📝 June 15, 2026

Special Session on Towards the 6G Standardization

- Moray Rumney, University Of Bristol, United Kingdom
  6G! - Hold my antenna…
- Carles Anton, CTTC, Spain
- Laurent Clavier, University of Lille, France

DEMO: ***Scaled Implementation of V2X-Based Cooperative Intersection with 1:10 Cooperative Connected and Automated Mini-Cars***

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Special Session on Goal Oriented Communications

Chair: Roberto Verdone

Keynote Speaker: Petar Popovski, University of Aalborg, Denmark

- Lorenzo Mario Amorosa, University of Bologna, Italy,
  Goal-Oriented Learning and Resource Management at the Edge via Over-the-Air Graph Neural Networks
  Sixth-generation (6G) wireless networks are evolving from connecting devices to connecting intelligence, driving a paradigm shift toward Goal-Oriented Communications. In this context, the effectiveness of communication is increasingly assessed through task-level objectives rather than traditional throughput-centric metrics. As distributed machine learning is deployed at the network edge to manage highly dynamic resources, a critical trade-off emerges between task accuracy and communication efficiency. Traditional digital radio access schemes are not inherently designed for this trade-off, often facing severe scalability and latency bottlenecks when supporting distributed inference.
  Overcoming these limitations requires a fundamental integration of communication and learning processes. A highly effective paradigm for this integrated goal-oriented approach emerges from coupling over-the-air computation with spatio-temporal graph neural networks (GNNs). Rather than treating communication and computation as isolated stages, leveraging the physical wireless channel as an analog aggregation layer enables ultra-low-latency distributed inference. Theoretical foundations confirm that such an analog architecture converges to the expressive power of digital approaches while offering decisive scalability advantages.
  The efficacy of this integrated paradigm for dynamic edge resource management is effectively demonstrated through the challenging task of proactive line-of-sight

blockage prediction in millimeter-wave networks. Supported by high-fidelity ray-tracing simulations, over-the-air graph learning exhibits strong inductive generalization to unseen network topologies and adapts to domain shifts via lightweight transfer learning. By matching or outperforming traditional digital baselines with significantly reduced communication overhead, this approach highlights the transformative potential of unified goal-oriented communication and learning for intelligent network management in 6G.

- Marco Skocaj, Huawei Munich, Germany
  To Diffuse or not to Diffuse? A Goal-Oriented Perspective on Generative Channel Estimation.
  The pursuit of end-to-end effectiveness in wireless networks fundamentally challenges our traditional, modular communication pipelines. While modern architectures split tasks to manage complexity, the ultimate objective remains holistic: maximizing the utility and meaning of the transmitted data. In recent years, generative modeling—and score-based diffusion methods in particular—has emerged as a major paradigm shift in physical-layer signal processing. However, the vast majority of the approaches focus strictly on minimizing reconstruction distortion, leaving a critical gap in the literature: When does score-matching offer a tangible advantage over traditional and learning-based distortion minimization approaches? This talk addresses this open question through the lens of channel estimation—a fundamental inverse problem in wireless systems. We present a theoretically grounded interpretation of score-based channel estimation by analyzing the inherent perception–distortion tradeoff. Through this framework, we identify the precise conditions under which score-matching excels, as well as its inherent limitations. Finally, we demonstrate that by adopting a goal-oriented perspective, generative channel estimation can bridge the gap between modular designs and ad-hoc end-to-end models, delivering optimal system-level performance without sacrificing the modularity of the communications pipeline.

Special Session on Joint Communication and Sensing

Chair: Alister Burr

Keynote Speaker: Stefano Buzzi, Università di Cassino e del Lazio Meridionale, Italy

- Carsten Smeenk, Fraunhofer IIS, Germany
- Claude Oestges, University of Louvain, Belgium

Special Session on Digital Twin

Chair: Giampaolo Cuozzo

Keynote Speaker: Michele Ludovico, FiberCop, Italy

- Riccardo Marini, WiLab, Italy,
  Building the Network Digital Twin: From Research Vision to Industrial Impact
  Network Digital Twins (NDTs) are moving from conceptual frameworks to operational systems that can support AI-driven decision-making across the network lifecycle—planning, deployment, assurance, and evolution. This keynote introduces the core foundations that make an NDT deployable: key enablers, a modular reference architecture for integrating data, analytics, simulation and orchestration, and a concise overview of today's standardization landscape. These foundations become particularly relevant in private and industrial networks, where operational continuity and safety constraints make trial-and-error in production particularly costly. In this context, NDTs enable structured "what-if" exploration—e.g., changes in network configuration, mobility and traffic patterns, or environmental conditions—to anticipate their impact on service KPIs and to assess safety-critical situations before deployment.

- Federico Montori, University of Bologna, Italy
  Generating Digital Twins for Dynamic IoT Scenarios
  This presentation explores the evolving landscape of Digital Twins (DTs) in dynamic Internet of Things (IoT) environments, with a particular focus on the recent research activities of the IoT Prism Lab at the University of Bologna. Starting from the foundational pillars of Digital Twins, the talk discusses how they converge to create adaptive and predictive representations of physical systems.
  The seminar introduces the concept of Relativistic Digital Twins, a model-driven framework that embeds domain knowledge directly into automatic Digital Twin generation through behavioral equations and semantic descriptions based on the W3C Web of Things standard. This approach enables application-agnostic and device-agnostic DT generation while supporting simulation of past and future states through differential and algebraic modeling. The second part of the talk presents ongoing work on Generative Digital Twins (GDTs), which leverage transformer-based generative deep learning models to predict future sensor states in previously unseen hardware configurations without requiring retraining. By combining attention mechanisms, flexible device embeddings, and temporal-dynamics-aware loss functions, the proposed framework generalizes across changing IoT topologies and device sets. Experimental results on smart-home scenarios demonstrate strong predictive performance and promising adaptability under evolving configurations. Overall, the presentation outlines the group's vision toward a comprehensive strategy for Digital Twin generation that bridges physics-inspired modeling and data-driven artificial intelligence, paving the way

for scalable, adaptive, and semantically grounded Digital Twins for next-generation IoT systems.