2025

COMMUNICATIONS SYSTEMS INTEGRATION AND MODELING TECHNICAL COMMITTEE

CSIM-TC

NEWSLETTER

December 2025

Jonathan Rodriguez (Chair)
Petros Spachos (Vice-chair)
John Vardakas (Secretary)

1. Table of Contents

2. About CSIM

The Communications Systems Integration and Modeling technical committee focuses its activities on simulation, analytical tools and measurement of communications links and networks. CSIM has been sponsoring activities on traffic modeling, performance and integration of next generation wireless and wireline networks.

CSIM sponsors its traditional workshop CAMAD, as well as special issues in the IEEE Communications Magazine and in the IEEE Journal on Selected Areas in Communications. CSIM is very active in ICC and in GLOBECOM and was one of the co-founders of MILCOM. CSIM has its roots on the Communications Systems Engineering technical committee and its past chairs are:

2025-now – Jonathan Rodriguez

2023-2025 – Luca Foschini

2021-2023 – Nizar Zorba

2018-2021 – Burak Kantarci

2015-2018 – Christos Verikoukis

2013-2015 – Stefano Giordano

2011-2013 – Harry Skianis

2009-2011 – Fabrizio Granelli

2007-2009 – Pascal Lorenz

2005-2007 – Nelson L.S. da Fonseca

2002-2005 – Mike Devetsikiotis

2000-2002 – Mohammad Ilyas

1999-2000 – Hussein Mouftah

1996-1999 – Guy Omydar

1994-1996 – Bill Tranter

For more information: http://csim.committees.comsoc.org/

3. Awards/Distinctions for CSIM members

- Professor Damla Turgut
    - Invited Talk on “AI driven dynamic path planning in mobile sensors,” hosted by University Of Missouri at St. Louis, November 12, 2025
    - IEEE ComSoC Distinguished Lecture on “Communication, computation, and privacy trade-off in machine learning for smart environments,” hosted by by IEEE ComSoC Turkiye Chapter and Medipol University, Istanbul, Turkey, June 27, 2025
    - IEEE ComSoC Distinguished Lecture on “Communication, computation, and privacy trade-off in machine learning for smart environments,” hosted by by IEEE ComSoC and Computer Society Turkiye Chapter and Ozyegin University, Istanbul, Turkey, June 26, 2025
    - IEEE ComSoC Distinguished Lecture on “Privacy in smart healthcare,” hosted by by IEEE ComSoC Turkiye Chapter and Istanbul Technical University (ITU), Istanbul, Turkey, June 25, 2025
    - IEEE Communications Systems Integration and Modeling (CSIM) Technical Committee; Awards Committee Member (2021–)
    - Advisor, SIG on Machine Learning for Ad Hoc, Sensor and IoT Networks; Internet of Things, Ad Hoc and Sensor Networks Technical Committee (IoT-AHSN) (2021–)
    - SIG Chair on Green Smart Grid Communications; Technical Committee on Green Communications and Computing (TCGCC) (2024–)
    - SIG Co-Chair on AI and Computational Intelligence for Smart Grid; Technical Committee on Smart Grid Communication (2021–)

- Professor Burak Kantarci
    - (Keynote) "At the Edge of Everything: Unlocking Infinite Intelligence", IEEE 30th Symposium on Computers and Communications (ISCC), Bologna, Italy, July 2025
    - (Keynote) "Multimodal LLMs for Smarter Traffic Monitoring in Connected Vehicle System," Wireless World Research Forum (WWRF)- Huddle 2025- Connected Vehicles Workshop, September 2025
    - "Edge Intelligence and Generative-AI in 6G", IEEE Systems Council Online Distinguished Lecture, July 2025
    - "The Edge Shift: Redefining Intelligence for the 6G Era," at Istanbul Technical Univ, Aug. 2025
    - "Securing the Future: AI-Powered Cyber Resilience for Critical Infrastructures in the 6G Era ," Penn State Berks, October 2025

- Semantic Communications and Multimodal LLMs for Intelligent Traffic Monitoring with Quanser Interactive Labs, Quanser Inc., Markham, ON, Oct. 2025

Awards/Distinctions

- Professor Burak Kantarci

IEEE Ottawa Section- 2025 Outstanding EngineeringEducator Award

- Professor Claudio Fiandrino
  - Best Student Paper Award at IEEE International Conference on Machine Learning for Communication and Networking 2025, for the paper "A scalable DNN (Deep Neural Network) Training Framework for Traffic Forecasting in Mobile Networks," authors: Serly Moghadas Gholian, Claudio Fiandrino, and Joerg Widmer

4. Past Events

- A. Mesodiakaki, Tutorial entitled “6G Requirements, Technology Enablers and Challenges”, during ELIXIRION School 2 «3GPP architecture and introduction to the 6G enabling technologies towards Healthcare 4.0», Amsterdam, Nov. 2024.
- A. Mesodiakaki, J. Ruiz de Ortega, Online talk in NTN Workshop organized by HEXA-X-II Flagship project entitled “ETHER Sustainable 3D architecture”, Nov. 2024.

- Damla Turgut, IEEE ComSoC Women in Engineering (WiE) Virtual Distinguished Lecture on “Physical and computational modeling of smart homes”, hosted by IEEE Affinity Group, Region 9, November 6, 2024
- Damla Turgut, IEEE ComSoC Women in Engineering (WiE) Virtual Distinguished Lecture on “Physical and computational modeling of smart homes”, hosted by IEEE WiE Queensland, Australia section, November 4, 2024
- Damla Turgut, Invited Talk on “Communication, computation, and privacy trade-off in machine learning for smart environments,” hosted by TU Wien, October 31, 2024
- Damla Turgut, Invited Talk on “Privacy in smart healthcare,” hosted by University of Versailles Saint-Quentin-en-Yvelines, October 10, 2024

5. Ongoing Research Projects/Grants

Functional Composition Of Post Quantum Cryptosystems At Large

FOCAL is a three-year, European Research and Innovation (RIA) project, coordinated by Prof. **Angelos Marnerides**, Dept. of Electrical & Computer Engineering and the KIOS Research and Innovation Center of Excellence, University of Cyprus. With a starting date the 1st of October, the project brings together 15 partners from across Europe with the goal of developing a new generation of communication networks that will be resilient against quantum attacks.

FOCAL is one of the three projects funded by the European Cybersecurity Competence Centre (ECC) and aims to enable the transition of Information Communication Technologies (ICT) and critical infrastructure systems to evolve as quantum-safe deployments. It will thus deliver a unified framework for practical end-to-end functional composition of post-quantum cryptography (PQC) in edge environments through cross-layering approaches combining hardware reconfigurability, advanced network orchestration, trusted execution environments, and ML-driven interoperability.

Beyond its technological vision, FOCAL will play a strategic role in supporting the European Union's efforts on Post-Quantum Cryptography standardisation. The project will develop metrics and methodologies to assess the readiness of edge ecosystems for PQC deployment and contribute to policy recommendations aligned with the European Commission's Recommendation on Post-Quantum Cryptography. FOCAL's core objectives include:

- Enabling hardware-level crypto-agility through reconfigurable and heterogeneous computing platforms tailored for PQC workloads.
- Advancing physical-layer security with innovative RIS architectures that reinforce PQC-enabled wireless systems.
- Developing a PQC network assemble that supports in-network processing, orchestration, and secure service chaining across cloud-to-edge.
- Introducing ML-driven resource management to optimize PQC execution, energy efficiency, and system-level adaptability.
- Integrating post-quantum proof into Trusted Execution Environments to ensure verifiable, quantum-safe device identity and execution integrity.
- Securing application-layer interoperability and smooth integration of NIST PQC standards into future communication and computing ecosystems.

FOCAL adopts a six-pillar architecture that tightly interconnects hardware, wireless, network, execution, and application layers:

- Pillar 1: Hardware adaptability and crypto agility

FOCAL will establish a flexible hardware foundation capable of adapting to evolving post-quantum requirements and supporting agile cryptographic updates across diverse devices.

- Pillar 2: Communication schemes for PQC-enabled environments

This pillar advances secure and resilient communication methods tailored for PQC-ready wireless, mobile, and distributed systems.

- Pillar 3: PQC Network Instrumentation & Orchestration

Through programmable networking and orchestration mechanisms, FOCAL will enable scalable deployment, monitoring, and coordination of PQC services across cloud-to-edge infrastructures.

- Pillar 4: Accelerated computation & learning

AI-driven optimization and accelerated computation methods are introduced to ensure efficient execution, workload prediction, and adaptive resource management for PQC processes.

- Pillar 5: PQC enhanced Trusted Execution Environment (TEE)

This pillar integrates quantum-safe mechanisms into TEEs, strengthening system integrity, attestation, and secure execution across heterogeneous platforms.

- Pillar 6: PQC-enabled & Interoperable Application Protocols

FOCAL supports seamless adoption of PQC by developing interoperable, future-proof application protocols that ensure smooth transition from classical to quantum-safe communication ecosystems.

Large-Scale Proof-of-Concept Demonstrators

FOCAL validates its innovations through six large-scale PoCs across high-impact sectors:

1. Next-Generation Networking (B5G/6G): This PoC will demonstrate how quantum-safe security and intelligent monitoring can be applied across emerging B5G/6G infrastructures and distributed sensing environments.

2. Automotive Security: In the automotive domain, the PoC will validate quantum-resilient protection for in-vehicle systems, internal communications, and vehicle-to-cloud services.
3. Space & Satellite Communications: For satellite and space applications, this PoC will showcase secure and adaptable PQC-enabled communication frameworks enhanced by physical-layer techniques.
4. Fintech: Within financial environments, the PoC will evaluate crypto-agility and PQC mechanisms to strengthen digital trust, interoperability, and signature verification processes.
5. Medtech: This PoC highlights the integration of PQC into low-power, connected medical technologies to ensure secure and reliable operation of wearable and IoT-based healthcare devices.
6. Data Centers: At data center level, the PoC will assess PQC-enabled protection of critical communication flows and management operations across large-scale distributed computing infrastructures.

(1)

FOCAL officially kicked off in October 2025 in Nicosia, Cyprus, where partners initiated the technical roadmap for the project pillars and demonstrators. In November 2025, the project was showcased at SEMICON Europa in Munich, where the *Prof. Angelos Marnerides* delivered a keynote speech titled: “Towards Quantum-Ready End-to-End Security and Resilience for Critical Infrastructures”
This early dissemination milestone set the stage for FOCAL’s engagement with semiconductor and next-generation communications communities.

More information about FOCAL can be found here:
https://cordis.europa.eu/project/id/101225859

UNITY-6G: A unified architecture for open RAN-enabled distributed, scalable and sustainable 6G networks

UNITY-6G: A unified architecture for open RAN-enabled distributed, scalable and sustainable 6G networks

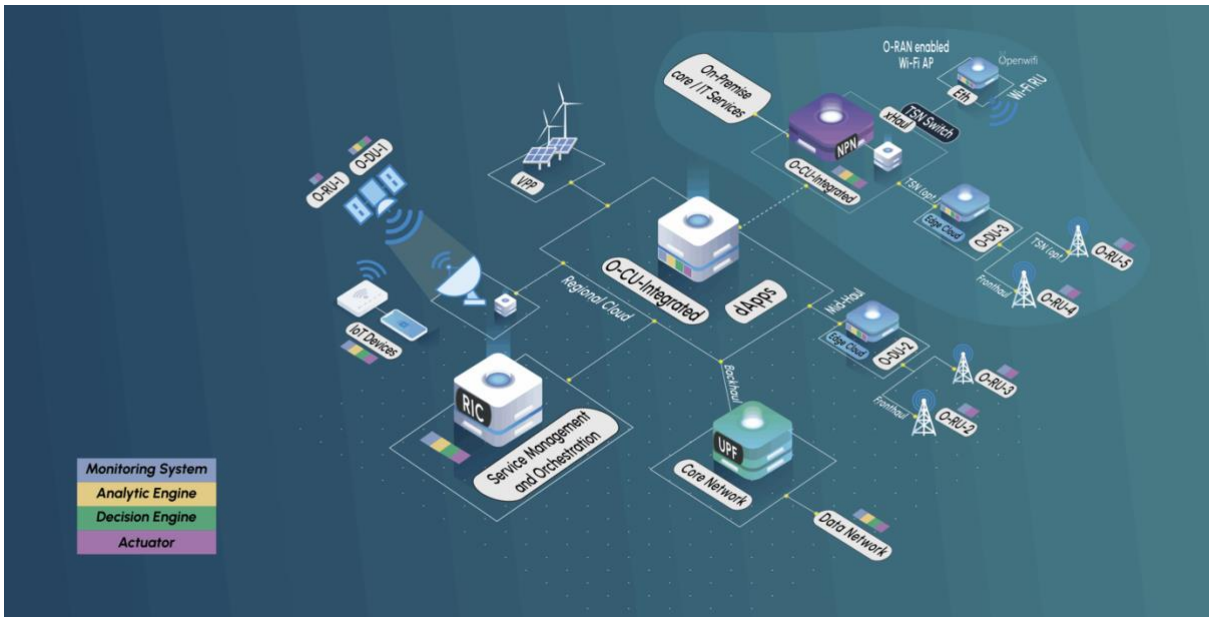
by Engin Zeydan, Luis Blanco, Selva Via (CTTC, Spain), Klaudia dos Santos (Martel Innovate, Switzerland), Maria Serrano and Angelos Antonopoulos (Nearby Computing, Spain)

Website: https://unity-6g.eu/
LinkedIn: https://www.linkedin.com/company/unity-6g/

UNITY-6G is an SNS JU Research and Innovation Action that focuses on tackling energy efficiency and sustainability challenges in networked services. The project leverages artificial intelligence, machine learning, and distributed ledger technologies to secure data exchange and foster trust between parties. It also explores various network access technologies, including non-terrestrial networks, non-public networks, and approaches like open radio access networks. The primary goal of UNITY-6G is to develop energy-efficient, integrated network infrastructures that support the convergence and interoperability of heterogeneous domains, such as wireless networking, IoT, and mobile and distributed computing.

The UNITY-6G Architecture

UNITY-6G is built upon a highly modular, intelligent 6G system designed for sustainable, scalable, and AI-native operations across heterogeneous domains.



At its core, the architecture features distributed Service Management and Orchestration (SMO), including the RIC, deployed across regional and edge clouds for dynamic control and low latency. It tightly integrates distributed AI (Monitoring System, Analytics Engine, Decision Engine, Actuators) into network elements, enabling closed-loop AI management across the core, RAN, and edge.

The network uses a flexible xHaul infrastructure enhanced by TSN switches for deterministic low-latency communication. Its sustainability vision is underscored by the inclusion of VPPs (Virtual Power Plants), integrating renewable energy. Multi-RAT support for NPN deployments (via Wi-Fi RUs and O-RAN-enabled Wi-Fi APs) allows seamless cellular/Wi-Fi coordination, with different integration options explored at the control and data planes. UEs/IoT connect via intelligent O-RUs and O-DUs, orchestrated by AI-powered SMO subsystems, supporting private 6G deployments with on-premise cores.

The overall UNITY-6G design enables robust, low-latency, and context-aware services that can adapt to critical scenarios such as disaster recovery, industrial automation, and immersive applications.

Strategic Use Cases

To meet its ambitious vision for the future of communication infrastructure, the project has defined four strategic use cases. Together, these use cases demonstrate how the advanced features of the UNITY-6G architecture and its technologies can address critical societal needs, enable new industrial capabilities, and deliver resilient, intelligent, and sustainable networks. Each of the four UNITY-6G use case explores a key challenge area where 6G innovation can have transformative impact:

- **Use Case 1: Sustainable Networks for Disaster Handling**
  As climate-related and natural disasters become more frequent, maintaining reliable communication during emergencies is more essential than ever. This

use case focuses on creating resilient, energy-efficient 6G network solutions capable of supporting critical operations, such as rescue coordination and situational awareness, even under extreme conditions like earthquakes and floods.

- **Use Case 2: Real-Time Holographic Communication**
  Next-generation industrial collaboration will rely on seamless, real-time extended reality. This use case enables multi-user XR/holographic communication powered by an intelligent, semantic-aware 6G network. Using the Hololight Space XR platform, it demonstrates how immersive interaction can enhance productivity, training, and decision-making in demanding industrial environments.
- **Use Case 3: Digital Twin for Integrated 6G Network Evaluation**
  Operating future networks will require unprecedented coordination across terrestrial, transport, satellite, non-public network (NPN), and edge-cloud infrastructures. This use case develops a digital twin framework to model, evaluate, and optimize such heterogeneous 6G environments. It enables advanced testing, monitoring, and orchestration of complex network scenarios in a virtual yet realistic setting.
- **Use Case 4: Multi-RAT O-RAN NPN for Industry 4.0**
  Industry 4.0 demands deterministic, ultra-reliable, and low-latency communication to support advanced automation. This use case explores how a multi-radio access technology, O-RAN-enabled non-public network can deliver the performance required for time-sensitive industrial processes. It showcases 6G's potential to empower safe, flexible, and efficient smart factory operations.

Funding acknowledgement

The UNITY-6G project received funding from the European Union's Horizon Europe Research and Innovation Programme under Grant Agreement No 101192650. Views and opinions expressed are however those of the author(s) only and do not necessarily reflect those of the European Union. Neither the European Union nor the granting authority can be held responsible for them.

This work has received funding from the Swiss State Secretariat for Education, Research and Innovation (SERI).

6G-XR — 6G eXperimental Research Infrastructure for Extended Reality

6G-XR (6G eXperimental Research Infrastructure for Extended Reality) [1] is a flagship European project funded under the Smart Networks and Services Joint Undertaking (SNS-JU) of Horizon Europe. The project is coordinated by the University of Oulu, with the Institute of Telecommunications and CSIM-TC members (Mohammed Al-Rawi, Jonathan Rodriguez) sitting on the Technical Management board. The consortium brings together a strong multi-partner team from several European countries, combining academia, research institutes, and industry.

6G-XR is establishing a pan-European experimental infrastructure for beyond-5G and 6G-enabled Extended Reality (XR), integrating advanced radio access, edge/cloud computing, AI-driven optimization, and large-scale real testbeds. The project targets disruptive XR services such as holographic communications, collaborative 3D digital twins, and immersive remote interaction.

6G-XR Plenary Meeting

A major outcome of 6G-XR is its exceptional open-source contribution. To date, the project has released 18 public repositories on GitHub under the SNS-JU organization, including software tools and datasets, with additional assets available internally and planned for future release. This places 6G-XR among the most active SNS-JU projects in terms of open and reproducible research. In parallel, the project has successfully supported 30 third-party projects through the cascade funding mechanism, accelerating industrial adoption in multiple vertical sectors.

One of the most visible highlights of 6G-XR is over-the-top holographic services and also based on IMS Data Channel session, which was selected among the Top-10 achievements out of 186 use cases of SNS-JU projects [2] — a major recognition at European scale. The project has also delivered strong results in XR-enabled Digital Twins, supporting real-time remote collaboration and industrial monitoring. In addition, 6G-XR has made significant contributions to Green 6G, including AI-based energy-aware radio and edge management, and intelligent selection of the optimal edge technology based on performance and sustainability rather than simple proximity.

In advanced imaging and sensing, 6G-XR has progressed novel 4D light-field and volumetric capture technologies through close collaboration with Raytrix, enabling next-generation holographic acquisition pipelines.

To validate all technologies at scale, 6G-XR deployed a unified Trial Controller providing remote access to multiple European test sites in Oulu and Helsinki (Finland), and Barcelona and Madrid (Spain). This platform enables cross-border experimentation, unified user access, orchestration of XR trials, and real-time KPI visualization on heterogeneous infrastructures.

Through close collaboration across disciplines and countries, the 6G-XR team has delivered an exceptional scientific, technological, and innovation impact. As the project now enters its final phase toward completion in December 2025, 6G-XR stands as a strong European success story in 6G experimental research, open science, SME innovation, and sustainable XR systems.

References:

[1] **Project Website:** https://6g-xr.eu/

[2] https://smart-networks.europa.eu/sns-ju-unveils-its-2025-top-10-key-achievements-leading-europes-6g-innovation/

6. Special Issues organized by CSIM members

Intelligence and Service Orchestration in Next-Generation Mobile Networks

Submission deadline: **28 February 2026**

Mobile communication and computing infrastructures are undergoing a profound transformation, moving toward highly dynamic, service-centric ecosystems. Fundamental to this evolution is a novel paradigm for the infrastructure and service management for 5G-and-beyond networks.

Indeed, the architectural paradigm of 5G is shifting toward Open Radio Access Network (RAN), which introduces RAN Intelligent Controllers (RICs) for network overseeing and reconfiguring through Artificial Intelligence (AI) applications able to enhance the overall performance. The shift from monolithic components to virtualized functions through Network Function Virtualization (NFV) and the adoption of Software Defined Networking (SDN) allow the deployment of innovative solutions that demand flexible orchestration methods. In this context, Service Management and Orchestration (SMO) and Network and Service Orchestration (NSO) play a crucial role by enabling real-time automation and optimization across highly dynamic and heterogeneous network environments, whilst integrating radio, transport, and core domains under a single control plane. These solutions are apt to tackle key challenges including service provisioning, resource allocation, power consumption, and quality of service. Central to this scenario is the role of AI, which enables closed-loop network automation and control, predictive management, automated fault detection, and intent-based service delivery. As such, network intelligence is essential for resilient, scalable, and adaptive orchestration techniques capable of meeting the stringent latency, reliability, and performance requirements of future mobile networks. This Special Issue aims to collect innovations proposed by the research community in the field of Intelligence and Service Orchestration in next-gen mobile networks. These topics and challenges have recently been investigated by researchers, telco stakeholders, government agencies, and international organizations (e.g. Next Generation EU, CAMARA).

Topics of interest include, but are not limited to:

Management and orchestration architectures and techniques for next-gen networks

Automation, coordination, management and optimization of network resources and servicesPlacement and resource allocation for VNFs

Resource monitoring and service analytics

Orchestration solutions for control plane, core, and RAN

Orchestration in Transport and Multi-Domain Networks

Enabling technologies for network orchestration

AI-based network orchestration

Closed-loop automation engines in NSO

Zero-Touch and intent-driven Open RAN orchestration, optimization, control, and management

QoS in network orchestration

NSO for sustainability

Resilience, scalability, and adaptability of next-gen networks

Industry-supported efforts for network optimization

Integrated Sensing and Communications

Privacy in orchestration frameworks

Energy-aware and Sustainable Network Management

Testbeds, emulators and benchmarking for orchestration solutions

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Stacked Intelligent Metasurface-Empowered Advanced Signal Processing Paradigm for 6G and Beyond

Publication Date

August 2026

Manuscript Submission Deadline

1 November 2025

Special Issue

Call for Papers

Stacked Intelligent Metasurfaces (SIM) is an emerging technology to enable electromagnetic-domain signal processing. Unlike single-layer reconfigurable intelligent surfaces (RISs), SIMs stand out due to their structural resemblance to artificial neural networks (ANNs). In SIMs, each hidden layer is essentially a metasurface, and the meta-atoms within each layer function similarly to the artificial neurons in conventional ANNs. Once the multiple programmable metasurfaces are properly configured, a SIM is capable of processing spatial electromagnetic waves as they propagate through the hierarchical structure. Since it directly processes electromagnetic waves carrying information in free space, SIMs eliminate the need for digital storage, transmission, and information preprocessing. Remarkably, all information processing within a SIM occurs at the speed of light. Furthermore, SIMs can be easily scaled to accommodate extremely large inputs and massive connections in a cost-effective and efficient way.

Due to these unique advantages, some advanced SIMs have been designed to perform various tasks in the wave domain, such as filtering, MIMO precoding, and discrete Fourier transform (DFT). Additionally, thanks to its internal multi-path propagation, SIMs can achieve frequency-selective response by reconfiguring the meta-atom's scattering properties, making it well-suited for generating waveforms required by advanced modulation schemes, such as orthogonal frequency division multiplexing (OFDM) in the wave domain. However, as a developing field, significant work remains to deploy SIM in real-world wireless networks. This Special Issue (SI) uniquely calls for the study of SIMs from the perspectives of hardware design, modeling, performance analysis, signal processing architecture, and experiments. Consequently, the topics of interest include but are not limited to the following:

- Theoretical limit of SIMs for signal processing in wireless communication and sensing systems.
- Wave propagation-based signal processing architectures for communication and sensing.
- Hardware implementation and modeling of SIMs.
- Testbeds and technological demonstrations of SIMs across millimeter wave, terahertz, and optical frequency bands.

- Efficient algorithms for SIM configuration and channel parameter estimation.
- Implementations of various AI technologies in the electromagnetic domain.
- Advanced modulation and coding schemes based on SIMs.
- Inter-layer propagation coefficient calibration and robust SIM configuration.
- Enhanced computational capability of SIMs.
- Promising applications of SIMs in 5G-Advanced, 6G, and beyond.
- Interplay with emerging physical-layer technologies, e.g., cell-free networks, satellite communication systems.

Submission Guidelines

Prospective authors should prepare their submissions in accordance with the rules specified in the "Information for Authors" of the *IEEE Wireless Communications* Author Guidelines. Authors should submit a PDF version of their complete manuscript to Author Portal. The timetable is as follows:

Important Dates

Manuscript Submission Deadline: 1 November 2025
Initial Decision Date: 1 January 2026
Revised Manuscript Due: 1 February 2026
Final Decision Date: 1 March 2026 **Final Manuscript Due:** 15 May 2026
Publication Date: August 2026

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