Centre for Wireless Technology Eindhoven (CWTe)

CWTe 2018 Research Retreat

October 10, 2018

Recent developments in WiFi
Speaker: Richard van Nee (Qualcomm)

Abstract:

An overview is given of recent developments in WiFi, in particular the 11ax standard that introduces peak rates up to 10Gbps as well as new features such as uplink MU-MIMO and OFDMA. Besides data transfer, there is a growing interest to use WiFi for different applications such as positioning and detection of movement, gestures, and even heart rate.

Speaker's bio:

Richard van Nee received the PhD degree from Delft University of Technology in 1995. From 1995 to 2000, he worked for Lucent Technologies Bell Labs where he invented the CCK codes that are used in IEEE 802.11b and developed the OFDM-based proposal that was adopted in IEEE 802.11a. In 2001, he cofounded Airgo Networks – acquired by Qualcomm in 2006 – that developed the first MIMO-OFDM modem for wireless LAN which formed the basis of 802.11n. Together with Ramjee Prasad, he wrote a book on OFDM, entitled 'OFDM for Mobile Multimedia Communications.' He is currently a Senior Director at Qualcomm where he is working on WiFi algorithm design and new 802.11 standards.

Seeing and thinking with the visual brain – even if the eyes don't work
Speaker: Pieter Roelfsema, Netherlands Institute for Neuroscience

Abstract:

A long-standing dream of scientists is to be able to directly project images from the outside world onto the cerebral cortex, bypassing the eyes. This method could provide a solution for blind and visually impaired patients. In particular, it is the only possible solution for patients in whom the connection between eye and brain is lost so that a retinal prosthesis is not an option.
I will first give an overview of the functioning of the visual cortex, which has low level areas for the analysis of simple visual features and higher areas for the analysis for more complex properties such as object category and face recognition. I will then give a brief overview of previous studies that implanted electrodes into the visual cortex of patients. The electrical stimulation of electrodes leads to artificial percepts called "phosphenes" and it also works in patients who have been blind for decades. The goal of our own research is to bring a prosthesis for the visual cortex closer. We are currently carrying out experiments with 1000 electrodes in the visual cortex with the aim to generate complex visual patterns. Does this stimulation lead to interpretable images, in the same way that pixels form recognizable patterns on a screen? If successful, this research will take an important step in the direction of prostheses that can restore a rudimentary form of vision. However, the availability of this prosthesis will still have to wait a few more years.

Speaker's bio:

Pieter R. Roelfsema received his MD degree in 1991. For his PhD work he went to the group of Wolf Singer at the Max-Planck-Institute for Brain Research in Frankfurt (Germany) and he received his PhD degree at the University of Amsterdam in 1995. In 2002 he was employed by the Royal Academy of Arts and Sciences of the Netherlands in the institute now named Netherlands Institute for Neuroscience. In 2007 he was appointed as general director of this institute. In 2005 he became strategic Professor at the Free University of Amsterdam and in 2012 also Professor at the AMC in Amsterdam. Pieter Roelfsema received the highly competitive NWO-VICI award (2008) and the ERC-Advanced grant (2013). He studies visual perception, plasticity and memory in the visual system using multi-electrode recording techniques in experimental animals, behavioral paradigms in humans, and computational neuroscience approaches. He investigates how neurons in different brain areas work together during tasks that require thinking with the visual brain. Even the simplest visual task activates thousands neurons across a large number of cortical and subcortical brain areas. Roelfsema studies how these networks of neurons work together to solve the task and how networks configure themselves during learning. He aims to create a visual prosthesis for blind people that will restore a rudimentary form of sight.

Towards a smarter use of spectrum
Speaker: Ingrid Moerman, Ugent

Abstract:

Wireless networks are becoming extremely complex systems involving a high density of heterogeneous devices and technology platforms with ever-growing parameter spaces and configuration options, competing for spectral resources and serving applications with diverging and dynamic QoS requirements. Unfortunately spectrum is limited and does not scale with the increasing need for high data rate applications, and hence needs to be shared more efficiently, not only in unlicensed, but also in licensed bands.
Scheduling schemes and algorithms based on domain-expertise only cannot cope anymore with the complex, dynamic and heterogeneous nature of emerging wireless networks and lead to suboptimal use of the available spectrum and limited or no QoS guarantees. This talk will show how intelligent monitoring and scheduling techniques based on machine learning can lead to efficient collaborative spectrum sharing.

Speaker's bio:

Ingrid Moerman received is a part-time professor at Ghent university and a staff member at IDLab, a core research group of imec with research activities embedded in Ghent University and University of Antwerp. Ingrid Moerman is coordinating the research activities on mobile and wireless networking, and she is leading a research team of about 30 members at Ghent University. Her main research interests include: collaborative and cooperative networks, intelligent cognitive radio networks, real-time software defined radio, flexible hardware/software architectures for radio/network control and management, Internet of Things, Low Power Wide Area Networks (LPWAN), High-density wireless access networks, Next generation wireless networks, and experimentally-supported research. Ingrid Moerman has a longstanding experience in running and coordinating national and EU research funded projects. She is currently coordinating the H2020 ORCA project.
Ingrid Moerman has received many awards and prizes during her career. The most recent award is winner of the DARPA spectrum collaboration challenge with team SCATTER (https://www.darpa.mil/news-events/2017-12-21a).
Ingrid Moerman is author or co-author of more than 700 publications in international journals or conference proceedings..

Really dense Internet of Things
Speaker: George Exarchakos, TU/e

Abstract:

The promise has been there for more than half a decade. IoT is not yet delivering the density of devices initially expected. Besides important non-technological factors, resource scarcity is a key barrier. Wireless mesh resource control algorithms are yet to simultaneously deliver optimized reuse, high network throughput and implementation/deployment simplicity. This talk will overview efforts for optimum network resource allocation and advocate solutions beyond provisioning higher data rates. While 4G and 5G targeted 10^5 and NB-IoT 10^6 connections per km^2, the required power budget and user experienced data rates of these technologies constrain their applicability. Fog and edge computing come to orthogonally address the issue of wireless node density by increasing intelligence and reducing the traffic and effectively allocate resources at the edge.

Speaker's bio:

George Exarchakos is assistant professor with the Electro-Optical Communications group at the TU/e. His areas of expertise include low-power networks, peer-to-peer computing, data mining and machine learning. His research focuses on network reliability via smart distributed resource allocation mechanisms applied on wireless and wired (i.e. optical) networks. In the past six years, he has been working on scheduling resources of wireless networks at the time, frequency and transmit power domain. Currently, he also works on fog computing resource allocation problems. Georgios leads the Internet of Data research program of Data Science Center of TU/e and the Internet of Things Communications program of Center for Wireless Technology of TU/e.
He is co-author of the "Networks for Pervasive Services" book (Springer, 2011), co-editor of two scientific books more than 50 peer-reviewed international journal and conference publications.
Before joining TU/e as post-doctoral researcher (2009-2011) on Quality of Experience for edge-to-edge video conferencing systems, Georgios obtained his Ph.D. (2009) from University of Surrey, U.K.

Phased array feeds, a new lease of life for the Westerbork Radio Telescope
Speaker: Wim van Cappellen, ASTRON

Abstract:

Radio telescopes observe very weak radio waves emitted by celestial objects. They enable us to look billions of years back in time, and to unravel the mysteries of the universe. Modern radio telescopes have a continuously increasing demand to observe large parts of the sky with high sensitivity and bandwidth. For this reason, phased array feeds (a.k.a. focal plane arrays) are quickly becoming very popular in radio astronomy. ASTRON, the Netherlands Institute for Radio Astronomy, is a pioneer in this area. This presentation focuses on the phased array feeds that provide a new scientific life to the 50-year old Westerbork Synthesis Radio Telescope and are currently being commissioned.

Speaker's bio:

Wim van Cappellen received his MSc degree from Delft University of Technology and joined Signaal Delft (currently Thales Nederland) to investigate innovative radar concepts. In 2001 he started at ASTRON, the Netherlands Institute for Radio Astronomy. He has been leading the Radio Group, worked on the development of LOFAR and the SKA, and led the development of the Phased Array Feeds for the Westerbork Telescope. He is currently the Program Manager of the LOFAR 2.0 Program. This program is upgrading the LOFAR telescope, the world's largest and most sensitive low-frequency radio telescope, such that it remains a world class telescope until at least 2030.

The evolving automotive radar landscape: waveform, system solutions and technology partitioning
Speaker: Cicero Vaucher, NXP / TU Delft

Abstract:

Advanced driving assistance systems (ADAS) will have a steep penetration in automotive segments over the next years. Automotive radar is a key element of ADAS, as it directly provides range, velocity and angular target information, complementary to other sensors such as cameras and LIDARs. For easy adoption into a wide range of vehicles, small size, low power and low cost are the key market drivers. In this talk, we will introduce trends, system constraints and discuss IC technology options for next-generation car-radar products, with emphasis on a 40nm CMOS-based 77GHz radar IC product featuring 3 TX and 4 RX paths.

Speaker's bio:

Cicero Vaucher has been with Philips Research Labs Eindhoven and later with NXP since 1990, where he's worked on integrated RF circuits for communication and radar applications. Presently, he is a Radar Product Architect with the NXP Automotive division, and a part-time professor of mmWave front ends at TU Delft. He is an IEEE Senior Member and an NXP Technical Fellow.

Focused wireless power transfer
Speaker: Huib Visser, imec-nl / TU/e

Abstract:

Through the transmission of time-delayed pulses by the elements of an array antenna, so-called 'high-energy-density-bubbles' are created in space and time. Using this technique, energy can be focused on a desired location. The peak power density that can be realized using this technique can increase by a factor equal to the square of the number of array antenna elements without violating transmit power restrictions. In the presentation the theory will be explained and first experimental results will be shown demonstrating the feasibility of the focusing technique and the associated power density gain.

Speaker's bio:

Huib Visser (1964) received his MSc degree in Electrical Engineering from Eindhoven University of Technology (TU/e, The Netherlands) in 1989. In 1990, he joined the Defence, Security and Safety division of the Netherlands Organization for Applied Scientific Research TNO (The Hague, The Netherlands). During 1996 and 1997, he was seconded to ESA-ESTEC in Noordwijk. In 2001, he moved to TNO Science and Industry in Eindhoven. He was assigned part-time to the TU/e department of Electrical Engineering to teach antenna theory and supervise BSc, MSc and PhD research projects. In 2006, he was assigned part-time to the Holst Centre in Eindhoven. In 2009, he started working in the Holst Centre as an employee of IMEC Netherlands, leading research in the field of Wireless Power Transfer. In 2009, he obtained his PhD from TU/e and KU Leuven (Belgium). In 2014, Huib Visser was appointed as part-time professor at the department of Electrical Engineering of Eindhoven University of Technology (TU/e, The Netherlands), with a chair on Wireless Data and Power Transfer for Miniature and Environment-Independent Electronics. He is author of the books "Array and Phased Array Antenna Basics" (Wiley, 2005), "Approximate Antenna Analysis for CAD" (Wiley, 2009), "Antenna Theory and Applications" (Wiley, 2012) and numerous book chapters. He holds 12 patents.

AESA radar developments at Thales Nederland BV
Speaker: Gertjan Werkhoven, Thales

Abstract:

Thales is a global supplier of mission critical systems. Activities of Thales in the Netherlands are focused on cyber security, ground transportation and on military defense systems, including naval military radar which is highlighted in this presentation.

In last decades active electronically scanning arrays (AESA) have made their appearance in radar applications replacing conventional reflector technology. AESA radars must operate in increasing complex above-water environments, requiring fast detection and classification of harmless and less friendly objects, but at the same time slow air and surface objects need to be recognized and followed, requiring longer observation times. Such functions can be performed due to fast electronic beam scanning, the ability to send and receive information from multiple simultaneous receive beams, and task driven flexibility in the transmitted radar pulse sequences to measure not only position but also radial velocity (4D radar). The development of AESA radar front-ends involves a continuous effort in integration of the hardware components, including antennas, reduced-size transmit and receive modules, receivers, and packaging technologies, supported by consistent architecture.

This talk provides a view of several radar sensors and associated front-end technologies, including the I-mast, the NS family and the Smart-L EWC (Early Warning Capability).

Speaker's bio:

Dr.ir. **Gertjan van Werkhoven** joined Thales Nederland BV from 1996, where he started working in the field of radar cross section analysis and computation. Over time he has been active on electromagnetic interference in phased array antenna systems, RF performance of the Active Phased Array Radar (APAR), antenna R&D roadmaps and proposals, and on various antenna-related developments.
From 2014 he is a member of the telecommunications engineering group (TE) of the EWI faculty of the University of Twente, where he teaches a master course on antennas. Main interests include radar cross-section analysis, antenna modeling and calibration, design and validation, new (meta-) materials, optimization techniques, and array architecture and calibration.