



SEMANTIC

end-to-end Slicing and data-drivEn autoMAtion of Next generation cellular neTworks with mobille edge Clouds

*Marie Skłodowska-Curie Actions (MSCA)
Innovative Training Networks (ITN)
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WP7 – Dissemination, communication and standardization

D7.4: Dissemination, standardization, communication and public engagement plan

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Executive Summary

The SEMANTIC project has strong commitment to ensure that all activities and research findings are disseminated, communicated, transferred into other research settings and to the society at large, in order to promote understanding of science by non-specialists. This mission will be accomplished through three main activities: dissemination of research results, their exploitation and public engagement.

This deliverable provides an update at M24 of the dissemination, communication, and standardisation plan. The first objective is to disseminate research achievements in order to foster adequate visibility in standardisation bodies, to promote results visibility in specialised and non-specialised communities. The dissemination of research results comprises the set-up of a public web site, conference and journal publications, open access engagement, 5GPPP initiative, standardisation, workshops and conference organisation, industrial dissemination days and participation in technical committees and special interest groups.

The second objective is to exploit the results and IPR created in SEMANTIC. SEMANTIC has the potential for introducing radical scientific and industrial innovations. All partners have well-defined exploitation plans which are described in this deliverable: Academics in terms of journal publications, conference attendance, international visibility, and the provision for adding new modules in their postgraduate programs, industrials in terms of products development and submission of patents to secure new technological know-how.

This deliverable is the third report on dissemination, communication and standardisation of SEMANTIC. It is a living document which will evolve over time, summing up all dissemination, communication and standardization activities undertaken by the partners during the project's lifetime.



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1. Introduction

The dissemination, communication, and standardisation plan to be followed within SEMANTIC will be developed along a line of well-defined actions and activities. They will cover all relevant aspects for all partners regardless of their type. A first structure to support and monitor all relevant activities is given below.

SEMANTIC has a strong commitment to ensure that all activities and research findings are disseminated, communicated, transferred into other research settings and to the society at large, in order to promote understanding of science by non-specialists. This mission will be accomplished through three main activities:

1. Dissemination of research results
2. Their exploitation
3. Public engagement.

2. General structure

SEMANTIC is introducing a general structure to manage and monitor all related dissemination and exploitation activities. In the course of the project, the topics will be “translated” into real actions. The following draft provides the overall structure with first tangible adaptations. Further details will be provided later on.

A. Dissemination of research results

- A.1 Conference/journal publications

Scientific publications journals and conferences will be one of the main dissemination mechanisms. It is expected that, on average, each ESR will publish two conference papers and one journal paper a year.

- A.2 Open access engagement

Open access will be provided for all scholarly results, by traditional (e.g., IEEE) or open access publishers, who publish only open access journals (gold open access). The practice of depositing articles in institutional repositories or a subject repository (e.g., arXiv) will be also adopted (green open access). All publications will be available in www.openaire.eu, the Open Access Infrastructure for Research in EU. To follow the H2020 open data strategy, a local open data repository will be available, conforming to potential ethical issues.

- A.3 5GPPP Initiative



The most innovative and industrial-oriented results will be presented at the 5GPPP (<http://5g-ppp.eu/>). SEMANTIC will exploit the presence of almost all the beneficiaries in 5GPPP projects. The results of recruited ESR in the project will be presented through multiple channels (e.g., white papers or presentations), consolidating the SEMANTIC viewpoint in different Work Groups (WG): Spectrum WG, 5G Architecture, Software Networks and Network Management and QoS.

- A.4 Standardization

The industrial partners will contribute to ongoing standardisation activities by presenting achieved results to the relevant bodies. Since standardisation is a long lasting process, such activities may continue even after the end of the project.

- A.5 Industrial Dissemination Days

Two IDD's will be organized, enabling ESRs to present results to industrial experts, potentially exploiting co-location of flagship events organized by the partners (e.g. NI Week conference, NOKIA Hackathon) to provide valuable networking and feedback to the ESRs, while maximizing the project visibility.

- A.6 Workshop/Conference Organization

In close collaboration with the consortium, two workshops and one conference will be organized, which will be open to academic and industrial communities, in order to disseminate a unified view of all project achievements. Specific details on the organisation will be determined later on.

- A.7 Participation in IEEE Technical Committees (TC)

SEMANTIC will be present at IEEE TCs, e.g., by creating special interest groups, exploiting the active participation of the consortium in IEEE TCs. ESRs will become members of relevant TCs and attend meetings co-located with IEEE flagship conferences (e.g., ICC, GLOBECOM). The TCs organize different forms (e.g., standardization activities, workshops) of information exchange in the multi-disciplinary fields.

B. Exploitation of results and intellectual property

- B.1 Mainly for academic partners

Academic partners will publish results in journals, they will make presentations in conferences, increasing their international visibility, and they will add new modules in their postgraduate programs.

- B.2 Mainly for industrial partners



Improve their products and solutions, enhance their services, train current and future teams to use the newest research knowledge into industrial efforts, and expand business opportunities.

SEMANTIC is expected to generate a significant amount of intellectual assets, which will include specific methods (protocols, algorithms, policies, etc.), network data statistics and analytics, and network architectural models. Whenever possible, an open access strategy will be adopted (see the policies for disseminating results above), so as to motivate further innovation by academia and industry.

C. Communication and public engagement

- C.1 Communication strategy

SEMANTIC will use different communication channels to promote the project widely to different target groups and to contribute to an EU “Innovation Union”, such as:

- i) brochures and leaflets describing the potential applications and services of the Project;
- ii) social network accounts (Twitter, LinkedIn, etc.);
- iii) multimedia content to target public. SEMANTIC will use a YouTube channel for the project showing trailers on the plans, activities and achievements of the project;
- iv) e-newsletters with the project achievements and distributed to different mailing lists;
- v) online/printed press releases and attempt to reach a general audience by approaching TV and radio networks to provide interviews;
- vi) present results and deploy stands and demos showing the project results in industrial exhibitions;
- vii) white papers to identify project contributions and open issues, targeting to influence policy-makers, regulators and experts.

- C.2 Public engagement strategy

The aim is to interact with the general public and a wide range of public engagement activities will be organized:



- i) “Doors Open Days” events will be organized in collaboration with existing events;
- ii) social media, use of several online social media sites;
- iii) SEMANTIC hackathons;
- iv) café science. Four cafe science events will be scheduled along with some training activities (e.g., workshops, plenary meetings) in informal setting at public areas (e.g., cafe, pubs, etc.) where the ESRs will make a short presentation about their work;
- v) each ESR will give 3 public talks at different local associations, universities, science festivals, high-schools, etc. ESR will explain open issues in a didactic manner to promote the research carried out in the EU and generate interest for science and technology.

3. Supporting Activities

3.1 Website

The project website has been created by CTTC and is available at: <https://semantic2020.eu/>. The website presents the project concept and objectives, as well as information on the consortium, workpackages, the SEMANTIC Fellows, and training activities. The website also includes public documents (e.g., deliverables) and communication material (e.g., newsletters) that is publicly available on the website. Further, it includes links to communication media (e.g., Twitter and LinkedIn). The website significantly contributes to disseminating the vision and the results of SEMANTIC to the community of interested parties. To this end, the website comprises a section where all publications and communication material is uploaded.

Finally, all the learning contents (i.e., school/courses videos, slides, agendas, etc.) are available in the “Seminars and Schools” folder in a private nextcloud cloud storage accessible from all ESRs.

Figure 1 reports a screenshot of the Home section of the website.



End-to-end slicing and data-driven automation of next generation cellular networks with mobile edge clouds

The mission of SEMANTIC is to create a vibrant EU-based **TRAINING** and **RESEARCH** environment for young European and international researchers, aiming at design architectures, systems and algorithms for building the 5G and beyond cellular networks.

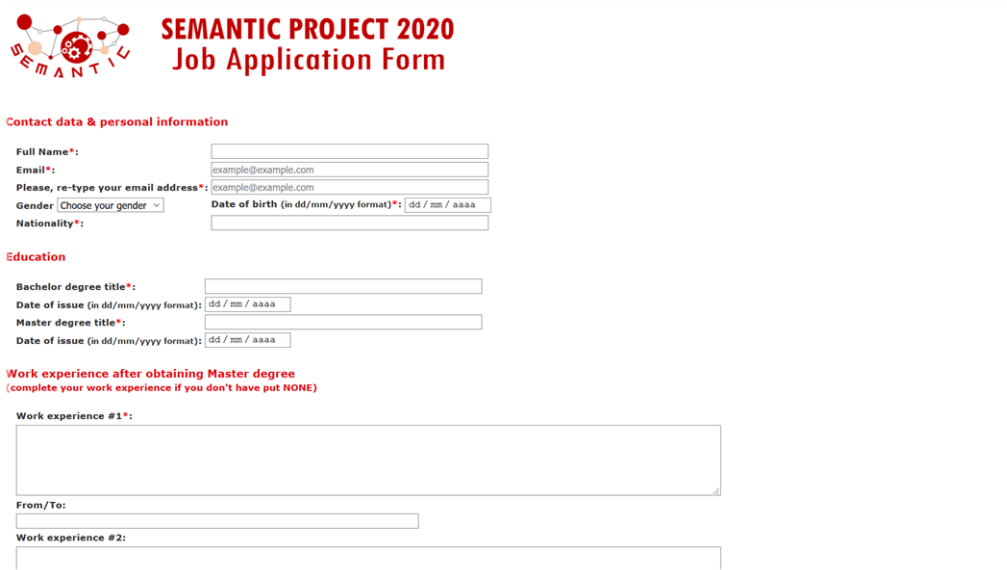


Figure 1: SEMANTIC web page (Home section)

3.2 Online application system

An online application system has been setup to receive all applications centralized, all candidates are submitting their applications through the online system and this way it is easier to control all the applications received and to preserve the security and privacy of applicants. CTTC has setup this online system and controls and distributes all the applications received to the rest of the partners.

The link to the online system is <https://jobapp.semantic2020.eu/>. A snapshot of the website is shown below:



SEMANTIC PROJECT 2020
Job Application Form

Contact data & personal information

Full Name*:
Email*:
Please, re-type your email address*:
Gender: Date of birth (in dd/mm/yyyy format)*:
Nationality*:

Education

Bachelor degree title*:
Date of issue (in dd/mm/yyyy format):
Master degree title*:
Date of issue (in dd/mm/yyyy format):

Work experience after obtaining Master degree
(complete your work experience if you don't have put NONE)

Work experience #1*:

From/To:

Work experience #2*:

Figure 2: Online application system

3.3 Twitter social network

The information on the Twitter (@semantic_itn) account created for the project are kept up-to-date on a regular basis, thanks to the work coordinated by CTTC.

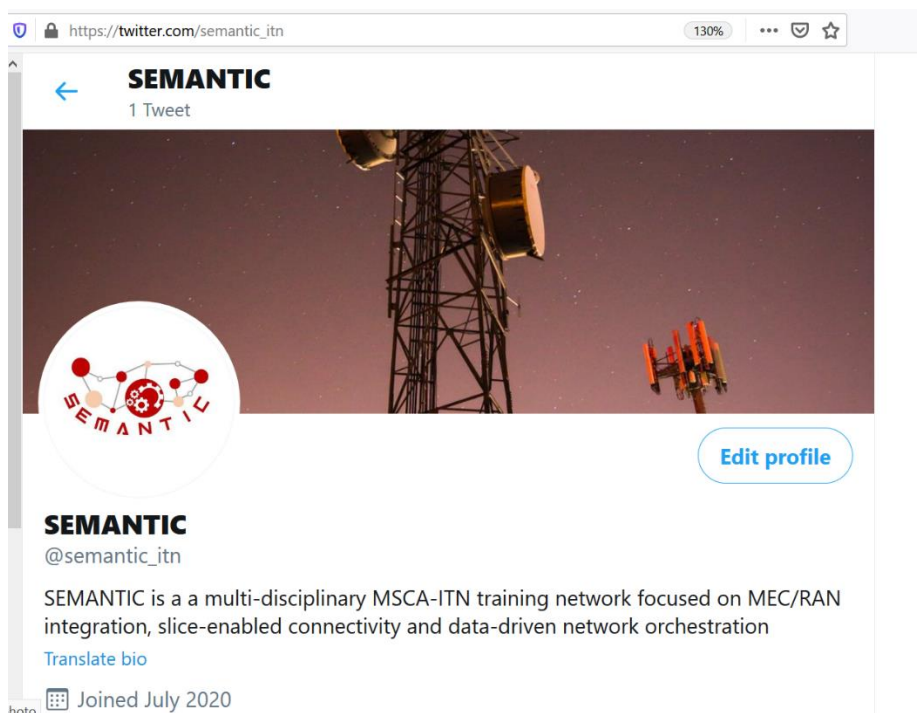


Figure 3: Twitter account (snapshot)

3.3 LinkedIn

The information on the LinkedIn ([linkedin.com/in/semantic-msca-itn-9349851b2](https://www.linkedin.com/in/semantic-msca-itn-9349851b2)) account created for the project are kept up-to-date in a regular basis, thanks to the work coordinated by CTTC.

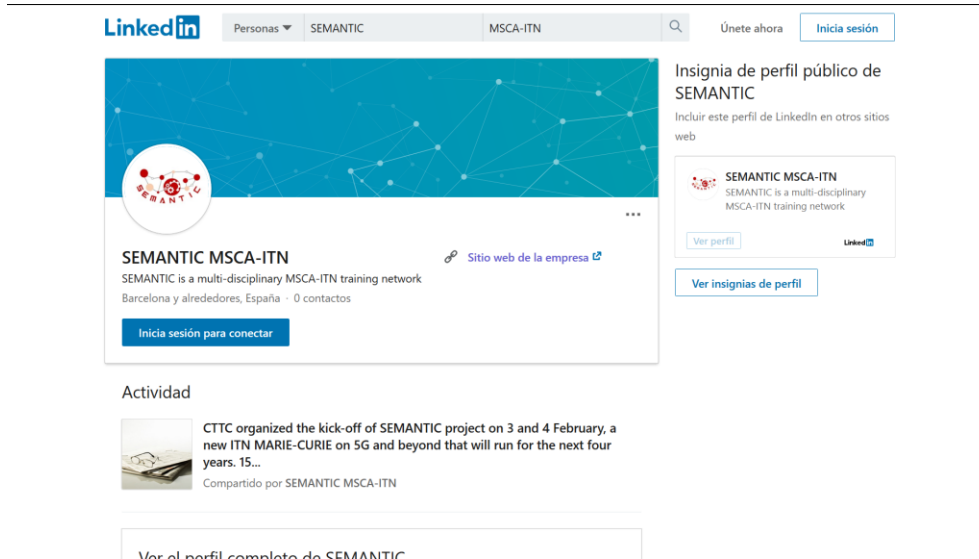


Figure 4: LinkedIn account (snapshot)

3.4 YouTube

A YouTube channel has been setup to host videos related to the SEMANTIC project. The link to the channel is https://www.youtube.com/channel/UCelqjbh_hpsFNy645CMMknQ. The channel currently hosts two videos of the SEMANTIC School 2: "OpenAirInterface for 5G cloud native and open RAN deployments" by Dr. Florian Kaltenberger and R. Schmidt, and "OpenAirInterface and Mosaic 5G, ecosystem, Kube5G and FlexRAN" by Prof. Nikaein and Osama Arouk. A screenshot of the SEMANTIC YouTube channel is reported in Figure 5.

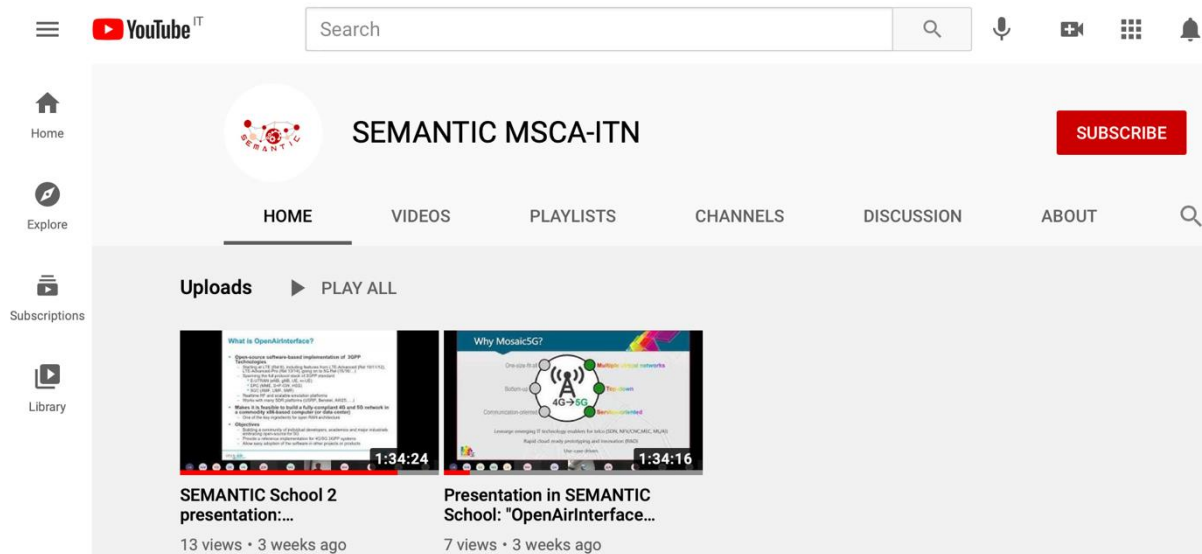


Figure 5: YouTube page

3.5 Logo

In order to increase visibility and to create a recognition feature, the SEMANTIC logo was designed. It will be largely used in every possible context related to the project.



Figure 6: Project logo

4. Dissemination of research results

4.1 Conference/journal publications

The ESRs from academic and industrial partners are expected to participate to one international conference (e.g., IEEE ICC, IEEE GLOBECOM, EUCAP, IEEE VTC, IEEE PIMRC) per year of their recruitments, they will be encouraged to contribute to EU



conferences (e.g., EUCNC) and to publish their work to 2–3 high impact journals. These include:

- IEEE Transactions on Mobile Computing (www.computer.org/portal/web/tmc/home)
- Computer Networks Journal, Elsevier (www.journals.elsevier.com/computernetworks)
- The Journal of Mobile Communication, Computation and Information (Wireless Networks), Springer (<http://www.springer.com/engineering/signals/journal/11276>)
- ACM Springer Mobile Networks and Applications (MONET) Journal (<http://link.springer.com/journal/11036>)
- EURASIP Journal on Wireless Communications and Networking (www.jwcn.eurasipjournals.com)
- IEEE Transactions on Vehicular Technology (www.vtsociety.org)
- IEEE Network (www.comsoc.org/netmag)
- IEEE Transactions on Communications (www.comsoc.org/tc)
- IEEE Transactions on Wireless Communications (www.comsoc.org/twc)
- IEEE Communications Magazine (www.comsoc.org/commag)
- IEEE Vehicular Communications Magazine (<http://ieeexplore.ieee.org>)

Conference Publications

Following is the list of papers by ESRs that are accepted/published in various conferences.

1. **S. Roy**, H. Chergui, L. Sanabria-Russo and C. Verikoukis, "A Cloud Native SLA-Driven Stochastic Federated Learning Policy for 6G Zero-Touch Network Slicing," *ICC 2022 - IEEE International Conference on Communications, 2022*, pp. 4269-4274, doi: 10.1109/ICC45855.2022.9838376.
2. **M. Adeppady**, C. F. Chiasserini, H. Karl and P. Giaccone, "iPlace: An Interference-aware Clustering Algorithm for Microservice Placement," *ICC 2022 - IEEE International Conference on Communications, 2022*, pp. 5457-5462, doi: 10.1109/ICC45855.2022.9839222.
3. **P. Doanis**, T. Giannakas and T. Spyropoulos, "Scalable end-to-end slice embedding and reconfiguration based on independent DQN agents," accepted for publication at GLOBECOM 2022.

Special sessions

MeditCom 2021

On Friday 10 September 2021 took place the SEMANTIC Special Session at IEEE International Mediterranean Conference on Communications and Networking (IEEE MeditCom 2021). Our ESRs presented their research topics and had the opportunity to discuss current opportunities and challenges in the design of beyond 5G NR techniques, MEC/RAN integration, network slicing in joint MEC/RAN infrastructures and data-driven network automation.

More info available at (Special Session 5 – Virtual): <https://meditcom2021.ieee-meditcom.org/program/special-sessions/>. All the recruited fellows in Sept 2021 (12 ESRs) have presented their research topics.

Special Session call for papers available at: https://meditcom2021.ieee-meditcom.org/wp-content/uploads/sites/159/2021/03/SS5_SEMANTIC_Meditcom_2021_Special_Session.pdf

Friday, September 10

Friday, September 10 9:00 – 16:00

SS5: End-to-end slicing and data-driven automation of next generation cellular networks with mobile edge clouds (SEMANTIC)

Room: Virtual 1

Chairs: Abdo Gaber (Physical Layer and System Design, Germany), Walter Nitzold (National Instruments, Germany), Tommy Svensson (Chalmers University of Technology, Sweden), Anna Tzanakaki (National and Kapodistrian University of Athens, Greece), Dionysis Xenakis (National and Kapodistrian University of Athens, Greece)

Building Datasets for Predicting VNF Interference

Madhura Adeppady, Carla Fabiana Chiasserini and Paolo Giaccone (Politecnico di Torino, Italy)

Zero Touch Enabled Management and Orchestration of The Next Generation E2E Networks & Services

S. Roy (Universitat Politècnica de Catalunya & Centre Tecnològic Telecomunicacions Catalunya, Spain)

MEC Service Integration in Open RAN Based on AI/ML

Vaishnavi Kasuluru (Universitat Politècnica de Catalunya & Centre Tecnològic Telecomunicacions Catalunya, Spain)

AI-enabled techniques for enhanced video service provisioning in mobile data networks

Yueheni Osadchuk (National and Kapodistrian University of Athens, Greece); Dionysis Xenakis (National and Kapodistrian University of Athens, Greece)

End-to-end network slicing and orchestration

Suvidha Sudhakar Mhatre (Iquadrat Informatica, Spain)

A reinforcement learning approach for end-to-end slicing in beyond 5G networks

Pavlos Doanis, Theodoros Giannakas and Thrasylouos Spyropoulos (EURECOM, France)

Identification of Network KPIs to Improve Network performance using Machine Learning Techniques

Quat Ullain, Vestergaard Christian, Arne Morten Kastei, Enver Asad and Bjorling Axel (Telenor, Sweden); Colella Riccardo (Telenor, Sweden & Politecnico di Milano, Italy); Rius I Riu Jaume (Telenor & Lund Technical University, Sweden)

Deep Learning-based Channel Estimation for Intelligent Reflecting Surfaces aided MIMO Systems

Mehdi Sattari and Tommy Svensson (Chalmers University of Technology, Sweden)

Towards Application-aware Efficient and Agile Non-orthogonal Multiple Access Techniques

Azadeh Tabeshnezhad and Tommy Svensson (Chalmers University of Technology, Sweden)

O-RAN meets AI

Sudharshan Paindi Jayakumar (Nokia Bell Labs, France)

Towards SEMANTIC massive connectivity in 5G networks using MEC and blockchain technologies

Diana Zhussip (Fogus Innovations and Services P. C., Greece); Dionysis Xenakis (National and Kapodistrian University of Athens, Greece)

Resource allocation in beyond 5G Virtualized Networks with Distributed Deep Neural Networks

Ali Ehsanian, Thrasylouos Spyropoulos and Theodoros Giannakas (EURECOM, France)

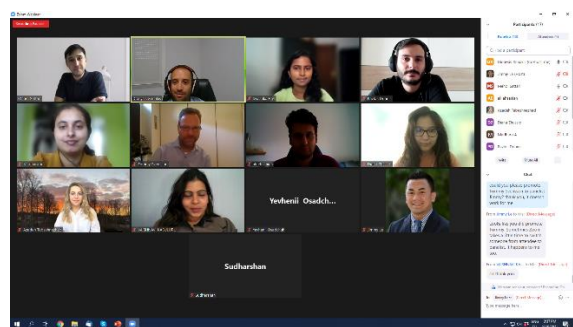


Figure 7: SEMANTIC special session at Meditcom 2021



CAMAD 2022

On Thursday, 3 November 2022, the SEMANTIC Special Session was held at IEEE International Workshop on Computer Aided Modeling and Design of Communication Links and Networks (IEEE CAMAD). All the recruited ESRs attended the workshop in person and presented their research topics on various topics, including network slicing in joint MEC/RAN infrastructures, resource allocation and orchestration, 5G NR techniques, and data-driven network automation.

Special Session

Room: Lavoisier #1

- **Title:** SEMANTIC session I
- **Chair:** Nikos Passas
- **Meeting Link:** Will be sent individually to the remote participants

1570836906: Machine Learning-Based Network Slicing and Resource Management for Beyond 5G Intelligent Networks. Navideh Ghafouri Jeshvaghani; John S Vardakas; Christos Verikoukis.

1570837044: Scalable slice orchestration with DQN agents in beyond 5G networks. Pavlos Doanis; Thrasylvoulos Spyropoulos.

1570838395: Explainable Federated Learning-Based Zero-touch Management for 6G Network Slicing. S. Roy; Christos Verikoukis; Hatim Chergui.

1570838776: Reconfigurable Intelligent Surface-assisted Power-domain NOMA. Azadeh Tabeshnezhad; Lee Swindlehurst; Tommy Svensson.

1570838791: DRL based dynamic slicing and resource allocation using O-RAN architecture for beyond 5G networks. Suvidha Sudhakar Mhatre; Kostas Ramantas; Christos Verikoukis.

1570838942: Resource Orchestration For Massive Connectivity At The Network Edge. Klearchos Palias; Dionysis Xenakis.

1570838965: Efficient Container Retention Strategies for Serverless Edge Computing. Madhura Adeppady; Paolo Giaccone; Alberto Conte; Holger Karl; Carla Fabiana Chiasserini.

Thursday Afternoon Sessions

Room: Amphithéâtre Lavoisier

- **Title:** SEMANTIC session II
- **Chair:** Nikos Passas
- **Meeting Link:** Will be sent individually to the remote participants

1570839062: Full-Duplex mmWave Massive MIMO Channel Estimation. Mehdi Sattari; Tommy Svensson.

1570839099: ML-based Resolution Time Prediction of Trouble Ticket for Operational Telecommunication Networks. Maryam Bandali, Rius I Riu Jaume, James Gross, Andreas Lewitzki.

1570839159: Joint Beamforming Design and APs Selection in Cell-free mMIMO O-RAN system. Vaishnavi Kasuluru.

1570839215: A Bitrate Adaptation Scheme for Streaming Media Over HTTP in MEC-empowered Slice-Enabled Networks. Vasilis Gretsistas; Dionysis Xenakis; Nikos Passas.

1570839276: Performance Analysis and Optimization of Integrated Access and Backhaul at mmWaves. Ayham Alyosef; Nikos Passas; Dionysis Xenakis.

1570839280: Machine Learning-based Beam Management for mmWave Bands: A Short Review. Muhammad Quratulain Khan; Abdo Gaber.

1570842814: AI-driven Base Station Clustering for Parameter Optimization and RAN Automation. Sudharshan Paindi Jayakumar; Alberto Conte.

1570863019: Edge/Cloud Traffic Prediction in 5G/6G Networks with Distributed Deep Neural Networks; Ali Ehsanian; Thrasylvoulos Spyropoulos.



Figure 8: SEMANTIC special session at CAMAD 2022

4.2 Open access engagement

Open access will be provided for all scholarly results, by traditional (e.g., IEEE) or open access publishers, who publish only open access journals (gold open access). The practice of depositing articles in institutional repositories or a subject repository (e.g. arXiv) will be also adopted (green open access). All publications will be available in www.openaire.eu, the Open Access Infrastructure for Research in EU. To follow the H2020 open data strategy, a local open data repository will be available, conforming to potential ethical issues.

4.3 5GPPP initiative

The most innovative and industrial-oriented results will be presented at the 5GPPP initiative (<http://5g-ppp.eu/>). SEMANTIC will exploit the presence of almost all beneficiaries in 5GPPP projects (e.g. FOG, EUR, NOKIA and TLN participate in three out of three 5GPPP- Phase 3 infrastructure projects, to articulate the results of recruited ESRs through multiple channels (white papers, presentations, etc.), consolidating the SEMANTIC viewpoint in WGs: i) the



spectrum WG (NI is member), ii) 5G Architecture (IQU is member), Software Networks (Nokia is leader) and Network Management & QoS (FOG is member).

SEMANTIC will publish a white paper, led by NOKIA, to identify the project contribution and state open issues, targeting to influence policy-makers, regulators and experts. This white paper will be also articulated in the 5GPPP and IEEE Future Networks Initiatives.

4.4 Standardization

SEMANTIC targets at a significant impact on 5G standardization, fully leveraging the leading role of SEMANTIC partners in relevant standardization bodies (e.g. TLN in IETF/IRTF, NI and NOKIA in 3GPP, POLITO and CTTC in ETSI, NOKIA and EUR in NGMN), setting the ambitious aim to achieve at least 6 impactful contributions in relevant standards and 6 presentations/posters in workshops/meetings organized by these bodies. **1) IETF** (Internet Engineering Task Force): TLN (IETF group member) is committed to contribute in the traffic engineering and signaling (TEAS) working group (WG) with research outcomes on inter-slice control, **2) 3GPP**: NI will process the results on MIMO/beam management to contribute in 3GPP RAN WG1 (NI is group member with focus on MIMO) and 3GPP RAN WG2 (NI is group member with focus on beam management). Also, NOKIA will further contribute to SA5 on management operations for network virtualization and SFC. **3) ETSI** (European Telecommunications Standards Institute): NI will contribute to the ETSI mmWave Transmission (mWT) group with results of his/her study for high band utilization/interference modelling (Table 3.1.d). POLITO and CTTC (active ETSI members) are also committed to promote POLITO-1 and CTTC-1 contributions in ETSI MEC on MEC/RAN integration and location-based service continuity. **4) IRTF** (Internet Research Task Force): TLN will integrate outcome of his/her work on the joint orchestration of MEC/RAN resources to the IRTF Network Management (TLN is group member), **5) ITU**: NOKIA will contribute to the new ITU-T focus group on “ML for Future Networks including 5G” (FG-ML5G) with his/her outcome on data-driven prediction for SFC in MEC/RAN, **6) NGMN** (Next Generation Mobile Networks): NOKIA (NGMN contributor) and EUR (NGMN advisor) will analyze the results on e2e integration (WP4), to contribute (e.g. white papers) in the Network Management & Orchestration and the 5G Trial & Testing Initiatives.

4.5 Industrial Dissemination Days (IDDs)

Two IDDs will be organized, enabling ESRs to present results to industrial experts, potentially exploiting co-location of flagship events organized by the SEMANTIC partners (e.g. NI Week conference, NOKIA Hackathon) to provide valuable networking and feedback to the ESRs while maximizing the project visibility. During the IDDs, industry-focused keynotes will be presented, while sessions for oral, poster and demo presentation will be organized. Through



IDDs, all ESRs will be given the opportunity to apply theoretical knowledge and skills to significant practical problems, further to establishing links with other industry and academic partners (e.g. for fostering new career opportunities and future collaborations).

4.6 Organization of Workshops and Conferences

SEMANTIC will organize two workshops and one conference, which will be open to academic and industrial communities and co-located with important IEEE conferences (e.g., ICC, GLOBECOM, EuCNC, CAMAD, etc.), aiming to disseminate a unified view of all the project achievements. ESRs will present their results in the workshops, receiving valuable feedback for their research. All project achievements will be shown at the final conference. It is expected that around 100 people will attend each workshop while more than 300 people will attend the conference.

4.7 Participation in IEEE Technical Committees (TC)

TCs foster different forms of information exchange in multidisciplinary fields of wireless networking (e.g., standardization, workshops). SEMANTIC will be present at IEEE TCs, e.g. by creating special interest groups, exploiting the active participation of the consortium in IEEE TCs (e.g., CTTC is officer of the IEEE Communications Systems Integration and Modelling – CSIM TC). ESRs will become members of relevant TCs and attend meetings co-located with IEEE flagship conferences (e.g., ICC, GLOBECOM, etc.) to present and discuss steps toward standardization. It is expected that the ESRs will attend one meeting per year.

5. Communication and public engagement strategy

5.1 E-newsletters

E-newsletters with the project achievements (e.g., novel technologies), events organized (e.g., training schools, workshops) and the societal benefits of providing high speed communications, will be distributed to different mailing lists and made available via the project website. Short interviews with the ESRs will show the impact of the multidisciplinary Network in his/her career/excellence/life. A new issue will be released every three months starting from M10 and ESRs will be involved in the preparation of them.

5.2 Broadcast media

Three TV/radio interviews, and at least one visit of a recognized EU or local politician in the lab facilities of beneficiaries (followed by the press) will be targeted by SEMANTIC, aiming at



maximum visibility of the project at the public at large, communicating the impact of EU-funded research and 5G and beyond networks to the life of EU citizens. The objective is to inform public audience about: i) benefits – scientific excellence, new products & services – for setting up a collaborative Network of young researchers hosted by 10 different institutions, and ii) how people’s interaction with the Internet will change and will open up new kinds of intelligent analytics ready to be harnessed for tangible business and everyday life benefits.

5.3 Brochures and leaflets

In order to increase visibility, the first brochure has been created by POLITO, describing the project concept and vision, the goal of the workpackages, and the consortium, and introducing the ESR that have been hired. The brochures are reported in Figure 9 and 10.

Future brochures will be also translated in Spanish, Greek, French, German and Swedish, and will be disseminated to city councils, local universities, schools, recreational areas, etc.,

This project has received funding from the European Union's Horizon 2020 research and innovation program under Grant Agreement No 861165

end-to-end Slicing and data-driven autoMation of Next generation cellular networks with mobile edge Clouds

1. Who we are

The development of next generation mobile network is the reflection of booming demand for higher data rates coupled with ever-increasing demand for remote yet timely monitoring, control and reconfiguration of cyber-physical infrastructure supporting our day-to-day lifestyle. 6G strives to become more scalable, flexible, and effective by incorporating novel strategies in order to fulfill a wide range of services across businesses, the health care domain, virtual presence, and other anticipated challenging applications.

We, as part of SEMANTIC project, will be working together to meet and surpass various ambitious Key Performance Indicators (KPIs) designed by 5GPPP for specific use cases spanning over manufacturing, automotive, media, energy, e-health, public safety, and smart city industries. The main target of SEMANTIC is to develop and experiment new solutions with a gamut of techniques, methodological frameworks, and tools that leverages wide variety of newly proposed 5G key-enablers.

2. Research Objectives

❖ Propose future proof 5G NR transmission techniques for advanced beam management, adaptive duplexing, self-contained transmissions, mmWave system coexistence (A).

❖ Devise architectural and functional enhancements for MEC services into the standard operation of 5G by considering MEC service mobility, flexible resource utilization, and massive edge connectivity (B).

❖ Develop forward-thinking strategies for flexible modeling, creating, and optimizing dynamic e2e slices over joint MEC/RAN infrastructures, exploiting functional split, X-haul design, and slicing (C).

❖ Innovate data-driven network control and automation towards fast acceleration and joint optimization of critical network tasks affecting system-wide performance (D).

3. Consortium

Towards achieving various research objectives, SEMANTIC has established a group of 15 early-stage researchers who will work in line with current academic and industrial efforts to meet the ambitious 5G and beyond system requirements. The early stage researchers will become unique experts in their respective areas of work through rigorous training activities focusing on cross-sector training, technical skills, communication skills, IPR and standardization process, managerial skills, etc.

4. Dissemination

Various innovations and solutions proposed by the SEMANTIC researchers will be directly beneficial to several target groups: relevant scientific communities, industries and businesses, standardization bodies, and society. For disseminating the various research activities and to increase the engagement with industries, SEMANTIC will adopt the following strategies.


- ❖ Website publication
- ❖ Conference and journal publications
- ❖ Participation to standardization bodies
- ❖ Workshop/Conference organization
- ❖ Industrial dissemination day
- ❖ Open access engagement
- ❖ Participation into IEEE technical committees
- ❖ Contribution to 5GPPP workgroups

Project Coordinator: **CTTC**


Partners: **FOGUS, EURECOM, NOKIA, CHALMERS, UNIVERSITA' DEL SALENTO, POLITO**

Figure 9: First SEMANTIC brochure





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end-to-end Slicing and data-driven autoMation of Next generation cellular neTworks with mobile edge Clouds

in Semantic MSCA-ITN
 @semantic_itn
 SEMANTIC MSCA-ITN
 semantic@cttc.es
<https://www.semantic2020.eu/>

Who we are

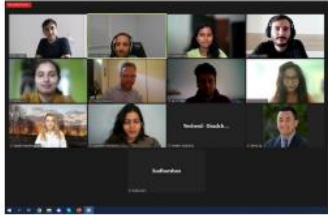
The development of next generation mobile network is the reflection of booming demand for higher data rates coupled with ever-increasing demand for remote yet timely monitoring, control and reconfiguration of cyber-physical infrastructure supporting our day-to-day lifestyle. 6G strives to become more scalable, flexible, and effective by incorporating novel strategies in order to fulfill a wide range of services across businesses, the health care domain, virtual presence, and other anticipated challenging applications.

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Semantic at IEEE MEDITCOM


On Friday 10 September 2021 took place the SEMANTIC Special Session at IEEE International Mediterranean Conference on Communications and Networking (IEEE MEDITCOM) virtually.

Our ESRs presented their research topics and had the opportunity to discuss current opportunities and challenges in the design of beyond 5G NR techniques, MEC/RAN integration, network slicing in joint MEC/RAN infrastructures and data-driven network automation.




Consortium

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Industrial Exhibition

SEMANTIC participated in MWC 2021 where Suvidha Mhatre, one of the SEMANTIC fellows, presented 'beyond 5G end-to-end slicing and data-driven automation using mobile edge clouds'. The Mobile World Congress 2021 was held between 28 June and 1 July. It had more than 20,000 physical attendees and over 100,000 virtual visitors, according to the figures presented by the organizers, the GSMA.



Project Coordinator



Partners


















Figure 10: Second SEMANTIC brochure

5.4 Online/printed Press

Four articles will be published in national/local (e)-newspapers to inform the general public (e.g., *El Pais* in Spain with 220k readers, *Protothema* in Greece with 7M visits per month), and university magazines (e.g., «το Καποδιστριακό» by UOA), on the societal benefits, scientific excellence, new products and services of the SEMANTIC consortium.

5.5 Industrial Exhibitions

The key ESR innovations will be presented through stands/demos of working testbeds in at least three industry-attended events (e.g., Mobile World Congress-110k visitors, 5G World-

10k visitors), or events organized by the EC (e.g., 5G Summit, RAN World) and the project partners (e.g. NI Week conference). This activity will increase the awareness of the industrial stakeholders and operators on the SEMANTIC results. Next, we present the most relevant Industrial Exhibitions held so far.

Mobile World Congress 2021

SEMANTIC participated in Mobile World Congress (MWC) 2021 where Suvidha Mhatre, one of the SEMANTIC fellows, presented ‘beyond 5G end-to-end slicing and data-driven automation using mobile edge clouds’. The Mobile World Congress 2021 was held between 28 June and 1 July. It had more than 20,000 physical attendees and over 100,000 virtual visitors, according to the figures presented by the organizers, the GSMA.

More info available at: https://twitter.com/semantic_itn/status/1412810541253509126



Figure 11: ESR Presentation at Mobile World Congress (MWC) 2021

5.6 White paper

SEMANTIC will publish a white paper (M30), led by NOKIA, to identify the project contributions and state open issues, targeting to influence policy-makers, regulators and experts. The white paper will be also articulated in the 5GPPP and IEEE Future Networks Initiatives.

5.7 Open Days

SEMANTIC will organize 3 open days, collocated with existing events (e.g., Fete de la science in EUR, Science Week in CTTC, International Science Festival in Gothenburg, EU Researcher’s Night), with a target 300-400 audience of students, engaging students in a research environment and to familiarize with EU-funded actions. Experimental demonstration, hands-on sessions and applied examples will be prepared by the ESRs. Locals and young

students will be invited to familiarize themselves with the research activities performed by and provide valuable feedback to the ESRs through questioners. Next, we expose the most relevant Open Days activities held so far.

EU Researcher’s night 2021

SEMANTIC was present at the European Researchers’ Night to disseminate the general research objectives of the project and the planned targets. More info available at: <https://lanitdelarecerca.cat/semantic/>

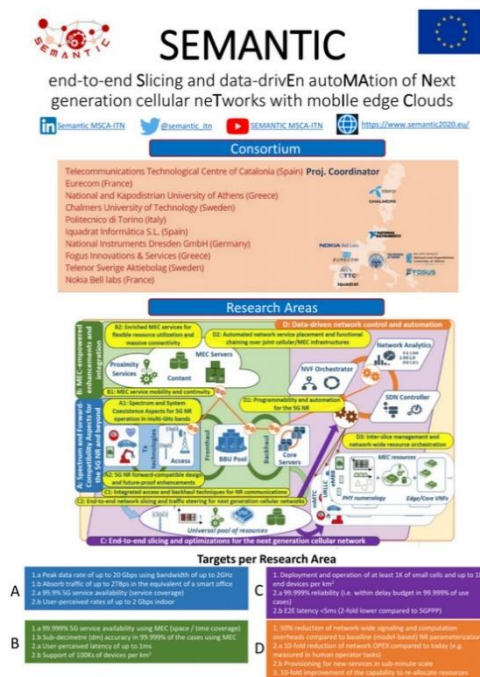


Figure 12: Poster used for the dissemination of the project in the European Researcher’s Night.

5.8 Social media

The two-way access between the project partners and the public audience has been enabled via the use of several online social media sites (e.g., Twitter, Facebook, LinkedIn, YouTube). The ESRs regularly contribute to publish announcements and initiate discussions on topics of the project. The content will be updated in systematic regular basis (at least monthly updates) and the obtained feedback (comments, ideas, opinions, etc.) will heavily influence project’s directions and decisions.

5.9 Multimedia content

SEMANTIC has set up a YouTube channel for the project, including i) four trailers on plans, activities, and achievements of the project, ii) at least one interview per ESR communicating his/her experience from the participation in MSCA actions, summarizing recent achievements,



iii) at least one interview per beneficiary, highlighting how EU-funding and SEMANTIC promotes academic/ industrial innovation. The material will be also made available through the project website.

5.10 Public talks

Each ESR will give 3 public talks at different local associations, universities, science festivals, high-schools, etc. ESRs will explain open issues in a didactic manner (with examples and hands-on activities) to promote fruitful discussions to explain the research carried out in the project and generate interest for science and technology. The target audience is a multidisciplinary public with interest in Science, Technology, Engineering and Math (e.g., STEM program in Greece). During the talks the ESRs will encourage the audience participations through interactive, multimedia presentations. The attendees will be asked to fill out questionnaires to get feedback about the content and its applicability in real life scenarios.

In the second semester of 2021, two Chalmers ERSs have presented their ongoing research work during the Communications Systems group seminar series at Chalmers University:

- ESR02 Mehdi Sattari, “**Channel Estimation and Passive Beamforming for IRS-assisted Systems**” (Oct 22, 2021). Abstract: The problems of channel estimation and passive beamforming are studied in intelligent reflecting surface (IRS)-assisted systems. To obtain channel estimates reflected by IRS and optimal phase configuration, we have utilized tools from deep neural networks and both TDD and FDD transmission are considered.
- ESR04 Azadeh Tabeshnejad, “**Using RIS for Agile Non-Orthogonal Multiple Access**” (Nov. 19, 2021). Abstract: Future mobile networks will need to be both highly efficient and agile to meet the envisioned requirements of diverse beyond-5G/6G services. Non-orthogonal multiple access (NOMA) allows flexible resource allocation via superposition of several signals in the same resource block. In this talk we give an introduction to our ongoing work on using reconfigurable intelligent surfaces (RIS) for agile non-orthogonal multiple access. In particular, we focus on the use of Simultaneous Transmission and Reflection (STAR)-based RIS as tools for achieving the channel gain differences necessary for NOMA to be effective.

In 2022, ESRs have presented their ongoing research activities at various venues:

- Madhura Adeppady (ESR05) presented her work at the Italian Networking Workshop (INW) 2022, held at Courmayeur, Italy, on January 18. (<https://inw2022.polito.it/>) .



Abstract: Efficiently deploying microservices (MSs) is critical, especially in data centers at the edge of the network infrastructure where computing resources are precious. Unlike most of the existing approaches, we tackle this issue by accounting for the interference that arises when MSs compete for the same resources and degrades their performance. In particular, we first present some experiments highlighting the impact of interference on the throughput of co-located MSs. Then, we formulate an optimization problem that minimizes the number of used servers while meeting the MSs' performance requirements. In light of the problem complexity, we design a low-complexity heuristic called iPlace, that clusters together MSs competing for resources as diverse as possible and, hence, interfering as little as possible. Importantly, the choice of clustering MSs allows us to exploit the benefit of parallel MSs deployment, which, as shown by experimental evidence, greatly reduces the deployment time as compared to the sequential approach applied in prior art.

- Maryam Bandali presented her work entitled “**ML-based Resolution Time Prediction of Trouble Ticket for Operational Telecommunication Networks**” at A5GARD (Achieving 5G service Assurance in the Residential Domain) project plenary session, Sweden, Stockholm 10-14 October 2022 and received feedback from partners.
- Klearchos Palias (ESR08), presented his work titled “**Massive Connectivity at the Network Edge**” at the Department of Digital Industry Technologies (University Of Athens) on 6 October 2022.

Abstract: Due to the continuous growth of mobile video traffic, along with the demand for massive connectivity and fully personalised content consumption, new sets of standards for mobile data access have been set. Our proposed platform presents a blockchain based model, where 5G stakeholders can trade and share data in a fully decentralised and anonymous highly-robust fashion. Our proposed platform allows content streaming between peers, by utilising the openethereum blockchain consensus network. To this extent, different kinds of methods and functionalities can be executed and called through specific Smart Contract implementations and to finally allow users achieving secure communication and accurate content delivery, from one side to another (Client-PaymentRelay-ServiceProvider) through specific actions and procedures. Our proposed solution enables: high degree of decentralisation upon blockchain consensus, improved security mechanisms due to its blockchain distributed architecture, multi-million transactions/second, increased network's capacity throughput and finally



anonymous instant off-chain payments, enabling fair-exchange of network and blockchain level resources.

- Swastika Roy (ESR09) is going to present her poster on “**Transparent 6G Network Slicing**” at the CTTC workshop, CTTC, Spain, 29 November 2022.

5.11 Semantic hackathon

The SEMANTIC partners will adapt the context of existing Hackathons events organized by them (e.g. POLITO organizes the MEC ETSI Hackathon in Turin, NOKIA has its own Hackathon event) to organize two comprehensive events on MEC-empowered service provisioning and 5G network automation with wide participation of programmers, engineers, students and others.

The SEMANTIC hackathon on “**Multi-access Edge Computing**” took place virtually on Thursday, February 24, 2022. This event was organized by Politecnico di Torino. All the ESRs actively participated in the event and gained knowledge on the concept of virtualization, container-based applications, and container orchestration. The ESRs performed various activities on Crownlab, a platform developed at Politecnico di Torino that allows immediate access to remote computing labs, using Kubernetes as a reference container orchestration system. Figure 13 shows all the participating ESRs and the hosts of SEMANTIC hackathon 2022.

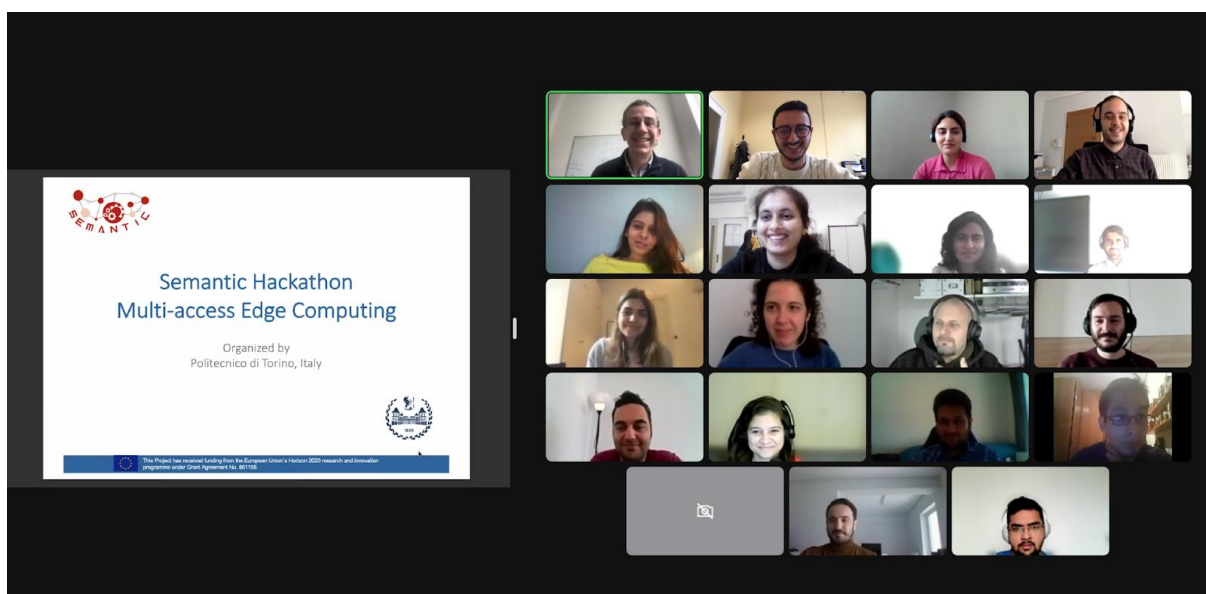


Figure 13: SEMANTIC Hackathon 2022



5.12 Café science

Four cafe science events will be scheduled along with some training activities (e.g. workshops, plenary meetings) in informal setting at public areas (e.g., cafe, pubs, etc.) where the ESRs will make a short presentation about their work

6. Conclusion

The central aim of this deliverable was to give a detailed view of the dissemination activities that will be undertaken by the SEMANTIC project. This not only includes the tradition dissemination routes, but also wider exploitation of results, including standardisation, and engagement of the general public.

The report is a living document, i.e., it will evolve during the course of the project, providing additional information on both overall and individual dissemination/exploitation activities. This deliverable includes the main achievements until M24.