



# 2<sup>nd</sup> International Workshop on Massive Digital Twins for the Computer-Networks Evolution (TwinNets)



BOSTON, MASSACHUSETTS, June 12, 2023

Co-located with WoWMoM 2023

[www.twinnets.unipi.it](http://www.twinnets.unipi.it)

## Organizers

Antonio Viridis	University of Pisa, Italy
Marco Picone	University of Modena and Reggio Emilia, Italy
Robert Gazda	InterDigital Communications, US
Antonio de la Oliva Delgado	University Carlos III of Madrid, Spain

## Description

During the last decade, due to the dynamic and quick Internet of Things (IoT) technological evolution, several applications opened to the possibility of an effective merge between the physical and the cyber worlds. This scenario became attractive both for the Academia and the Industry, revitalizing the concept of Digital Twin originally introduced between 1999 and 2002. A Digital Twin provides a virtual synchronized replica of a physical object mirroring its properties, data and behaviors and enabling new intelligent and augmented functionalities with respect to the original physical device such as an extended interoperability, modeling and simulation, analytics and cognitive capabilities. Gartner classified the technology as one of the top 10 strategic trends of the last few years and forecasts that their market will reach 35 billion USD by 2025. Following this trend, Digital Twin technologies has been seen as a rapid adoption technology in multiple fields such as Smart Manufacturing, E-Health, Smart City and Industry 4.0.

Unfortunately, the lack of uniform Digital Twin representations, standards or common agreements created (as already seen unfortunately for other IoT technologies) several platform-specific silos and a consequent strong bond with technology providers where each model is built from scratch without common methodologies or norms extending the way to realize their real potential.

In this challenging context, the design and adoption of Digital Twin technologies in networking represents a new open research field that can enable and drive a new intelligent evolution of computer networks as confirmed by a recent IETF draft on the topic. The fast growth of network scale together with the associated increased load and demand creates the need to introduce dynamic and intelligent management and implies a big new challenge for network operators. First, Network Digital Twins will be in charge of building and maintaining the virtual representations of the network and its components through an effective synchronization with their physical counterparts. Second, they will create a uniform digital abstraction to support the design of new management and orchestration services. Finally, the network itself will be called to support the design, deployment, and communications of a massive amount of distributed Digital Twins across multiple architectural layers and environments. The effective possibility to decouple the

complexity and heterogeneity of the networking physical assets from the digitalized and software layers represents a new concrete opportunity to analyze, diagnose, emulate, and then control the network based on data, models, interfaces and augmented cognitive capabilities.

TwinNets23 aims to provide a forum that brings together authors from the research and academic communities, standardization bodies, and institutional entities to meet and exchange ideas on recent research, challenges and future directions for Digital Twins and Intelligent Networking in multiple application scenarios and use cases. The technical topics of interest to the workshop include, but are not limited to:

- Network Digital Twins Properties, Modelling and Definitions
- Reference Architecture for Network Digital Twins
- Cyber-Physical Interaction between Networking Assets and Digital Twins
- Digital-Twins Life Cycle
- Digital Twins in Software Defined Networking and Network Function Virtualization
- 5G/6G Digital Twins
- Digital-Twin-oriented approaches and cyber-physical interaction applications
- Networking emulation and simulation through Digital Twins
- Digital Twins to support Networks Data acquisition, Big-Data processing, and AI modeling
- Optimized Networking Decision Making
- Digital-Twins Management and Orchestration
- Edge/Fog/Cloud Network Digital Twins
- Privacy and Security Issues and Opportunities
- Digital Twins Platforms & Interoperability Issues
- Real-World Deployments and Experimentations
- Evaluation and analysis of experimental data
- Creation and sharing of datasets of broad interest to the community
- Application of Digital Twins towards a Predictive Internet
- Massive Digital Twinning requirements and applications
- Testing and Validation of Digital Twins - approaches, frameworks, testbeds
- Quality of Service for Digital Twins
- Digital Twins as a Service
- Design of Digital-Twin-based applications
- Autonomic/cognitive Digital Twins

## **Publicity Chair**

Carlo Puliafito University of Pisa, Italy

## **Technical Program Committee members (TBC)**

- Marco Mamei - University of Modena and Reggio Emilia
- Enzo Mingozzi - University of Pisa
- Milan Groshev – University Carlos III of Madrid
- Jorge M. Perez – University Carlos III of Madrid
- Franco Zambonelli - University of Modena and Reggio Emilia

- Marco Lippi - University of Modena and Reggio Emilia
- Gianluigi Ferrari - University of Parma
- Luca Veltri - University of Parma
- Carlo Giannelli - University of Ferrara
- Pietro Manzoni - Universitat Politècnica de València
- Maria Fazio - University of Messina
- Antonella Molinaro - University of Reggio Calabria
- Claudia Campolo - University of Reggio Calabria
- Andrei Ciortea - University of St. Gallen
- Federico Montori - University of Bologna
- Cinzia Bernardeschi - University of Pisa
- Carlos G. Guimaraes – ADLINK
- Militiadis Filippou – Intel Deutschland

### **Important Dates**

- Abstract registration due by: February 22, 2023
- Papers due by: March 1, 2023
- Paper selections due by: April 1, 2023
- Camera Ready by: April 15, 2023