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An IEEE Future Networks Technology Roadmap
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ABSTRACT

The fifth generation (5G) wireless communication systems development has brought about a paradigm shift using advanced technologies; including softwarization, virtualization, massive MIMO, and ultra-densification, in addition to introducing new frequency bands. However, as societal needs for any form of information grow, it is necessary to satisfy the UN's Sustainable Development Goals (SDGs). Migrations to 6G and beyond systems are envisioned to provide augmented capacity, so massive IoT, with better performance relying on optimization made possible by artificial intelligence, it is absolutely necessary. Non-Terrestrial Networks (NTNs), including satellite systems, High-Altitude Platforms (HAPs), and Unmanned Aerial Vehicles (UAVs), provide the best solutions to connect the unconnected, unserved, and underserved in remote and rural areas.

Over the past few decades, Geo Synchronous Orbits (GSO) satellite systems have been deployed to support broadband services, backhauling, Disaster Recovery and Continuity of Operations (DR-COOP), and emergency services. Recently, novel non-GSO satellite systems are attracting significant interest. Within the next few years, several thousands of Low Earth Orbit (LEO) satellites and mega-LEO constellations will provide global internet services, offering user throughput comparable to terrestrial mobile or fixed access networks.

This report represents the 2023 Edition of the INGR Satellite Working Group Report, following the previous three editions [1], [2], [3]. This edition of the INGR Satellite Working Group Report addresses NTN and 6G more in detail, adding further contributions on optical wireless communications, artificial intelligence techniques, seamless handover, security, and recent standardization efforts given the prospected unification of terrestrial and NTN components of 6G.

Key words

Satellite Communications, Satellite Networks, Waveforms, MIMO, mmWave, OFDM, QoS, QoE, Security, Network Architecture, LEO, MEO, GEO, HAP, UAV, MEC, AI/ML, IoT, Artificial Intelligence (AI), Machine Learning (ML)

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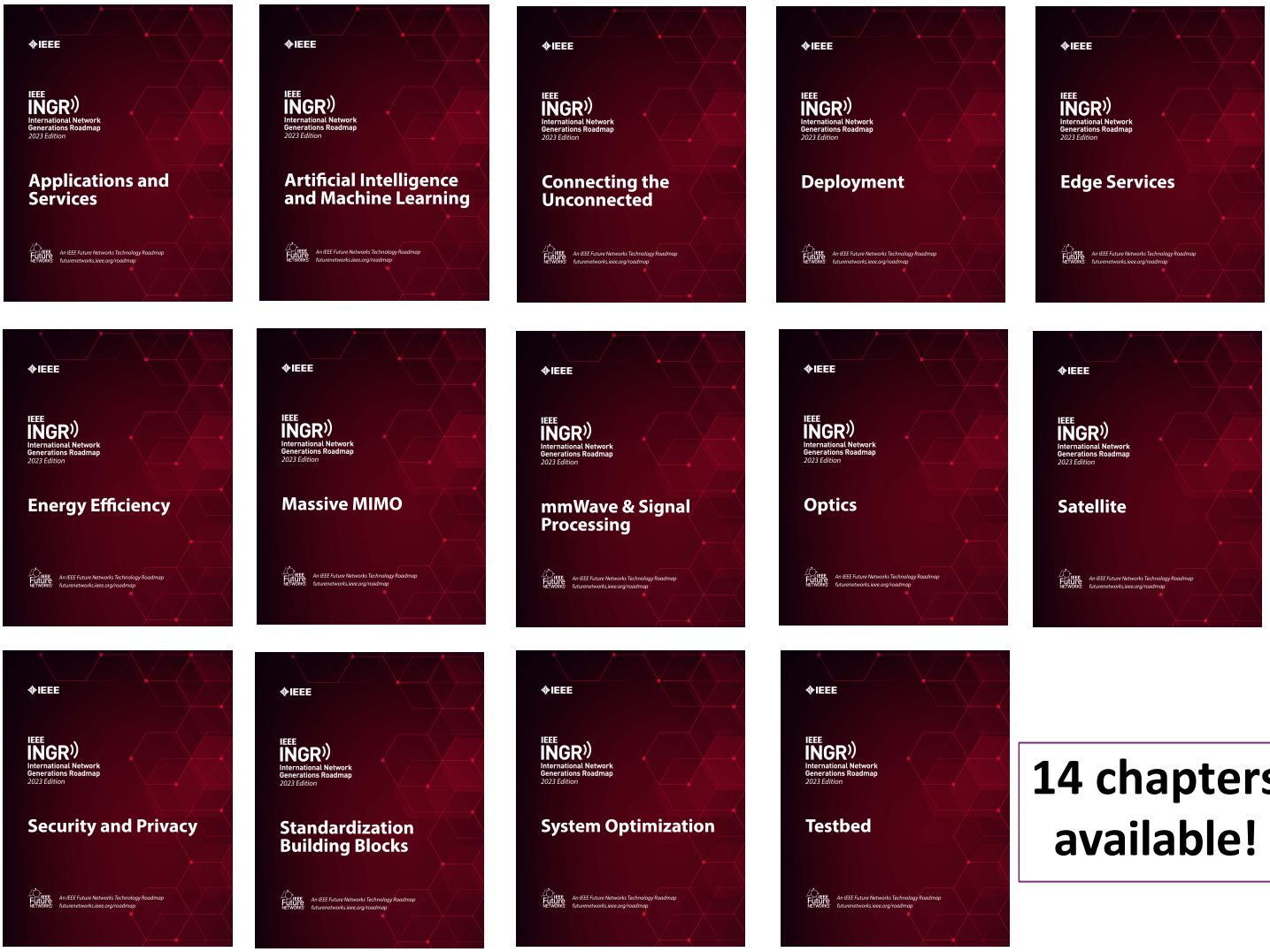

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