



UNIVERSITÀ DI PISA  
DIPARTIMENTO DI INGEGNERIA DELL'INFORMAZIONE  
Dottorato di Ricerca in Ingegneria dell'Informazione

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Doctoral Course

**“Edge Computing technology toward 6G: applications, open-source and role of AI”**

Teacher: Dario Sabella

*IEEE Senior Member - ITALY*

E-mail address: [dario.sabella@ieee.org](mailto:dario.sabella@ieee.org)

**Short Abstract:**

The course will cover the main aspects of Edge Computing, from a practical perspective and with the aim to provide useful tool for application development. An initial technology overview will provide the description of MEC and related standards and industry associations working in the field, together with various open-source frameworks available. A particular emphasis will be given to the ETSI MEC standard (Multi-access Edge Computing), by mentioning as well other SDOs and the relationship with 3GPP for the definition of the future 6G systems. A special focus will be given to AI and the recently available frameworks that can help software development. A classroom exercitation will complete the course, where students will be asked to build their own application example exploiting MEC and based on the open-source software introduced during the course.

**Course Contents in brief:**

- Edge Computing, Fog computing, Cloud computing
- ETSI MEC Framework and Reference Architecture
- MEC in 4G, MEC in 5G, MEC in Wi-Fi networks
- MEC Services, MEC Management, MEC Mobility
- Network APIs, CAMARA APIs, MEC APIs
- Open-Source frameworks: MEC Sandbox, ETSI Forge
- Artificial Intelligence, tools and Ecosystem
- Classroom exercise

**Total # of hours of lecture: 20**

**Final Exam:** quiz with multiple choices

## References:

- [MEC011] ETSI GS MEC 011 V3.2.1 (2024-02), "Multi-access Edge Computing (MEC); Edge Platform Application Enablement," [https://www.etsi.org/deliver/etsi\\_gs/MEC/001\\_099/011/03.02.01\\_60/gs\\_mec011v030201p.pdf](https://www.etsi.org/deliver/etsi_gs/MEC/001_099/011/03.02.01_60/gs_mec011v030201p.pdf)
- [MEC001] ETSI GS MEC 001 V1.1.1 (2016-03) Mobile Edge Computing (MEC) Terminology - [http://www.etsi.org/deliver/etsi\\_gs/MEC/001\\_099/001/01.01.01\\_60/gs\\_MEC001v010101p.pdf](http://www.etsi.org/deliver/etsi_gs/MEC/001_099/001/01.01.01_60/gs_MEC001v010101p.pdf)
- [MEC002] ETSI GS MEC 002 V1.1.1 (2016-03) Mobile Edge Computing (MEC); Technical Requirements - [http://www.etsi.org/deliver/etsi\\_gs/MEC/001\\_099/002/01.01.01\\_60/gs\\_MEC002v010101p.pdf](http://www.etsi.org/deliver/etsi_gs/MEC/001_099/002/01.01.01_60/gs_MEC002v010101p.pdf)
- [MEC003] ETSI GS MEC 003 V1.1.1 (2016-03) Mobile Edge Computing (MEC); Framework and Reference Architecture - [http://www.etsi.org/deliver/etsi\\_gs/MEC/001\\_099/003/01.01.01\\_60/gs\\_MEC003v010101p.pdf](http://www.etsi.org/deliver/etsi_gs/MEC/001_099/003/01.01.01_60/gs_MEC003v010101p.pdf)
- [IEG004] ETSI GS MEC-IEG 004 V1.1.1 (2015-11) Mobile-Edge Computing (MEC); Service Scenarios - [http://www.etsi.org/deliver/etsi\\_gs/MEC-IEG/001\\_099/004/01.01.01\\_60/gs\\_MEC-IEG004v010101p.pdf](http://www.etsi.org/deliver/etsi_gs/MEC-IEG/001_099/004/01.01.01_60/gs_MEC-IEG004v010101p.pdf)
- [IEG005] ETSI GS MEC-IEG 005 V1.1.1 (2015-08) Mobile-Edge Computing (MEC); Proof of Concept Framework - [http://www.etsi.org/deliver/etsi\\_gs/MEC-IEG/001\\_099/005/01.01.01\\_60/gs\\_MEC-IEG005v010101p.pdf](http://www.etsi.org/deliver/etsi_gs/MEC-IEG/001_099/005/01.01.01_60/gs_MEC-IEG005v010101p.pdf)
- [IEG006] ETSI GS MEC-IEG 006 V1.1.1 (2017-01) Mobile Edge Computing; Market Acceleration; MEC Metrics Best Practice and Guidelines - [http://www.etsi.org/deliver/etsi\\_gs/MEC-IEG/001\\_099/006/01.01.01\\_60/gs\\_MEC-IEG006v010101p.pdf](http://www.etsi.org/deliver/etsi_gs/MEC-IEG/001_099/006/01.01.01_60/gs_MEC-IEG006v010101p.pdf)
- [MEC009] ETSI MEC 009 "General principles for Mobile Edge Service APIs" - [http://www.etsi.org/deliver/etsi\\_gs/MEC/001\\_099/009/01.01.01\\_60/gs\\_MEC009v010101p.pdf](http://www.etsi.org/deliver/etsi_gs/MEC/001_099/009/01.01.01_60/gs_MEC009v010101p.pdf)
- [MEC010-1] ETSI MEC 010-2 "Mobile Edge Management; Part 2: Application lifecycle, rules and requirements management" - [http://www.etsi.org/deliver/etsi\\_gs/MEC/001\\_099/01002/01.01.01\\_60/gs\\_MEC01002v010101p.pdf](http://www.etsi.org/deliver/etsi_gs/MEC/001_099/01002/01.01.01_60/gs_MEC01002v010101p.pdf)
- [MEC010-2] ETSI MEC 010-2 "Mobile Edge Management; Part 2: Application lifecycle, rules and requirements management" - [http://www.etsi.org/deliver/etsi\\_gs/MEC/001\\_099/01002/01.01.01\\_60/gs\\_MEC01002v010101p.pdf](http://www.etsi.org/deliver/etsi_gs/MEC/001_099/01002/01.01.01_60/gs_MEC01002v010101p.pdf)
- [MEC012] ETSI MEC 012 "Radio Network Information API" - [http://www.etsi.org/deliver/etsi\\_gs/MEC/001\\_099/012/01.01.01\\_60/gs\\_MEC012v010101p.pdf](http://www.etsi.org/deliver/etsi_gs/MEC/001_099/012/01.01.01_60/gs_MEC012v010101p.pdf)
- [MEC013] ETSI MEC 013 "Location API" - [http://www.etsi.org/deliver/etsi\\_gs/MEC/001\\_099/013/01.01.01\\_60/gs\\_MEC013v010101p.pdf](http://www.etsi.org/deliver/etsi_gs/MEC/001_099/013/01.01.01_60/gs_MEC013v010101p.pdf)
- [MEC015] ETSI MEC 015 "Bandwidth management API" - [http://www.etsi.org/deliver/etsi\\_gs/MEC/001\\_099/015/01.01.01\\_60/gs\\_MEC015v010101p.pdf](http://www.etsi.org/deliver/etsi_gs/MEC/001_099/015/01.01.01_60/gs_MEC015v010101p.pdf)
- [MEC016] ETSI MEC 016 "UE application interface" - [http://www.etsi.org/deliver/etsi\\_gs/MEC/001\\_099/016/01.01.01\\_60/gs\\_MEC016v010101p.pdf](http://www.etsi.org/deliver/etsi_gs/MEC/001_099/016/01.01.01_60/gs_MEC016v010101p.pdf)
- [MEC018] ETSI MEC 018 "End to End Mobility Aspects" - [http://www.etsi.org/deliver/etsi\\_gr/MEC/001\\_099/018/01.01.01\\_60/gr\\_MEC018v010101p.pdf](http://www.etsi.org/deliver/etsi_gr/MEC/001_099/018/01.01.01_60/gr_MEC018v010101p.pdf)
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## CV of the Teacher

**DARIO SABELLA** works with xFlow Research Inc. as Vice President, Technology and Standards, leading the team's involvement in ETSI, both on standardization and open-source activities, and guiding the strategy to expand in other areas, also for features evolution and prioritization in the company. Previously, he was with Intel Corporation as Senior Manager Standards and Research, driving new technologies and edge cloud innovation for advanced systems, involved in ecosystem engagement and coordinating internal alignment on edge computing across standards and industry groups. In February 2021 has been elected as Chairman of ETSI MEC (Multi-access Edge Computing), while from 2019 he was serving as vice-chairman, previously Lead of Industry Groups, and from 2015 vice-chair of IEG WG. Since 2017 he is also delegate of 5GAA (5G Automotive Association). Before 2017 he worked in TIM (Telecom Italia group), as responsible in various research, experimental and operational activities on OFDMA technologies (WiMAX, LTE, 5G). Author of several publications (80+) and patents (50+) in the field of wireless communications, energy efficiency and edge computing, Dario is IEEE senior member and has also organized several international workshops and conferences. Dario served multiple times as expert and advisor to the European Commission for EU projects, is Senior Associated Editor or IEEE Consumer Electronics Magazine, and also member of the Editorial Board of MIT Technology Review Italia.

# Room and Schedule

Room: *Aula Riunioni del Dipartimento di Ingegneria dell'Informazione, Via G. Caruso 16, Pisa – Ground Floor*

**Schedule: 27-30 Jan 2025**

## Day1 (half day – Monday)

Afternoon: 15.00-18.00

Topics:

- Edge Computing, Fog computing, Cloud computing
- ETSI and 3GPP standards on edge computing
- 5G Advanced, Rel.18 and the path toward 6G systems
- MEC Framework and Reference Architecture [MEC003]
- General principles for Mobile Edge Service APIs [MEC 009]
- MEC Platform Application Enablement [MEC011]
- Classroom exercise – part 1

## Day2 (full day – Tuesday)

Morning: 9.00-12.00

Afternoon: 14.00-18.00

Topics:

- MEC in 4G, MEC in 5G, MEC in Wi-Fi networks
- MEC in NFV environment (MEC-017)
- MEC support for Network Slicing (MEC-024)
- MEC Management [MEC010-1][MEC010-2]
- MEC Application and E2E Mobility (MEC-018, MEC-021)
- Software Development for MEC
- MEC-027 – MEC support for Containers
- MEC Sandbox, Edge Connector, EDGEAPP
- Classroom exercise – part 2

## Day3 (full day – Wednesday)

Morning: 9.00-12.00

Afternoon: 14.00-18.00

Topics:

- OpenAPI MEC APIs representations, ETSI Forge
- MEC Sandbox, tools and MEC Ecosystem
- MEC-012 – RNI API, MEC-013 – Location API, MEC-028 – WLAN Information API
- MEC-016 – UE Application Interface, MEC-014 – UE identity API
- MEC Testing Framework (MEC-025), MEC Conformance Test Suite
- Performance Assessment, Metrics Best Practices and Guidelines (IEG006)
- MEC-026 – MEC support for regulatory requirements
- Artificial Intelligence: ML, /AI, FL, software tools. GenAI and edge intelligence.
- Application Deployment, Application Walkthrough
- Classroom exercise – part 3

## Day4 (half day – Thursday)

Morning: 9.00-12.00

Topics:

- Vertical segments: focus on automotive (MEC-022 “MEC support for V2X use cases”, and MEC-030 “MEC V2X API”)
- MEC-015 – Bandwidth management API
- MEC Federation, inter-MEC system communication
- MEC in action: examples and trials
- OpenNESS and 5G: integration with SimuLTE/5G
- MEC in 6G: edge AI intelligence, edge security, QKD
- Classroom exercise – presentation of results