

PRISMA workhop

Place and date: Tuesday 17th of September, 9.00-12.00, TAU Hervamta campus

PRISMA co-PIs: Assoc. Prof. Elena Simona Lohan and Assistant Professor Sergey Andreev (Tampere University); Academy Research Fellow Antti Tölli and Dr. Giuseppe Destino (Oulu University)

Program

9.00-9.15 Simona Lohan, TAU, PRISMA coordinator: **PRISMA project overview**

A brief overview of PRISMA project will be given, together with highlights of main developed solutions

9.15-9.30 Antti Tölli, OU, **Research on positioning in 5G systems: Theoretical bounds, trade-offs and robust power allocation**

The theoretical position error bounds (PEB) in different setups with 5G mmWave MIMO systems are presented. The focus is on the trade-offs between data rate and achievable position accuracy. A solution for power allocation based on PEB in a multi-connectivity context is given.

9.30-10.00 Yi Lu, TAU, **Location-aware Networks – a journey from positioning to communications**

In a first part, the connection between the relative geometry and positioning performance is highlighted and the EKF-based tracking is presented over two considered scenarios. In a second part, a novel beamforming strategy based on a cloud-oriented network architecture is presented. Its performance metrics are compared with other benchmark beamforming strategy.

10.00-10.15 Dileep Kumar, OU, **Multi-point Connectivity for Reliable Positioning and Resilient Communication**

mmWave frequency band the radio channel is very sensitive to line-of-sight blockages giving rise to unstable connectivity and inefficient communication. We tackle the blockage problem and propose a novel solution to increase the communication reliability by means of a coordinated multi-point reception. We also investigate the advantage of this solution in terms of positioning quality. More specifically, we describe a robust receive beamforming strategy to combat the unavailability of dominant links

10.15-10.30 short break

10.30-11.00 Antti Tölli and/or Dileep Kumar, OU, **Constrained by Capacity or Blockage? Reliable mmWave Communication via Multi-point Connectivity**

We explore the viability of using Coordinated Multi-point (CoMP) schemes, which facilitates multi-user precoding across spatially distributed base-stations (BSs), for more robust and resilient downlink communication. We provide a novel and computationally efficient iterative algorithm based on Successive-Convex-Approximation (SCA) framework and parallelization of corresponding Karush-Kuhn-Tucker (KKT) solutions, while accounting for the uncertainties of mmWave channel and random link blockers. We further quantify the complexity and performance advantages in terms of achievable sum-rate and reliable connectivity.

11.00-11.15 Tanmay Godbole: **Modeling mmWave Channels in High-Fidelity Simulations of Unmanned Aerial Systems**

A new simulation platform, combining communications and kinematics simulations, is presented. Application possibilities are demonstrated through two scenarios: UAV Angle of arrival (AoA) considerations; and Synthetic Aperture Antenna construction.

11.15-11.30 Nikita Tafintsev: **Aerial Access and Backhaul in mmWave B5G Systems: Performance Dynamics and Optimization**

The use of unmanned aerial vehicles (UAVs) acting as base station carriers in millimeter-wave (mmWave) frequencies will be presented. The main focus is on the performance evaluation of UAV-aided radio systems enabled by integrated access and backhaul (IAB) capabilities.

11.30-12.00 **Robot-based demo** organized by the team of Assis. Prof. Sergey Andreev, TAU and discussions