MOBILE COMMUNICATIONS AND NETWORKS


Wanshi Chen


Ilker Demirkol


Miraj Mostafa


Stefano Ruffini

This issue of Mobile Communications and Networks presents six articles covering various important and interesting aspects in wireless communications, including network capacity analysis in the presence of public safety related operations, shared fronthaul handling focusing on compression control, exploration of future-looking multi-tenanted radio communication systems, an overview of Wi-Fi 8 evolutions addressing new applications, investigation of power consumption for 5G base stations using an artificial neural network (ANN) architecture, and study of off-network communications in railway communications.

Disasters and the resulting emergencies are increasingly presenting situations where telecommunications infrastructure is often compromised, leading to diminished network capacity. The first article, "CPAWS: Cognitive Public Alerts to Wireless Subscribers for Enhancing Public Safety Operations During Emergencies," presents a framework that is able to predict and prevent mobile network overload/outage during emergencies using a mix of behavioral studies and machine learning tools. The efficacy of wireless emergency alerts (WEAs) is analyzed in terms of saving network bandwidth by reducing users' non-essential traffic across designated cellphone applications. Complementary access and alert control strategies ensure that the network load remains below the diminished available capacity during emergencies.

The emergence of centralized-RAN (Radio Access Network) has made fronthaul a more critical component for the current and evolving RAN. With the breakdown of base station to different units, continued antenna densification in 5G, and possibility of sharing single fronthaul interface for multiple cells, both capacity and latency are becoming critical requirements for fronthaul. Our second article, titling "Fronthaul Compression Control for Shared Fronthaul Access Networks," analyzes compression control to mitigate the new fronthaul requirements. It proposes new integral solutions for dynamic fronthaul compression control in shared fronthaul architectures. The focus is compression control strategies for multiple-cell/multiple-user scenarios sharing a common fronthaul link, where various methods for modulation data compression and scheduling can be used. The article also presents simulation results in favor of the proposed optimized modulation compression strategies.

Radio communication systems of the future are expected to move away from fixed infrastructure providers and static contracts, and towards multi-tenanted systems featuring actively negotiated terms of service. The third article "Distributed Trust and Reputation Management for Future Wireless Systems," introduces a trust-based framework to implement a massively shared, multi-tenant wireless communication system. The presented solution is based on a distributed, three-layer, and trust-based hardware sharing scheme among operators that overcomes the limitations of a single operator owned monolithic network.

The new user applications, such as AR (Augmented Reality)/VR (Virtual Reality), define ever more stringent requirements for the underlying networks, not only for data rates, but also for latency, the number of devices to be supported, etc. The new Wi-Fi technologies will need to satisfy such requirements. The possible ways to achieve these requirements are presented in the fourth article titled "Future Directions for Wi-Fi 8 and Beyond." The article first overviews the evolutions up until IEEE 802.11be, and provide future challenges and directions for the new Wi-Fi solutions.

Power consumption is an important aspect for 5G base stations. The fifth article, "Machine Learning and Analytical Power Consumption Models for 5G Base Stations," presents a data-driven and multi-carrier power consumption model. An ANN architecture for modelling and estimating the power consumption is provided, followed by a demonstration of its good accuracy using data collected from realistic commercial deployments. Subsequently, an analytic model is proposed to make the power control model analytically tractable, which can help generalize its usefulness for understanding and analyzing power consumption in realistic networks.

An interesting communication domain studied in this issue is the railway communications, specifically the direct (off-network) communication between the railway nodes without the network relaying. The sixth article titled "Off-Network Communications for Future Railway Mobile Communication Systems: Challenges and Opportunities" first lists such use cases, and then analyzes the possible technologies that could support such communications. Such use cases have been also studied by the International Union of Railways within its Future Railway Mobile Communication System (FRMCS) outline. The article provides a quantitative comparative analysis of these technologies through simulations, along with a list of open challenges.

We appreciate the authors for their timely works that helped us picking the combination of the above six forward-looking articles to address the needs and interest of wider audience we have.

Thanks to the reviewers for their usual silent contributions in making sure that the high quality and strong relevance of the articles are not compromised. With multiple revisions, their efforts are amplified, but they still remain behind the mask. We also acknowledge the continuous support we have been enjoying from the editors and staff members.

We ask the readers to come forward and join us as an author or a reviewer to make it even wider effort in laying the steppingstone of future mobile communications and networking domain.

BIOGRAPHIES

WANSHI CHEN (wanshic@qti.qualcomm.com), [SM] is a senior director, Technology at Qualcomm Inc., where he is involved in 5G research and standardization. He is currently 3GPP TSG RAN plenary Chair appointed in April 2021. Previously, he was 3GPP TSG RAN WG1 Chair and successfully led the group to deliver both the first and second 5G releases on time and with high quality. The highest degree that he received is a Ph.D. degree in electrical engineering from the University of Southern California.

ILKER DEMIRKOL (ilker.demirkol@upc.edu) [SM] is an associate professor in the Department of Mining, Industrial and ICT Systems Engineering at the Universitat Politècnica de Catalunya, Barcelona, Spain, where his research currently is focused on network algorithmics, the Internet of Things, and mobile networks. Over the years, he has worked in a number of research laboratories and industrial corporations in Europe and the United States. He has co-authored more than 75 ACM/IEEE journal and conference papers, including the recipients of the Best Paper Award at IEEE ICC '13 and the Best Demo Award at IEEE MASS 2019.

MIRAJ MOSTAFA (miraj.mostafa@americantower.com), is a senior manager for Network Engineering at American Tower Corporation. Previously, he worked for Nokia and Microsoft. He also contributed to standardization and industry collaboration activities in 3GPP, IEEE 802.11, Wi-Fi Alliance, and GSM Association. He received his Ph.D. in communications engineering, Master of Engineering in telecommunications, and Bachelor of Science in EEE from Tampere University of Technology, Asian Institute of Technology, and Bangladesh University of Engineering and Technology respectively.

STEFANO RUFFINI (stefano.ruffini@calnexsol.com) graduated in telecommunication engineering from the University of Rome La Sapienza. After a long experience at Ericsson, he is currently working as Strategic Technology Manager at Calnex Solution. He is currently contributing to ITU-T SG15 Q13 (serving as Rapporteur), IEEE1588, and other relevant synchronization standardization bodies and forums. He has published several international journal papers and delivered talks at various conferences. He is the Chairman of the International Timing and Sync Forum and a member of the Workshop on Synchronization in Telecommunication Systems Executive Committee.