

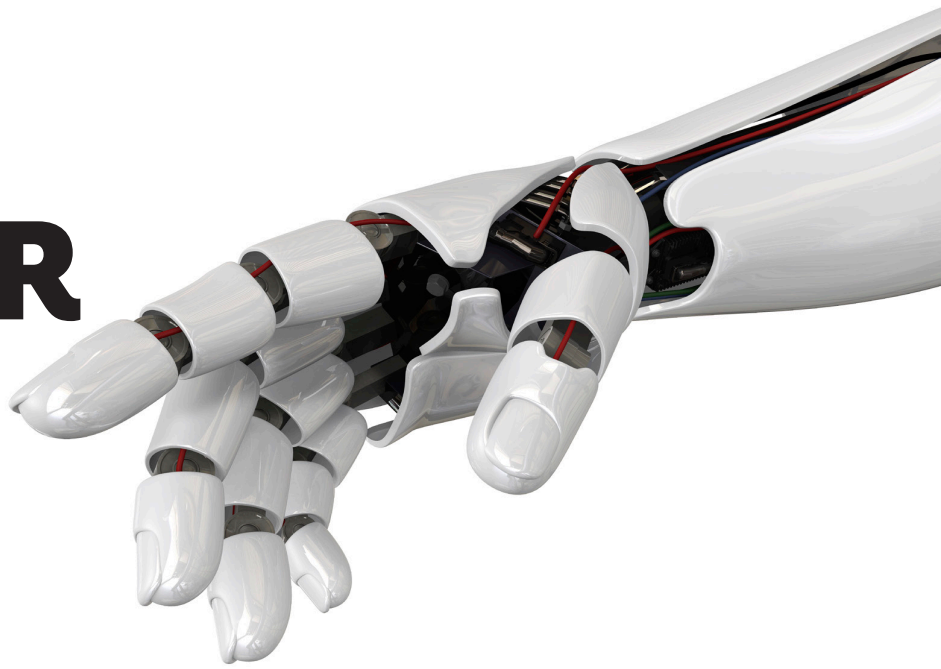
ECE SEMINAR

Department of Electrical
and Computer Engineering

October 5, 2016

1:30pm- 2:30pm

Egr Bldg 2, Rm W342

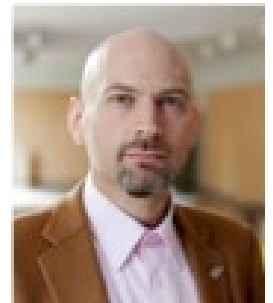


Dr. Riku Jantti

Machine Type Communications for Internet of Things – Recent Advances and Future Possibilities

The Internet of Things (IoT) is the network of physical objects 'things'. The connectivity requirements of the things depend heavily on the application. In this talk, we focus on the use cases that require low power consumption, long battery life, and are characterized by low duty cycle and massive number of low cost devices. This talk is divided into two parts. In the first part, we focus on Narrowband IoT system for low power cellular connectivity, and in the second part, we discuss ambient re-scatter communications that allow extreme low power short range connectivity. Narrowband IoT (NB-IOT) is a recent 3GPP standard that specifies narrow band low power long range connectivity for machine type communications (MTC). NB-IOT is non-backwards compliant version of LTE that has been optimized for MTC applications. It supports three modes of operation: standalone mode utilizing a GSM carrier, guard band mode utilizing resource blocks within a LTE carrier's guardband and in-band mode utilizing resource blocks within a normal LTE carrier. Operators can start using NB-IOT on their own frequency bands simply by updating the base station software making NB-IOT deployment easy. Besides the standard cellular MTC use cases, NB-IOT could potentially be used for other types of IoT connectivity applications as well. In this talk we will present a software defined radio based implementation of NB-IOT and discuss the system performance. We will also discuss the possible use cases of such an extreme light weight low cost base station implementation. Even though NB-IOT is very low power radio, its power consumption still may exceed the capabilities of ultra-low power sensor systems relying on energy harvesting. The radio transceiver is one of the most energy hungry components of the IoT devices. In RFID systems, the reader transmits an unmodulated carrier signal that gets reflected and modulated from the RFID tag. The RFID tag itself does not need transceiver. It modulates the carrier by changing its reflection coefficient (impedance) which only requires a simple switching action. In ambient re/backscatter systems, the tag or sensor devices, modulated and re-scatters a modulated signal that is utilized by some other (primary) system for communications. The receiver of the primary communication link could try to demodulate both the original (primary) signal and the signal superimposed by the re-scatter devices. We show that such a bistatic re-scatter system can increase overall channel capacity and the excess capacity can be divided between the original communication link and the re-scatter system. That is, sensor information can be read from the devices with almost zero energy cost without interfering with the ongoing data transmission.

Riku Jantti is an Associate Professor (tenured) in Communications Engineering and the head of the department of Communications and Networking at Aalto University School of Electrical Engineering, Finland. He received his M.Sc (with distinction) in Electrical Engineering in 1997 and D.Sc (with distinction) in Automation and Systems Technology in 2001, both from Helsinki University of Technology (TKK). Prior to joining Aalto (formerly known as TKK) in August 2006, he was professor pro tem at the Department of Computer Science, University of Vaasa. Prof. Jantti is a senior member of IEEE and associate editor of IEEE Transactions on Vehicular Technology. He is also a distinguished lecturer of the IEEE Vehicular Technology Society. The research interests of Prof. Jantti include radio resource control and optimization for machine type communications, Cloud based Radio Access Networks, spectrum and co-existence management and RF Inference.



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