users, interference is no longer present between users of the group!

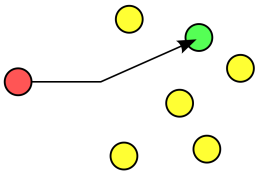

Figure 1: Unicast

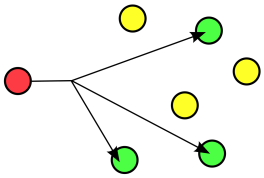

Figure 2: Multicast

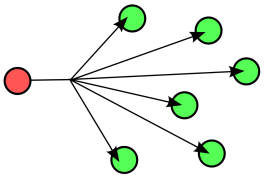

Figure 3: Broadcast

Physical-layer multicasting was originally intended to replace traditional wireless broadcasting, where the latter approach was based on radiating transmission power isotropically. The methodology has however also been proposed for downstream transmission in DSL systems. The goal of this project is to investigate physical-layer multicasting in the context of DSL systems, and to compare the performance of physical-layer multicasting to the performance of the state of the art in vectoring techniques.

The aim of the project is to investigate whether physical-layer multicasting is a viable option for future DSL systems. In the first part of the project, the existing literature on DSL vectoring techniques and physical layer multicasting will be studied. Subsequently, simulations will be implemented in Matlab in order to evaluate and compare physical-layer multicasting to state of the art vectoring techniques. If possible, this system will be further extended to incorporate simultaneous unicasting and multicasting.