Friedrich-Alexander-Universität
Department Elektrotechnik-Elektronik-Informationstechnik

EEI-Kolloquium

Next Generation Multiple Access from Basic Principles to Modern Architectures

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Donnerstag, den 26.09.2024, 14:00 Uhr
Seminarraum 01.021, Cauerstraße 7, 91058 Erlangen.

Abstract: The pressure to develop new network architectures and multiple access technologies is driven by increasing demands on network performance, number of devices, network traffic and use cases. Recent advances in open radio access networks with open interfaces and software-defined network functionalities allow adaptability in terms of medium access control and physical layer, but also flexibility in terms of network architectures. The aim of this tutorial is to provide a comprehensive overview of the current set of network architectures for wireless access together with next generation multiple access technologies. It starts with the classical models for MAC, BC, IC from network information theory and derives the fundamental results on capacity regions and their coding and signal processing schemes. Extensions to multi-carrier, multi-antenna and multi-cell scenarios are discussed. The evolution from orthogonal to SDMA, NOMA and RSMA techniques and their performance guarantees are carefully explained. Recent advances towards multiconnectivity, cloud RAN and CFMA are explained. The data rate benefits of an anecdotal open RAN network are developed, and corresponding user data rates are calculated. Massive random and grant-free access schemes are also discussed. The tutorial concludes with a list of open research questions.

Bio: Eduard A. Jorswieck (Fellow, IEEE) received the Ph.D. degree in electrical engineering and computer science from TU Berlin in 2004. From 2006 to 2008, he was a Post-Doctoral Fellow and an Assistant Professor with the Signal Processing Group, KTH Stockholm. From 2008 to 2019, he was the Chair of Communication Theory with TU Dresden. He is currently the Managing Director of the Institute for Communications Technology and the Head of the Chair for Communications Systems and a Full Professor with Technische Universitaät Braunschweig, Brunswick, Germany. He has published more than 180 journal articles, 17 book chapters, one book, four monographs, and some 330 conference papers. His main research interests include communications, applied information theory, and signal processing for networks. He was a co-recipient of the IEEE Signal Processing Society Best Paper Award. He and his colleagues were also co-recipients of the Best Paper and Best Student Paper Awards at the IEEE CAMSAP 2011, IEEE WCSP 2012, IEEE SPAWC 2012, IEEE ICUFN 2018, PETS 2019, ISWCS 2019, and ICC 2024. Since 2017, he has been the Editor-in-Chief of the EURASIP Journal on Wireless Communications and Networking. Currently, he is editorial board member of the IEEE TRANSACTIONS ON COMMUNICATIONS and IEEE TRANSACTIONS ON INFORMATION THEORY. He was on the Editorial Boards of the IEEE SIGNAL PROCESSING LETTERS, the IEEE TRANSACTIONS ON SIGNAL PROCESS- ING, the IEEE TRANSACTIONS ON WIRELESS COMMUNICATIONS, and the IEEE TRANSACTIONS ON INFORMATION FORENSICS AND SECURITY.

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