Editorial: Device-to-Device Communication in 5G Networks

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Editorial:

Device-to-device (D2D) communication technology for fifth generation (5G) mobile networks enables user equipment (UE) to communicate directly with other UEs without or with partial involvement of the network infrastructure, such as mobile access points or mobile base stations. There are several popular low-level D2D techniques available, and typically they use license-exempt- bands, such as Bluetooth and WiFi-Direct. Most of the cellular technologies do not support direct over-the-air communication between end users. The traditional cellular network is based on the "cells", which are the fundamental unit within the radio access network. To achieve the device-centric communication envisaged for 5G networks, there is a need for a fundamental change in the design structure of current cellular networks. This is indeed at the core for device-centric communication, leading to different mobile base station density, micro-clouds on base stations, more alternatives for frequency re-usability, and additional spectrum coexistence of frequency bands.

This special issue broadly covers various aspects of D2D communication in 5G networks. Out of 39 submitted papers, this special issue features 6 selected papers with high quality based on the revision of expert anonymous reviewers.

The first article, "A DOA Estimation Approach for Transmission Performance Guarantee in D2D Communication", proposes a 2D direction-of-arrival (DOA) estimation algorithm for coherently distributed sources based on conformal array. Authors claim the proposed algorithm has low computational complexity under some conditions. For the condition of a large amount of data, a distributed and parallel scheme is also proposed to accelerate the computing of the proposed algorithm. The effectiveness of the proposed algorithm is verified through a simulation study.

The second paper, "Optimal Virtualized Inter-Tenant Resource Sharing for Device-to-Device Communications in 5G Networks", focuses on the aspects of D2D users that belong to different virtual network operators (tenants). The paper assumes virtualized and programmable future 5G wireless networks as well as the existence of a cross-tenant orchestrator. The authors then show significant gains in terms of network performance by optimizing resource sharing from the different tenants. The efficacy of the proposed solution compared with legacy approaches through a set of numerical experiments.

The third article, "A Two-Stages Relay Selection And Resource Allocation with Throughput Balance Scheme in Relay-Assisted D2D System" discusses a relay-assisted D2D communication underlying

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cellular network. The authors deal with the relay selection problem as well as the analysis of throughput unbalance and resource waste problem. In this context, the paper proposes a two-stages method to address the relay selection considering resource allocation with throughput balance. Three throughput balance schemes are evaluated by simulation. Simulation results show that the proposed method improves the throughput of relay-assisted D2D communication with low signaling and measurement overheads.

The fourth paper, "Optimal D2D content delivery for cellular network offloading", evaluates the throughput performance of a mobile network cell where D2D communication is used to offload the base station of part of its content delivery traffic. The authors characterize optimal content placement for regular caching and coded caching. Numerical results demonstrate significant capacity gains for coded caching, thus justifying the added complexity of D2D communication.

The fifth article, "Speaker Recognition Exploiting D2D Communications Paradigm: Performance Evaluation of Multiple Observations Approaches", proposes a speaker recognition algorithm for mobile devices based on a multiple-observation approach and the efficient managing of the gathered information using D2D communication. The authors propose different fusion and clustering algorithms aimed at efficiently exploiting data coming from the mobile devices. The performance results show that the proposed multiple-observation approach is able to significantly improve the accuracy of the considered speaker recognition algorithm.

Finally, the sixth paper, "Outage Probability of Device-to-Device Communications in Frequency Reuse-1 Networks", analyzes the outage probability of device-to-device communications in a multi-cell frequency reuse-1 system. The author derives a formula for the outage probability of a D2D link in the considered context. Based on the performed analysis, the paper also proposes a location-based power control mechanism for D2D communications able to enhance the performance of the D2D link while reducing the transmit power required for communication.

Acknowledgement

Biography

Sanjay Kumar Biswash received his Ph. D, degree from the Indian Institute of Technology (Indian School of Mines), Dhanbad, in 2012. Dr. Biswash currently working as a Research Scientist with Department of Software Engineering, Institute of Cybernetics, National Research Tomsk Polytechnic University, Russia. He held a Post-Doc position at the National Laboratory of Scientific Computing (LNCC), RJ, Brazil, and San Diego State University, CA, USA. He was a visiting researcher at the University of Coimbra, Portugal. He served as an Assistant Professor (on contract) at the Motial Nehru National Institute of Technology, Allahabad, India. His research interests lies on Network Management, Mobility Management, 5G, Device-centric

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Artur Ziviani is a Senior Researcher at the National Laboratory for Scientific Computing (LNCC), Brazil. He received a Ph.D. in Computer Science at the LIP6 laboratory of the Université Pierre et Marie Curie (Paris 6) - Sorbonne Universités, Paris, France, where he has also been a lecturer for one academic year. He received a B.Sc. degree in Electronics Engineering and a M.Sc. degree in Electrical Engineering (emphasis in Computer Networking), both from the Federal University of Rio de Janeiro (UFRJ), Brazil. From September 2008 to January 2009, he was a visiting researcher at INRIA in France. He is on the Editorial Board of the journals Computer Networks (Elsevier) and the IEEE Communications Surveys & Tutorials. His current research interests include network characterization, modeling, and analysis; network science; and interdisciplinary research with a networking approach. He is a Member of SBC (the Brazilian Computer Society), an Affiliated Member of the Brazilian Academy of Sciences, and a Senior Member of both IEEE and ACM.

Raj Jain is a Life Fellow of IEEE, a Fellow of ACM, a Fellow of AAAS, a winner of 2015 A.A. Michelson Award, ACM SIGCOMM Test of Time award 2006, CDAC-ACCS Foundation Award 2009, IISc Distinguished Alumnus Award 2014, WiMAX Forum Individual Contribution Award 2008, and ranks among the top 90 in Citeseer's list of Most Cited Authors in Computer Science. Dr. Jain is currently the Barbara J. and Jerome R. Cox, Jr., Professor of Computer Science and Engineering at Washington University in St. Louis. Previously, he was one of the Cofounders of Nayna Networks, Inc - a next generation telecommunications systems company in San Jose, CA. He was a Senior Consulting Engineer at Digital Equipment Corporation in Littleton, Mass and then a professor of Computer and Information Sciences at Ohio State University in Columbus, Ohio. He is the author of ``Art of Computer Systems Performance Analysis,'' which won the 1991 ``Best-Advanced How-to Book, Systems'' award from the Computer Press Association. His fourth book entitled " High-Performance TCP/IP: Concepts, Issues, and Solutions," was published by Prentice Hall in November 2003. He has recently co-edited "Quality of Service Architectures for Wireless Networks: Performance Metrics and Management," published in April 2010.

Jia-Chin Lin joined the Department of Electrical Engineering at National Chi Nan University (NCNU) in Taiwan as an Assistant Professor. In August 2004, he was promoted to serve as an Associate Professor. From July to August of 2004 and from August 2005 to July 2006, he held the visiting associate professorship in the Department of Electrical Engineering at Stanford University. In August 2006, he joined the faculty in the Department of Communication Engineering at National Central University (NCU) in Taiwan as an Associate Professor. In August 2008, he was promoted to serve as a Full Professor. In January 2011, he became a Distinguished Professor. Since August 2011, he has been serving as the Chairperson in the Department of Communication Engineering at NCU. His research interests include wireless transmission technologies, signal processing for communications and signal synchronization techniques. Professor Lin also won the 2009 Ten Outstanding Young Persons Award of Taiwan. He is a Fellow of the IET and a Senior Member of IEEE.

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