Keynote Speech II

Massive MIMO for 5G

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ABSTRACT

In this talk, the fundamentals underlying the MIMO concept are explained. It will be shown how multiple reflections in indoor and urban environments can be effectively used to create additional independent channels that can serve the purposes of diversity and/or spatial multiplexing. Extending this concept for a base station to serve multiple users gives rise to Multiuser MIMO, in which both the number of served users and that of the array elements are very moderate.

Massive MIMO on the other hand uses large antenna arrays to produce very narrow multiple beams that are capable of simultaneously establishing independent channels between the base station and a number of mobile or stationary users.

The usually used deterministic and stochastic models for representing mobile wireless channels (linear time-varying systems) will be explained emphasizing the massive-MIMO aspects. Sample massive-MIMO systems that have been recently developed will be presented and discussed.

Most members of the ComSoc community assume that it will be possible to perform the entire Signal Processing of Massive MIMO in the Digital Domain. This would however necessitate that each of the array elements must have its own RF Front-End. The MTT and AP communities, on the other hand, are in some doubt about the feasibility of providing such a huge amount of RF Front-Ends, with PA/LNA, Up/Down Converting Mixers, DA/AD Converters, etc. for each individual array element of a Massive-MIMO antenna array. The alternative, which is called "Hybrid Solution" within the ComSoc, is to use Sub-Arrays, with a single RF Front-End per Sub-Array. Steerable Multiple Beams would need in this case a Butler Matrix with multiple Couplers and Phase Shifters for each Sub-Array. A comparison between these two alternatives as regarding Hardware/Software complexity, power consumption in both the RF Front-End and the Digital Signal Processing, Linearity and Efficiency of PA's, Signal Distortion, etc. will also be covered by this Tutorial.