SHORT-PAPER

# Cloud2Things 2025: From Cloud to Things - towards the convergence of IoT, Edge and Cloud Computing

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# Cloud2Things 2025: From Cloud to Things - towards the convergence of IoT, Edge and Cloud Computing

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## Abstract

The growing complexity and demand for ubiquitous applications, driven by the widespread adoption of smartphones, wearables, and IoT devices, requires dynamic and scalable computing support. The Computing Continuum, spanning IoT, Edge, and Cloud resources, offers a unified infrastructure to meet these needs by enabling seamless, context-aware, and low-latency service delivery. The Cloud2Things Workshop explores how the continuum can support the development and deployment of ubiquitous applications. It invites contributions that address resource orchestration, adaptive service provisioning, distributed AI, big data processing, and security across heterogeneous environments. Through technical presentations and discussion, the workshop aims to advance the integration of the continuum into a cohesive, pervasive computing fabric capable of supporting next-generation ubiquitous services.

## CCS Concepts

• **Human-centered computing** → **Ubiquitous and mobile computing design and evaluation methods**; • **Computer systems organization** → **Cloud computing**; • **Computing methodologies** → Self-organization.

## Keywords

Cloud Continuum; Cloud; Edge; IoT; Distributed AI; Big Data; Computing fabric

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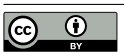


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## 1 Objective of the Workshop

The interest of research communities and business actors in ubiquitous computing is fueled by the relentless growth and global proliferation of personal devices such as smart phones, VR headsets, and wearables in general. The growing number and complexity of ubiquitous applications, combined with the rising demand for the services they provide, require increasingly robust computing support that must be dynamically provided by powerful and flexible resources. Although personal and user-proximate devices contribute (minimally) to this computing demand, in the Things-to-Cloud pathway there is a "continuum" of resources that can fulfill the mentioned need. For instance, resources located at the Edge of the network can be exploited by delay-sensitive tasks, while the Cloud could be harnessed when compute-intensive operations are requested. The Computing Continuum offers the opportunity to leverage a broad computing ecosystem that seamlessly integrates Cloud, Edge, and IoT resources, ensuring a continuous and uniform access to computing services for applications. Within this landscape, applications benefit from a pervasive and heterogeneous computing environment - including mobile resources - designed to meet their requirements for both computational power and low latency.

The Cloud2Things workshop will serve as a platform for researchers and practitioners to explore how the Computing Continuum can support the development and operation of ubiquitous applications. The workshop seeks to address the following research questions: how can the Computing Continuum efficiently handle the dynamic workloads generated by ubiquitous applications? In what ways can the Continuum potential be harnessed to enable applications to adapt to evolving user contexts? How can Ubiquitous computing utilize the various layers of the Continuum to scale with the growing number of users and the increasing volume of generated data? This workshop welcomes submissions that examine the opportunities and challenges associated with the support that the Continuum can offer to ubiquitous computing, presenting experimental solutions, case studies, deployed systems, and best practices in this research domain. Researchers and practitioners are invited to participate and discuss the benefits of integrating the multiple layers of the computing infrastructure into a seamless and pervasive computing environment. The goal is to create a unified virtual space where services can be customized and delivered transparently and efficiently to end-users.

We believe that tackling these challenges requires innovation in several research areas that are potentially of interest to the UbiComp community. In particular, the workshop aims to gather people from the following areas of expertise: resource provisioning in the Things-Edge-Cloud landscape, set-up and management of (virtual) communication networks, management of big data streams, modeling and operation of ML/DL models, dynamic context adaptation, enforcement of security in distributed and dynamic environment.

## 2 Workshop Format

The workshop will cover a half-day and will feature two 90-minute sessions. Authors of regular papers are assigned 25 minutes for the presentation (20 minutes + 5 minutes for questions); authors of short papers have 15 minutes (10 minutes + 5 minutes for questions). A "Best Paper Award" will be conferred on the author(s) of a paper presented at the workshop, selected by the workshop organizers based on the best-combined marks of paper review, assessed by the Program Committee. Depending on the tightness of the paper's presentation schedule, a demo session will be organized during which a small number of presenters (2-3) will be invited to run a short live demonstration (10 mins) of their proposal.

## 3 Paper selection and publication

All submissions went through a single-blind review process with two or three independent reviewers. Articles were collected through the Microsoft Conference Management Toolkit (CMT). All contributions will be included in the ACM Digital Library and companion proceedings of the conference. The selected papers will also appear on the workshop website https://cloud2things.netsons.org/.

## 4 Estimated number of participants

We expect to bring together 20–30 participants who are working on or have an interest in the Cloud Continuum and its applications. The accepted paper count for Cloud2Things 2025 was 5. The workshop is open to everyone. It aims to gather researchers and practitioners from academia and industry to enable cross-collaboration and knowledge sharing.

## 5 Organisers

**Prof. Paolo Bellavista** received his M.Sc. and Ph.D. degrees in Computer Science Engineering from the University of Bologna, Italy, where he currently serves as a Full Professor in the Department of Computer Science and Engineering. His research spans a broad spectrum of topics within distributed systems and pervasive computing, with particular emphasis on mobile and ubiquitous systems, middleware support for context- and location-aware services, adaptive service provisioning in edge-cloud continuum environments, and scalable software architectures for Industrial Internet of Things (IIoT) and Industry 4.0.

**Dr Alessio Catalfamo** is a Postdoctoral Research Fellow at the University of Messina, Italy. His research interests center around the design and implementation of resource orchestration mechanisms across the Cloud-Edge continuum, with a specific focus on low-latency service deployment, dynamic workload distribution, and federated learning techniques for privacy-preserving and decentralized model training.

**Prof. Giuseppe Di Modica** is an Associate Professor in the Department of Engineering at the University of Bologna, Italy. His research covers advanced topics in Big Data processing, distributed computing paradigms such as Cloud and Edge Computing, and Internet of Things (IoT) architectures. Recently, his work has increasingly focused on the conceptualization and realization of Digital Twin frameworks for predictive maintenance, system simulation, and decision support in industrial and manufacturing domains.

**Dr Antonino Galletta** is an Assistant Professor in the Department of Engineering at the University of Messina, Italy. His research activities involve the development of integrated platforms for Cloud, Edge, and IoT interoperability, with applications in Smart Cities, Intelligent Transportation Systems (ITS), and digital healthcare solutions. He has also contributed to the application of Blockchain technologies for secure and auditable data sharing in decentralized systems.

**Prof. Ioannis Konstantinou** is an Associate Professor in the Department of Computer Science and Telecommunications at the University of Thessaly, Greece. His primary research focus lies in the design, development, and evaluation of scalable data-intensive distributed systems. He has contributed extensively to the fields of Cloud Computing, Big Data infrastructure, and large-scale data management.

## 6 Call for Papers

The growing number and complexity of ubiquitous applications, combined with the rising demand for the services they provide, require increasingly robust computing support that must be dynamically provided by powerful and flexible resources. The increasing integration of computing resources across edge, fog, and cloud infrastructures, commonly referred to as the Compute Continuum, presents significant opportunities to enable ubiquitous computing paradigms. The Compute Continuum concept refers to the opportunity to take advantage of a broad ecosystem of heterogeneous and geographically sparse computing resources that applications access in a transparent and uniform fashion. As emerging applications demand real-time processing, adaptive decision-making, and resilient computing infrastructures, the Compute Continuum becomes a critical enabler in bridging gaps between distributed resources. The integration of ubiquitous computing with the Compute Continuum promises enhanced efficiency, scalability, and responsiveness for a wide range of domains, including the smart homes, smart cities, and cyber-physical systems. Several challenges must be addressed to make this integration profitable. Among them are multi-tier orchestration, efficient latency-sensitive tasks offloading, intelligent workload distribution, and cross-layer security. The Cloud2Things workshop aims to bring researchers, practitioners, and industry experts to examine how the Compute Continuum can effectively enable and enhance the Ubiquitous Continuum. Our goal is to discuss state-of-the-art advancements, identify key challenges, and promote collaborations that drive innovation in this fast-evolving field. We welcome contributions from both academia and industry, covering theoretical insights, practical implementations, and real-world applications that showcase the potential of this interdisciplinary domain.

Topics of the workshop include (but are not limited to):

**Architectures and Frameworks for Compute Continuum and Ubiquitous Continuum**

- Scalable and adaptive architectures for seamless integration of edge, fog, and cloud computing
- Middleware solutions for interoperability among edge, fog, cloud, and IoT systems
- Distributed computing frameworks to support latency-sensitive ubiquitous applications
- Software-defined and AI-driven orchestration for intelligent workload distribution
- Hybrid and multi-cloud approaches for ubiquitous service delivery

**Resource provisioning in in the ubiquitous continuum**

- Dynamic resource provisioning and adaptive load balancing
- Serverless and microservices computing;
- Cross-context and cross-domain service migration;
- Efficient offloading strategies for latency-sensitive and compute-intensive tasks;
- Network-aware workload placement and orchestration;
- Blockchain-based and ML-based resource orchestration;
- Energy-efficient computing and sustainability in the compute continuum.

**Data management and analytics**

- Scalable storage architectures in pervasive contexts;
- Data migration issues across heterogeneous infrastructures;
- Implementation of data pipes along the Things-to-Cloud path;
- Data governance in the computing continuum;
- Distributed analytics in the computing continuum;
- Orchestration of complex mixed data-parallel dataflow workloads in the computing continuum;
- Event-driven and publish-subscribe models for real-time processing.

**Intelligent and Autonomous Decision-Making**

- AI and machine learning techniques for autonomous resource orchestration;
- Federated and distributed learning approaches for ubiquitous intelligence;
- Reinforcement learning approaches for autonomous and distributed systems optimization;
- ML-based and continuum-powered solutions to enhance adaptivity in the ubiquitous continuum.

**Digital Twins**

- Frameworks for Distributed Digital Twins (DDTs) in pervasive contexts;
- Design methodologies for DDTs;
- DDT-based applications and solutions in pervasive contexts;
- Resilient, scalable and secure DDTs.

**Security, Privacy, and Trust**

- Secure data sharing and access control across heterogeneous platforms;
- Privacy-preserving computing techniques in ubiquitous environments;
- Threat modeling and mitigation strategies for distributed infrastructures;
- Blockchain and decentralized approaches for trust management.