

# Recent advances on high performance computing, mobile networking, and security

Pal Varga

**W**ITH the advent of new generation large language model-based tools, such as ChatGPT, many worktasks and positions must re-evaluate themselves. This applies to writing editorial messages as well. It is no secret: I am using Google for searching scientific articles. Similarly: I used ChatGPT to extract some key information of the articles in this issue. The result needed validation and verification (just like Google search results), and some re-writing from my side – but the world has changed. Hopefully for the better, even for the long term! So, let us see what are the articles about!

The paper by Mostafa et. al. presents an enhancement in radio frequency (RF) harvesting for a conventional patch antenna using a metasurface layer (MSL) consisting of a modified Jerusalem cross. RF harvesting measurements showed a significant enhancement in the output voltage when the MSL was involved, and the proposed antenna realizes an excellent symmetry in the radiation pattern after the proposed MSL introduction.

Zoltán Belső and László Pap address the problem of sharing available resources (such as bandwidth and power) in a multiple access channel system in order to determine how to allocate those resources between two users to achieve the highest achievable capacity region. An important achievement here is the formulation and derivation of the achievable capacity region for a downlink communication system using frequency division multiple access (FDMA) scheme with two users.

András Béres and Bálint Gyires-Tóth propose a method to enhance the performance of reinforcement learning agents through sim-to-real transfer using real-world images alongside visual domain randomization in the training procedure. They achieve this by training variational autoencoders (VAE) on both real and simulated frames, and then using the representations produced by the encoders to train reinforcement learning agents. The proposed method is evaluated against a variety of baselines and is shown to improve the learned representation effectiveness and robustness.

Norman Bereczki and Vilmos Simon provide a structured and comprehensive overview of machine learning (ML) usecases in the field of Cooperative Intelligent Transportation Systems (C-ITS). The authors categorized C-ITS applications based on the level of cooperativeness and provided a summary of how machine learning contributes to each layer of smart transportation. The paper shows how C-ITS applications are built on vehicle-level, inter vehicle-level and infrastructure level, and what is the impact of ML in these cases.

In their article, Leiter et. al. aim to show how failover and scaling can be applied to cloud-native Mobile IPv6 (CN-MIPv6) using closed-loop orchestration on top of the Open Network Automation Platform. They present numerical results and calculations on the utilization of failover, scaling, and availability in the case of cloud-native IP-level mobility management – findings, that can be applied to any (V)NF.

Gábor Lencse and Keiichi Shima explores the performance of iptables in stateful NAT44 translation and investigates the effect of various settings and parameters on its performance. The authors compare iptables to nftables, and conclude that iptables is still appropriate for implementing CGN due to its superior performance in handling a high number of connections. The authors also propose a new benchmarking methodology for stateful NATxy gateways to quantify the connection setup and connection teardown performance.

In their article, Mostafa et.al. propose a proactive, dynamic, and distributed network monitoring mechanism with monitor placement and scheduling for 6LoWPAN-based IoT networks intended for mission-critical applications. The results show that the proposed model achieves full network coverage while minimizing energy consumption, computational and communication overhead, and preserving scarce resources by effectively distributing the monitoring role.

Péter Orosz, Tamás Skopkó and Tamás Marosits presents a real-time, application-aware method for assessing network neutrality. This aims to provide a user-centric analysis of potential restraints affecting internet access quality and introduces three novelties to support this goal: application-specific measurements involving real content and traffic, measured traffic originating from the content provider's cloud infrastructure, and reference created in real-time. The proposed method is validated through a proof-of-concept use case of video streaming from a public VoD provider and laboratory measurements.

In his paper Gábor Földes analyzes the impact of mobile network sharing on social welfare in Hungary, specifically in the context of 4G-5G mobile broadband rollout. He argues that network sharing can be a cost efficiency enabler, accelerating price decreases, improving coverage and capacity, and ultimately contributing to social welfare increase. Mobile network sharing can benefit the telco sector and contribute to social welfare, but further research is needed to assess the appropriate level of access pricing to shared infrastructure and the passthrough of efficiency gains to customers.

With this overview, we hope you will enjoy the Infocommunications Journal papers in the first issue of 2023.



**Pal Varga** is the Head of Department of Telecommunications and Media Informatics at the Budapest University of Technology and Economics. His main research interests include communication systems, Cyber-Physical Systems and Industrial Internet of Things, network traffic analysis, end-to-end QoS and SLA issues – for which he is keen to apply hardware acceleration and artificial intelligence, machine learning techniques as well. Besides being a member of HTE, he is a senior member of IEEE, where he is active both in the IEEE ComSoc (Communication Society) and IEEE IES (Industrial Electronics Society) communities. He is Editorial Board member in many journals, and the Editor-in-Chief of the Infocommunications Journal.