MOBILE COMMUNICATIONS AND NETWORKS


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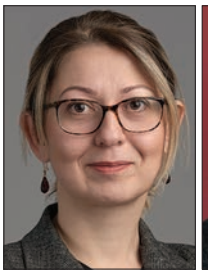
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In this January 2024 issue of Mobile Communications and Networks series, we are pleased to present six articles covering various topics related to 5G, WiFi, and future standardization such as 6G. In particular, it includes the use of multiple frequency bands (including Tera Hertz, or THz) in multi-band networks, the analysis of location-aware beyond 5G (B5G) local area network (LAN)-type services related to Industry 4.0, a block-chain-based self-sovereign identity for routing in an inter domain network, the usage of mmWave for 5G vehicle-to-everything (V2X), the practical deployment of automatic frequency coordination (AFC) based on WiFi 6G in South Korea, and the proposal of an alternative waveform for ultra-wideband (UWB).

6G is expected to make use of new frequency bands, including THz. However, the benefits of the new bands can be further expanded through the use of multiple frequency bands in multi-band networks (MBNs), as MBSs can offer ample frequency diversity and bandwidth choices. The article titled "Multi-Band Wireless Networks: Architectures, Challenges, and Comparative Analysis" provides an in-depth perspective of MBSs while considering optical and THz bands in addition to conventional radio frequency (RF) spectrum. The opportunities and the expected challenges are explained by focusing on two architectures: stand-alone MBN and integrated MBN. The authors compare the advantages and the disadvantages of each deployment option and also propose a molecular absorption-aware user offloading metric for MBNs while demonstrating its performance gains over conventional schemes.

One networking solution proposed for the Industry 4.0 is the Vertical LAN introduced in 3GPP Release 16. Its objectives include the provision of 5G LAN-type service with functionalities such as quality of service (QoS), mobility, and charging. The article titled "Location-Aware B5G LAN-Type Services: Architecture, Use Case, and Challenges" analyses the end-to-end delay challenges that such a solution brings. To tackle this challenge, the authors propose location-aware beyond 5G LAN-type services (LBLS), where the optimal user plane path is defined by also configuring the optimal anchor points through UPF, gNB, or nearby user equipment (UE) depending on the location. For this, functional extensions of the 5G control plane have been proposed, along with user plane path establishment procedures to configure the optimal anchor points. Numerical results demonstrate that LBLS can reduce the end-to-end delay by 87% compared to the conventional approach.

The current state of the Internet does not give Autonomous System (AS) sufficient visibility and authority over on-path forwarding devices in Inter-Domain Networks. To address this issue, a blockchain (BCN)-based SSI (Self-Sovereign Identity) system has been developed to enable routing device owners in Autonomous Systems to have greater control over inter-domain networks (IDNs). This is described in article "Blockchain-Based Self-Sovereign Identity for Routing in Inter-Domain Network." The authors use a GNS3 (Graphical Network Simulator-3) network emulation test bed and Hyperledger Indy distributed identity management system to test the proposed solution's AS convergence time and credential operation time, respectively. The experimental results show that the integration of a blockchain-based credential management of SSI system with the proposed routing in an IDNs-based approach is able to improve the security and efficiency to a significant extent.

The potential use of mmWave for 5G V2X services brings challenges including coverage problems due to e.g., blockages. To tackle such challenges, the article titled "Integration of 5G mmWave-Enabled V2I and V2V: Experimental Evaluation" studies the integration of vehicle-to-infrastructure (V2I) and vehicle-to-vehicle (V2V) in a mmWave-enabled vehicular network, including the technical features such as V2V beam management, sidelink unlicensed (SL-U) operation, and mobile relaying. The authors demonstrate the feasibility of such an integrated V2I and V2V operation through experimental studies implemented on gNBs and vehicle UEs, also considering handover scenarios.

The article titled "Deploying Automated Frequency Coordination System for Wi-Fi 6E in South Korea: Challenges and Opportunities" addresses how to deploy WiFi 6E for the 6GHz band in South Korea in the presence of co-channel interference due to incumbents such as fixed services and television and broadcast services. This is based on the so-called AFC system where an access point (AP) is provided with a list of available channels and permissible transmit powers based on the location of the APs and the incumbent systems. The transmit power is controlled based on a protection zone analyzer and a spectrum sharing manager, as illustrated in a realistic scenario. The article is concluded by listing several looming challenges for future work.

An alternative waveform for UWB has been proposed by the article titled "Filter Bank UWB Communications," namely FB-UWB, which is based on the use of filter bank multicarrier spread spectrum (FBMC-SS). The authors present its advantages over the alternative waveforms such as Infrared-UWB (IR-UWB). Those advantages include low peak-to-average power ratio (PAPR), ranging capabilities, and its support for transmission rates of up to one Giga bits per second.

We hope that the readers will enjoy reading the diverse set of topics, addressed by the six articles selected for this issue. We would like to thank our contributors for their excellent articles and the reviewers for their dedication and the great efforts for the timely review they provided. We would also like to acknowledge the continuous support from the editors and staff members.

BIOGRAPHIES

WANSHI CHEN [SM] (wanshic@qti.qualcomm.com) is a Sr. 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 the 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, USA.

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