
# A Secure and Reusable Artificial Intelligence Platform for Edge Computing in Beyond 5G Networks

## D6.3

# First Dissemination, Impact Assessment and Exploitation Report


This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 101015922

| D6.3 First Dissemination, Impact Assessment and Exploitation Report | |
|---|---|
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| **Glossary** | |
|---|---|
| AI | Artificial Intelligence |
| CA | Consortium Agreement |
| DMP | Data Management Plan |
| ETSI | European Telecommunications Standards Institute |
| FG-AN | Focus Group on Autonomous Networks |
| FRMCS | ETSI Future Railway Mobile Communication Systems |
| GA | General Assembly |
| IA | Infrastructure Association |
| IBN | Intent-Based Networking |
| IETF | Internet Engineering Task Force |
| IPR | Intellectual Property Rights |
| IRTF | Internet Research Task Force |
| ITU-T | ITU Telecommunication Standardization Sector |
| KPI | Key Performance Indicator |
| NM | Network Management |
| NMRG | Network Management Research Group |
| SDA | Standards Developing Association |
| SDO | Standards Developing Organization |
| SNS | Smart Networks and Services |
| WG | Working Group |
| WP | Work package |

# Executive Summary

This deliverable reports the complete set of activities performed during the first year of the project related to dissemination, standardisation, contribution to 5G-PPP, collaboration with other projects, as well as IPR, open access and data management. It also provides an initial impact assessment by reviewing the project's key performance indicators and targets relevant to the dissemination efforts.

This deliverable will be followed by a second-year deliverable (D6.4) and completed by a final deliverable (D6.5) at the end of the project.

# 1 Introduction

This deliverable reports the activities in relation to WP6 tasks, which have been realized during the first year. All these tasks are continuous over the project lifetime. They are monitored on a regular basis to assess the impact and visibility of the project regarding different communities and the public through a project Dissemination tracker.

Section 2 presents the activities of T6.1 for the dissemination and communication of the knowledge produced by the project. This is a key enabler to promote the project realizations and create potential synergies and relations with various actors from academia or industries. Various communications channels have been set up including social media and website, and other are in progress such as flyers and videos. Although some project results have been already presented in conferences, this is limited to virtual participation due to the pandemic.

Section 3 is about standardization and reports the activity of T6.2. Although an initial plan has been setup at the time of the proposal writing, this deliverable focus on the concrete actions done and more specific standardization groups which are now targeted based on the technical work developed in WPs 2 to 5. Standardization activity is a long-time process, which will certainly persist over the project. However, it was important to initiate this activity from the beginning of the project to increase our impact. This project will contribute to the definition of beyond 5G networks. Because it cannot cover all possible aspects, collaborations and discussions with other projects working towards the same perspective is very important.

T6.3 reported in Section 4 ensures interaction with other projects and WG from 5G Infrastructure Association (5G IA). To manage a proper exploitation and eventual commercialization of project results, IPR must be carefully managed and this objective of T6.4 is presented in Section 5, along with the DMP documented in D6.2.

Finally, Section 6 assesses the impact and exploitation of the project results based on KPIs.

# 2 Dissemination and Communication Activities

The activities around dissemination and communication within T6.1 were initiated with the creation and maintenance of the plan for the dissemination and use of knowledge of the project. It has since continued with actions taken to ensure the project's visibility through online channels, such as a project website and social media outlets, as well as the outcomes of the project consortium's dissemination efforts in various scientific and business events.

## *2.1 AI@EDGE dissemination strategy*

The AI@EDGE dissemination strategy has been prepared within WP6 and is already illustrated in D6.1. It will be kept regularly updated and managed.

To monitor all the dissemination activities carried out by the AI@EDGE partners, the consortium has decided to made use of a **dissemination tracker**, available online in the project repository hosted by FBK. The tracker has the purpose of keeping track of all relevant events that partners are attending (and where they are disseminating the progress and results of AI@EDGE). The **dissemination tracker** collects information about:

- Scientific publications
- Communication activities
- 5G-PPP meetings
- Scientific Dissemination activities
- Participation to conferences / events (organized by third parties)
- Organisation of conferences / events (by the AI@EDGE Consortium)

Partners are requested to update the tracker continuously by adding the activities they have had and are carrying out.

## *2.2 Communication tools and materials*

As foreseen in the AI@EDGE project proposal, the project will make use of a series of communication tools and materials.

### 2.2.1 Newsletters

One electronics newsletter in which to present the project main achievements and training activities is expected to be released each year, but the consortium agreed to produce more newsletters if needed to provide updates on the project outcomes.

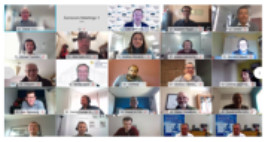
The 1st newsletter has been published on the 28th of June 2021 and is available on the project website at the following link: https://aiatedge.eu/the-first-aiedge-newsletter-is-out/

The second newsletter will be prepared for January 2022 and will present the project main achievements for the 1st year.

## About the AI@EDGE Project

**Artificial Intelligence** has become a major **innovative force**, and it is one of the pillars of the fourth industrial revolution. While significant progress has been made during the last years concerning **AI-enabled platforms' accuracy and performance**, their integration in potentially autonomous decision-making systems or even critical infrastructures requires **assuring end-to-end quality**. The goal of the H2020 AI@EDGE project is to address this issue by **introducing reusable, secure and trustworthy AI solutions** in the **Network Edge**. It aims to **revolutionise communication networks** achieving an EU-wide impact on **industry-relevant aspects of the AI-for-networks** and **networks-for-AI paradigms** in **beyond 5G systems**, with a variety of applications including vehicles, industrial networks, aviation and in-flight entertainment.

AI@EDGE is one of the 9 research projects retained from the 81 proposals submitted to the European Commission in response to the **H2020-ICT-52-2020 call:** 5G-PPP Smart Connectivity beyond 5G. The project, started in January 2021, lasts 3 years and involves 19 partners among industries, universities and research institutes from 8 countries. Find out more about it on the recently published sixth issue of the European 5G Annual Journal (pp.110-112) and on the Phase 3 projects brochure released by **5GPPP** to present the recently funded projects (p.56).



## AI@EDGE accelerates towards 6G

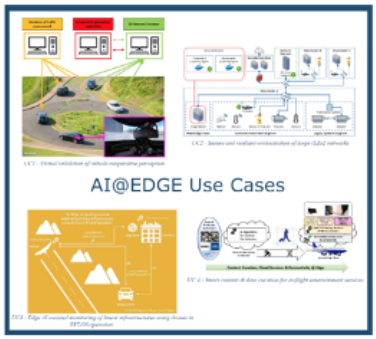
On March 16th AI@EDGE participated in the webinar organized by the 5G-PPP titled **"Europe accelerates towards 6G"**. AI@EDGE, together with the other new 5G-PPP Smart Connectivity beyond 5G projects, is indeed already working on developing **groundbreaking advances for beyond 5G and 6G networks**. The webinar was structured in two parts: during the first part our Technical Manager presented the overarching vision based on the **exploitation of AI and ML across a distributed edge computing fabric** spanning from the access to the centralized cloud. During the second part he reported on the **technical challenges** that will be addressed during the project and on the **enablers** that will help in addressing them. The webinar was an excellent opportunity for the various ICT-52 projects to get to know each other which in time will allow bootstrap **fruitful and exciting collaborations** in the future. We cannot wait to shape the **future of 6G** together with those projects.


## Our participation to Joint EuCNC & 6G Summit

On June 8th-11th AI@EDGE participated in the Joint EuCNC & 6G Summit virtual event with a paper titled **"AI@EDGE: A Secure and Reusable Artificial Intelligence Platform for Edge Computing"** which was selected for presentation.

The 2021 Joint EuCNC & 6G Summit put together two successful conferences in the area of telecommunications: EuCNC (European Conference on Networks and Communications), in its 30th edition, and the 6G Summit, in its 3rd edition. Overall, the event gathered **more than 2000 experts**.

The AI@EDGE paper was presented in the session "6G Platform, Intelligence and Trust" and introduced the concept of "reusable, secure, and trustworthy AI for network automation", a cornerstone of the AI@EDGE architecture. The session has been followed by more than 40 people and the Q&A session has been very interactive. In particular, significant interest was raised in the fields of **distributed/federated learning** and **sustainability**.




## The AI@EDGE validation framework

The technological solutions developed by AI@EDGE will be demonstrated through the implementation of four use cases that will serve as validation framework: **UC1: Virtual validation of vehicle cooperative perception**, **UC2: Secure and resilient orchestration of large (I)IoT networks**, **UC3: Edge AI assisted monitoring of linear infrastructures using drones in BVLOS operation**, and **UC4: Smart content & data curation for in-flight entertainment services**. A relevant activity carried out during the first six months of the project was the **characterization of the use cases** using a common framework aiming at **harmonising the analysis methodology** and their **presentation structure**. The output was a template which reports the use cases' actors and scenarios, the description and objectives, the technical requirements and Key Performance Indicators (KPIs), as well as the features of interest coming from the adoption of AI@EDGE's technical solutions, requested to meet the use case needs. The **Deliverable 2.1** ***"Use cases, requirements, and preliminary system architecture"***, available from the end of June also on the project website, reports the **results of this analysis** as well as the **system-level** and **functional requirements** taken into account to design the **preliminary version of the system architecture**.

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*Figure 1: AI@EDGE Newsletter #1.*

### 2.2.2 Project leaflet

A project leaflet was planned and is currently in preparation. We are in the process of collecting offers by different companies. The leaflet requested in the offer will be in the 4 sides closed 10,5 x 21 cm format and will provide general information on the project and its expected outcomes and impacts, as well as an overview of the project 4 use cases.


*Figure 2: AI@EDGE Leaflet outside.*

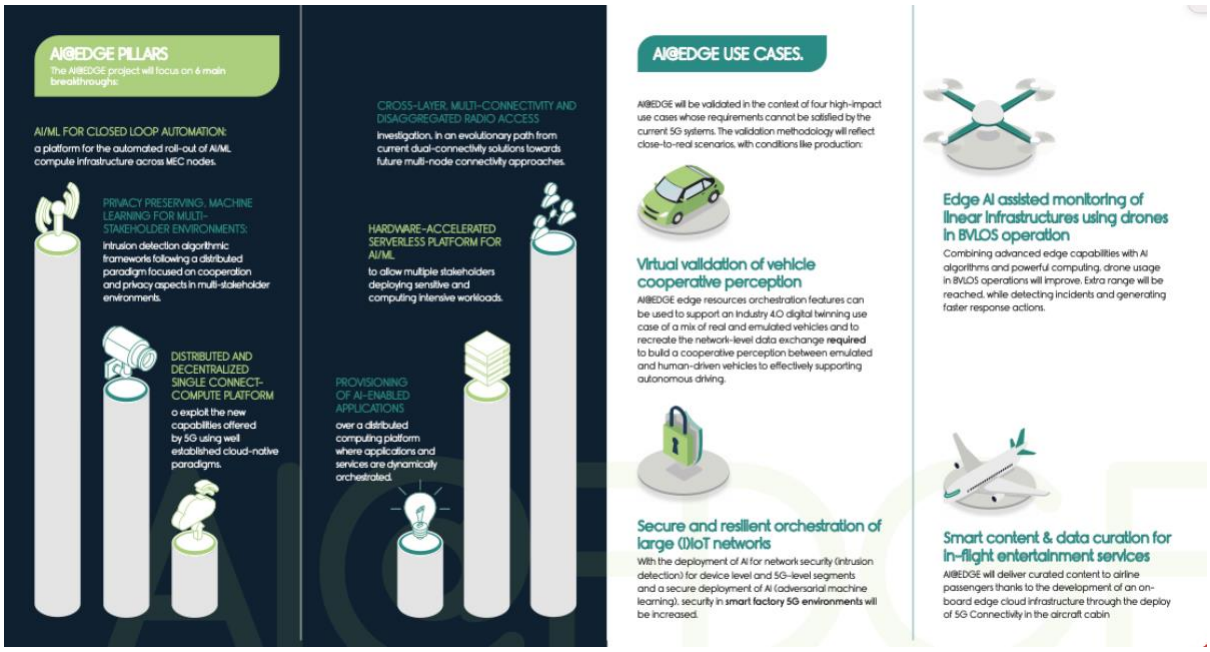



*Figure 3: AI@EDGE Leaflet inside.*

### 2.2.3 Roll-up banner

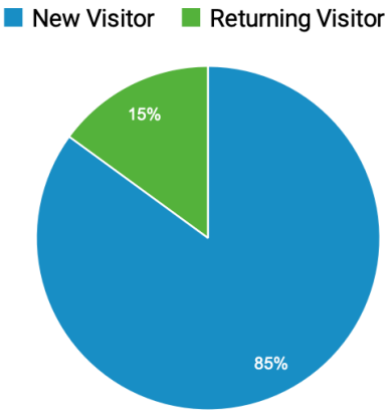
A roll-up banner is being prepared in 85 x 210 cm format. It will be available soon.

## 2.3 AI@EDGE online presence

The AI@EDGE website, available at https://aiatedge.eu/, is the main showcase of the project to the broadest audience and external institutions. The website is used as a prime public dissemination tool, making available the content derived from the development activities, and it also provides access to other informative material such as project technical reports, posters, and presentations. The website is kept up to date with the latest project achievements and dissemination activities. A section called "Publications" reports the project deliverables marked as Public and other interesting publications.


*Figure 4: AI@EDGE website main page.*

The website statistics as of December 6, 2021, shows 1.352 users, with 1.996 unique website visits.




### 2.3.1 LinkedIn

The project's LinkedIn page, available at https://www.linkedin.com/company/aiatedge, has 69 followers as of December 31, 2021.

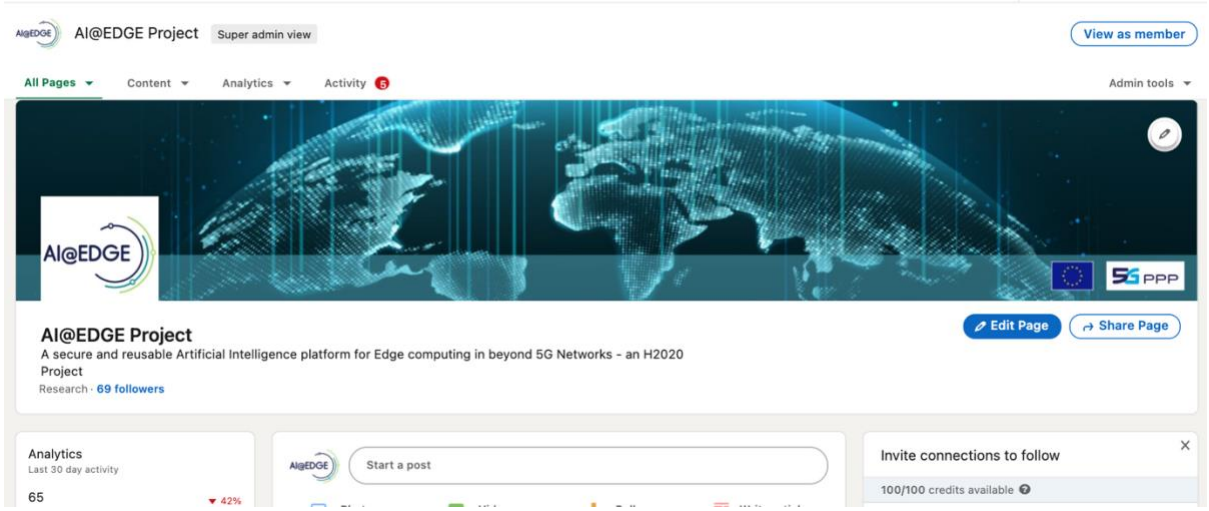



*Figure 5: AI@EDGE account on LinkedIn.*

### 2.3.2 Twitter

The project's Twitter account, available at https://twitter.com/AIatEdgeH2020, has posted 67 tweets and has 142 followers as of December 31, 2021.


*Figure 6: AI@EDGE account on Twitter.*

### 2.3.3 YouTube

A Youtube playlist is available for the project within the official YouTube channel of Fondazione Bruno Kessler, the AI@EDGEproject coordinator. It has been decided best to have a playlist instead than a dedicated channel. As also reported within D6.1 "Project website, dissemination channels and social media communications", the decision has been taken to capitalise on the subscribers of followers already available in the FBK channel, thus maximising the outreach potential of AI@EDGEvideos.

A video of the project is being prepared and will be made available soon on both the project website and the Youtube playlist.

## *2.4 Scientific publications*

The scientific publications of 2021 are listed below.

*Table 1: List of scientific publications.*

| Title of the Journal / Proceedings / Books series / Book | Title | Authors / Affiliation | Peer-reviewed publication (yes/no)? | Status[1] |
|---|---|---|---|---|
| **2021 EuCNC & 6G Summit - 6GV** | AI@EDGE: A Secure and Reusable Artificial Intelligence Platform for Edge Computing (https://doi.org/10.1109/EuCNC/6GSummit51104.2021.9482440) | Roberto Riggio [RISE], Estefanía Coronado [I2CAT], Neiva Linder [ERICSSON], Adzic Jovanka [TIM], Gianpiero Mastinu [POLIMI], Leonardo Goratti [SAFRAN], Miguel Rosa [AEROTOOLS], Hans Dieter Schotten [DFKI], Marco Pistore [FBK] | YES | A |
| **International Supercomputing Conference - High Performance (ISC) 2021, Workshop VHPC'21** | FaaS and Curious: Performance implications of serverless functions on edge computing platforms | Tzenetopoulos A. et al. [ICCS] Achilleas TzenetopoulosEmail authorEvangelos ApostolakisAphrodite TzomakaChristos PapakostopoulosKonstantinos StavrakakisManolis KatsaragakisIoannis | YES | A |

[1] A = accepted; S = submitted.

| | | | | |
|---|---|---|---|---|
| | (https://doi.org/10.1007/978-3-030-90539-2_29) | OroutzoglouDimosthenis MasourosSotirios Xydis, Dimitrios Soudris | | |
| **Int'l Mediterranean Conf. on Communications and Networking (meditcom 2021), Workshop 1 on Acceleration for Edge Computing** | Towards sharing one FPGA SoC for both low-level PHY and high-level AI/ML computing at the edge (https://doi.org/10.1109/MeditCom49071.2021.9647576) | Stratakos I. et al. [ICCS] Ioannis Stratakos; Elissaios Alexios Papatheofanous; Dimitrios Danopoulos; George Lentaris; Dionysios Reisis; Dimitrios Soudris | YES | A |
| **1st International Workshop on Network Programmability (NetP 2021) co-located with CNSM 2021** | Delay-Sensitive Wireless Content Delivery: An Interpretable Artificial Intelligence Approach (https://doi.org/10.23919/CNSM52442.2021.9615533) | Estefanía Coronado (i2CAT), Blas Gómez (UCLM), José Villalón (UCLM), Antonio Garrido (UCLM), Shuaib Siddiqui (i2CAT), Roberto Riggio (UNIVPM) | YES | A |

## *2.5 Third-party events and webinars*

During 2021, the first year of the project, with the COVID-19 pandemic still striking, the partners had the chance to attend only one event:

**Expodronica 2021 @ World ATM Congress**
Dates: 26-28/9/2021 (virtual event)
Venue: Madrid, Spain
Partner: AEROTOOLS presented the AI@EDGE project within their stand.

During 2022, the consortium expects to attend more events, both virtual ad in person, such as the following:

- IEEE International Conference on Communications, 16-20/05/2022, Seoul (South Korea)
- MWC Barcelona 2022, 28/02 – 03/03/2022, Barcelona (Spain)
- IEEE GLOBECOM 2022 - IEEE Global Communications Conference, Exhibition & Industry Forum, 4-8/12/2022, Rio de Janeiro (Brazil)
- European Conference on Networks and Communications (EuCNC) & 6G Summit, 4-8/12/2022, Grenoble (France)
- IEEE International Conference on Network Softwarization 2022, 27/06 – 01/07/2022, Milan (Italy)
- International Symposium on Mobile Ad Hoc Networking and Computing (MobiHoc), 17-22/10/2022, Seoul (South Korea)
- Edge Computing World Global 2022, to be defined

## 2.6 Events and webinars organised by AI@EDGE

During 2021, the first year of the project, the project consortium organised the following events.

### 2.6.1 Pre-kick-off meeting

The pre-kick-off meeting, held online on the 13th of January 2021, had the main objectives:

- Ensuring all partners were aware of the first project activities and upcoming deadlines for the first 18 months
- Ensuring all partners had the resources for allowing a smooth start of the project (considering COVID-19 and early start)
- Setting up the Kick-off meeting
- Discussing pending "preparatory" tasks

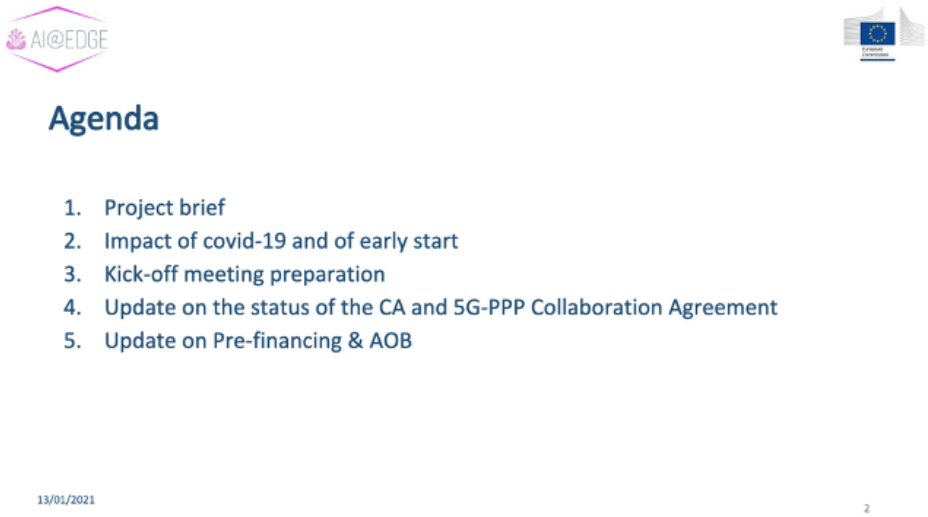



*Figure 7: Pre-Kick-off meeting agenda.*

### 2.6.2 Kick-off meeting

The project kick-off meeting was held online because of the COVID-19 pandemic, from the 3rd to the 4th of February 2021.

**Kick-off Meeting Agenda / 03-04.02.2021**

**Connection Details:**
Join via Gotomeeting: https://global.gotomeeting.com/join/800213501

**Day 1 - Wednesday 03.02.2021**

| TIME | TOPIC | LEAD |
|---|---|---|
| 14.00-14.30 | Presentations of Project Coordinator and Technical Manager | Marco Pistore (FBK - PC)<br>Roberto Riggio (RISE - TM) |
| 14.30-16.10 | WP Presentations<br>(WP2, WP3, WP4 - 30 min each. + WP5 - 10 min.) | Neiva Linder (EAB - WP2 Lead)<br>Roberto Riggio (RISE - WP3 Lead)<br>Cristina Costa (FBK - WP4 Lead)<br>Antonino Albanese (ITL - WP5 Lead) |
| 16.10-16.30 | Coffee Break | |
| 16.30 - 17.30 | Use Cases Presentations<br>(10 min. each + 5 min. Q&A at the end of each presentation) | CRF (UC1 Lead)<br>DFKI (UC2 Lead)<br>AERO (UC3 Lead)<br>SPI (UC4 Lead) |
| 17.30 - 18.00 | Wrap-up of the day &<br>General discussion | ALL Participants |

**Connection Details:**
Join via Gotomeeting: https://global.gotomeeting.com/join/963323333

**Day 2 - Thursday 04.02.2021**

| TIME | TOPIC | LEAD |
|---|---|---|
| 14.00-14.30 | Requirements for Platform, sw integration & environments | Roberto Riggio (RISE - TM)<br>Antonino Albanese (ITL - WP5 Lead) |
| 14.30-15.00 | Structure on use-case requirements and architecture (T2.1-D2.1) | ITL (T2.1 Lead) |
| 15.00-15.30 | Kick-off for T3.1 and T4.1 | RISE (T3.1 Lead)<br>I2CAT (T4.1 Lead) |
| 15.30-15.45 | Coffee Break | |
| 15.45-16.00 | Communication and dissemination plan, tools and channels | FBK (T6.1 Lead) |
| 16.00-16.15 | Standardization activities and participation to 5G PPP | INRIA (T6.2 Lead)<br>TIM (T6.3 Lead) |
| 16.15-16.25 | Data Management Plan | 8BELLS (T6.4 Lead) |
| 16.25 - 16.45 | Management and Administrative issues | Alessia Torre (FBK - Project Manager)<br>Roberto Riggio (RISE - TM) |
| 16.45 - 17.00 | Wrap-up & General discussion | ALL Participants |
| 17.00-18.00 | General Assembly | Marco Pistore (FBK - PC)<br>ALL APPOINTED MEMBERS |

*Figure 8: Kick-off meeting agenda DAYS 1-2.*

### 2.6.3 1st AI@EDGE plenary meeting

The 1st AI@EDGE consortium plenary meeting was held online because of the COVID-19 pandemic, on the 5th, 6th, and 8th of July 2021.

**AI@EDGE Consortium Meeting Agenda 05-06-08/07/2021**

**Connection Details:** https://global.gotomeeting.com/join/472266541

**Day 1 - 05.07.2021 | 14-18 CET**

| TIME | TOPIC | LEAD |
|---|---|---|
| 14.00-14.05 | Welcome | Marco Pistore (FBK-PC) |
| 14.05-14.20 | Project overview | Marco Pistore (FBK-PC)<br>Roberto Riggio (RISE-TM) |
| 14.20-15.20 | General Assembly/ Administrative overview | Marco Pistore (FBK-PC)<br>Alessia Torre (FBK-PM) |
| 15.20-15.30 | Coffee Break | |
| 15.30-17.30 | Workshop \| AI@EDGE use-cases: what they plan to integrate and experiment + Kick-off of WP5 | Antonino Albanese (ITL-WP5 Leader) |
| 17.30-18.00 | Wrap-up and conclusions | |

**Day 2 - 06.07.2021 | 14-18 CET**

| TIME | TOPIC | LEAD |
|---|---|---|
| 14.00-14.05 | Welcome | Marco Pistore (FBK-PC) |
| 14.05-14.15 | Introduction to Day 2 | Roberto Riggio (RISE-TM) |
| 14.15-15.15 | Communication and Dissemination: status and next steps | Jérôme François (INRIA-WP6 Leader) |
| 15.15-15.30 | Coffee Break | |
| 15.30-17.30 | Workshop \| Architecture and network automation platform | Roberto Riggio (RISE-WP3 Leader) |
| 17.30-18.00 | Wrap-up and conclusions | |

*Figure 9: 1st AI@EDGE Plenary meeting Agenda DAYS 1-2.*

**Day 3 - 08.07.2021 | 09-13 CET**

| TIME | TOPIC | LEAD |
|---|---|---|
| 09.00-09.05 | Welcome | Marco Pistore (FBK-PC) |
| 09.05-09.15 | Introduction to Day 3 | Roberto Riggio (RISE-TM) |
| 09.15-11.00 | Workshop \| AI@EDGE connect-compute platform | Cristina Costa (FBK-WP4 Leader) |
| 11.00-11.15 | Coffee Break | |
| 11.15-12.45 | Workshop \| Integration Testbed / Software components-integration | Cristina Costa (FBK-WP4 Leader) |
| 12.45-13.00 | Wrap-up and conclusions | |

*Figure 10: 1st AI@EDGE Plenary meeting Agenda DAY 3.*

### 2.6.4 General assembly meetings

The 1st general assembly has been held online on the 4th of February 2021 with the main aim to discuss the status of the Consortium Agreement and to reach an agreement on the management and communication tools to be used in the project.

**General Assembly Agenda / 04.02.2021**

**Connection Details:**
Join via Gotomeeting: https://global.gotomeeting.com/join/963323333

| TIME | TOPIC | LEAD |
|---|---|---|
| 17.00 - 17.10 | Constitution of the General Assembly - Confirmation of the Appointed Members | Marco Pistore (FBK - PC) |
| 17.10 - 17.30 | Consortium Agreement | Marco Pistore (FBK - PC)<br>Antonella Franceschin (FBK - Legal Office) |
| 17.30 - 17.40 | Proposed changes to the Grant Agreement | Marco Pistore (FBK - PC) |
| 17.40 - 17.50 | Agreement on management and communication tools | Alessia Torre (FBK - PM) |
| 17.50 - 18.00 | Next meetings, AOB | ALL representatives |

*Figure 11: 1st AI@EDGE General Assembly Agenda.*

The 2nd general assembly has been held online on the 5th of July 2021 with the main aim to provide a quick update on the status of the project activities and to provide an overview of the structure of the six-monthly report.

**AI@EDGE General Assembly Agenda 05/07/2021**

**Connection Details:** https://global.gotomeeting.com/join/472266541

**05.07.2021 | 14.20-15.20 CET**

| TIME | TOPIC | LEAD |
|---|---|---|
| 14.20-14.25 | Introduction of the topics to be discussed | Marco Pistore (FBK-PC) |
| 14.25-14.45 | Update on WPs* (WP2, WP3, WP4, WP6) | All WP Leaders |
| 14.45-14.55 | TM moving from RISE to UNIVPM | Marco Pistore (FBK-PC) |
| 14.55-15.05 | Adhesion of UNIVPM as a new partner | Marco Pistore (FBK-PC) |
| 15.05-15.15 | Change of WP3 leader within RISE | Marco Pistore (FBK-PC) |
| 15.15-15.20 | Six-month report overview | Alessia Torre (FBK-PM) |

*brief description (5 minutes per WP) of the activities carried out during the first reporting period. Highlight main results achieved and encountered difficulties that may impact the future activities. Provide a brief overview of the activities to be carried out during the next 6 months.

*Figure 12: 2nd AI@EDGE General Assembly Agenda.*

## 1.7 Opportunity-based dissemination

Opportunity-based dissemination takes place through partners' and other websites, as well as partners' and other newsletters, news press, publications, press releases, etc.

*Table 2: Opportunity-based dissemination activities 2021.*

| Type of publication | Title | Authors / Affiliation | Information | Notes |
|---|---|---|---|---|
| 5G-PPP Publication | A Secure and Reusable Artificial Intelligence Platform for Edge Computing in Beyond 5G Networks | FBK | 5G-PPP Projects Phase 3, June 2021. | Available in EN |
| News | AI@EDGE: the artificial intelligence of the future - safer, faster, more open | INRIA | INRIA's website, March 2021. FBK was interviewed and cited. | Available in both FR and EN |

| Type of publication | Title | Authors / Affiliation | Information | Notes |
|---|---|---|---|---|
| News | AI@EDGE : une super IA au service des réseaux de communication de demain | CNAM | CNAM's website, April 2021. | Available in FR |
| News | REUSABLE, SECURE AND TRUSTWORTHY AI SOLUTIONS IN THE NETWORK EDGE | FBK | FBK Magazine, May 2021. | Available in EN and IT |
| News | TIM Group \| Edge Computing and AI for the mobile networks of the future (gruppotim.it) | TIM | TIM's website, July 2021. | Available in EN and IT |
| News | i2CAT participates in AI@EDGE | i2CAT | i2CAT's website + twitter, August 2021. | Available in EN/SP/CAT |
| Newsletter | Introducing AI@EDGE: A secure and reusable Artificial Intelligence platform for Edge computing in beyond 5G Networks | ICCS | Hipeac Newsletter 63, May 2021. | |
| Press release | Italtel among the partners of AI@EDGE | ITL | ITL's website + Twitter + Linkedin + established communication press channels. | Available in EN and IT |

# 3 Contribution to Standards

In T6.2, the AI@EDGE project aims to monitor and contribute to relevant standardization organizations. This is an important task to ensure the potential integration and interoperability of solutions developed by AI@EDGE with other solutions and projects. Developing purely independent solutions will lead to short-term applicability without potential impact at long term.

To maximise the impact of AI@EDGE regarding standardisation, a three-step strategy has been established from the beginning of the project:

1. Identification of relevant standards AI@EDGE can rely on.
2. Identification of gaps. The project will analyse relevant standards and identify gaps in current state of standards development to fulfil the project objectives and so refine technical and scientific contributions.
3. Contributions to standards in different forms. Not all the project's developments necessarily have to be included into standard documents. However, it is also important to disseminate the project's activities towards the different organizations and groups, that will increase the awareness of the whole community. Therefore, attending to standardization-related meetings, participating in discussions, presenting the project outcomes are also relevant contributions in addition to writing standards whose adoption is also a long-term process and can span over the project duration.

## *3.1 Identified existing standards*

The identification of relevant standards is performed continuously in technical tasks in WPs 2 to 5. This is essential to define our contributions and their integration about existing standards. In Table 3, the most relevant identified standards are listed. We are considering here the standards with an active support or recently proposed which will merit a careful attention to monitor their eventual future progress. Obviously, there are other common standards or de facto standardized technologies we will use (XML, JSON, IP, TCP...).

*Table 3: Identified existing standards.*

| **Name of standard + reference / link** | **Scope** | **Potential use in AI@EDGE (component, framework, method...)** | **WP/Task/ UC** |
|---|---|---|---|
| 3GPP | 3GPP is a collaborative project that develops globally acceptable specifications for mobile systems. | 4G:<br>• Specifications for (4G) EPC and IWK between 3GPP access (LTE) and non-3GPP access (e.g., Wi-Fi): TS 23.401, TS 23.402 (Rel-8 onwards)<br>5G:<br>• Umbrella specifications for 5GS (Network Slicing, ATSSS, Exposure, etc.): TS 23.501, TS 23.502, TS 23.503 (Rel-15 onwards) | All |

| Name of standard + reference / link | Scope | Potential use in AI@EDGE (component, framework, method…) | WP/Task/ UC |
|---|---|---|---|
| | | • Network Analytics: TS 23.288 (Rel-16 onwards)<br>• Edge Computing: TS 23.548. TS 23.558 (Rel-17) | |
| ETSI MEC | Multi-access Edge Computing (MEC) offers application developers and content providers cloud-computing capabilities and an IT service environment at the edge of the network | ETSI MEC is the reference standardization group for the framework of deploying cloud-like computing capabilities and service at the edge of the mobile network. As such, it is the natural comparison benchmark for AI@EDGE. | All |
| ETSI Plugtests | Gathering engineers together to test the interoperability of their implementations and providing feedback for the improvement of standards | AI@EDGE may test its components in appropriate Plugtest events. | WP4, WP5 |
| Neural Network Exchange Format (NNEF) | A standard format to store models across Torch, Caffe, TensorFlow, Theano, Chainer, Caffe2, PyTorch, and MXNet (https://www.khronos.org/nnef) | • Can be used between AIFs to exchange their learned modls for collaborative scheme, for example for federated learning<br>• Pre-trained model could be stored using this format | WP3/WP4 |
| ONNX | Open Neural Network Exchange Format (https://github.com/onnx/onnx) | • Can be used between AIFs to exchange their learned models for collaborative scheme, for example for federated learning<br>• Pre-trained model could be stored using this format | WP3/WP4 |
| O-RAN WG2 | WG2 includes the Non-RT RIC and the A1 interface with the objective to support non-RT intelligent radio resource management, policy optimization in RAN, and provide AI/ML models to Near-RT RIC and other RAN functions. The A1 interface supports communication & information exchange between non-RT RIC and near-RT RIC, | • Non-RT RIC Architecture technical specification could be considered in the definition of NSAP Architecture<br>• A1 Interface technical specification for the RAN policy optimization (A1-P), for providing Enhanced Information (A1-EI) and for the providing AI/ML (A1-ML) to the Non-RT RIC | WP3/WP4 |

## 3.2 Plans for contributions

Table 4 summarizes our plan for contributions to standards. As already mentioned, the type of contributions may vary from participating to standardization meeting, presenting project contributions, or participating to write or review documents in SDOs/SDAs. An initial set of SDO/SDA partners planned to participate was defined at the time of proposal writing and project kick-off. However, after one year the plan has been refined and will continue to be refined based on project achievements.

*Table 4: Plan for contribution to standards.*

| Group | Scope | Potential contribution (Partners) | WP/Task/ UC |
|---|---|---|---|
| ETSI MEC | Multi-access Edge Computing (MEC) offers application developers and content providers cloud-computing capabilities and an IT service environment at the edge of the network | Attending WG meetings, contribution to reports or specifications (ATH, FBK) | WP2, WP4 |
| ETSI Plugtests | Gathering engineers together to test the interoperability of their implementations and providing feedback for the improvement of standards | Testing components developed or exploited in AI@EDGE (ATH) | WP4, WP5 |
| 3GPP SA2 | 3GPP is a collaborative project that develops globally acceptable specifications for mobile systems. | Attending WG meetings, contributing to specifications (TIM) Attending WG meetings, contributing to specifications (EAB) | WP2 |
| O-RAN WG2 | O-RAN is an initiative focused also on incorporating artificial intelligence (AI) in radio access network (RAN), specifying interfaces and APIs, driven by openness and intelligence | Attending WG2 meetings, contribution to specifications (TIM) Attending WG meetings, contributing to specifications (EAB) | WP2 |
| IRTF NMRG | Pre-standardization group about network management | Co-chairing, contribution to AI-based network management functions (INRIA) | WP3/WP4 |
| ITU-T FG AN | Define an exploratory road on the requirements of future networks, real-time responsive experiment | Attending meetings and presenting AI@EGDE concepts regarding network automation (RISE, I2CAT) | WP3 |

## 3.3 IRTF network management research group

Jérôme François (INRIA) is co-chairing NMRG from IRTF, a parallel organization of IETF. Like other research groups of IRTF, the objective of the group of NMRG is to foster collaborations between researchers and engineers. Indeed, through the proximity with IETF, application of

research proposals to practical problems can be discussed in-depth and, sometimes, when research is mature enough (with prototype and good validation), transfer to a standardization working group can occur. In a nutshell, the NMRG facilitates cooperation between academia and industry interested in network management. The current research agenda of the group has been defined around three themes. The first one is overarching as it continues the effort of the group towards more automation in the network (autonomous networks, self-driving networks…). Two themes have been then derived: Intent-Based Networking (IBN) to ensure the interface between a self-driving network and the humans managing the network and the coupling between AI and network management, a critical component to support automated decisions in an autonomous network. Therefore, automation and AI for managing networks are topics fully aligned with AI@EDGE objectives and expected contributions.

In addition to co-chairing the group, INRIA is particularly leading the activities about the AI topic by organizing technical presentations and leading an effort to write a joint document on challenges of AI and network management. This is a work in progress, but the objective is to derive challenges at different levels (technical, organizational, educational…) rather than being driven by use cases from avoiding so to focus purely on technical contributions.

In March 2021, NMRG organized a session at IETF 110 (https://datatracker.ietf.org/doc/agenda-110-nmrg/). We invited two presenters for technical talk on AI: Stefan Schneider (Self-Driving Network and Service Coordination Using Deep Reinforcement Learning) and Matthews Jose (Problems and Strategies implementing in-network AI).

In May 2021, NMRG organized an interim meeting virtually co-located with the IFIP/IEEE IM 2021. INRIA presented the activities of the group and invite newcomers to the group to contribute to the different topics. For instance, we introduce the research challenge on AI document under progress. In addition, MonB5G H2020 project was presented. It is about automating the creation of network slices and started one year before AI@EDGE. There are some similarities between the two projects and so this NMRG meeting allowed identifying this project for potential future synergies.

In June 2021, INRIA organized an interim NMRG meeting to resume the activity about the documentation of AI challenges in Network Management (NM). The goal was to free the main challenges and to define a common template to reach the same level of details for all challenges. It has also been presented during the NMRG session at IETF 111 in July 2021.

In November 2021, INRIA co-chaired the NMRG meeting at IETF 112. The meeting agenda is available at https://datatracker.ietf.org/meeting/112/materials/agenda-112-nmrg-01. One topic of the meeting was about digital twin in Industrial IoT networks. This is relevant regarding use-case 2. A data collection framework has been presented.

### 3.3.1 ITU-T FG autonomous networking

The ITU-T Focus Group on Autonomous Networks has as main objective to define an exploratory road on the requirements of future networks, real-time responsive experimentations and draft technical reports and specifications of autonomous future networks. Moreover, as a results of these specifications, the focus group aims to provide an open platform for experimentation where to perform pre-standards activities related to the topics of the groups.

On April 15, 2021, the FG-AN organized a session where RISE and I2CAT presented the AI@EDGE project, putting special attention to the autonomous networking concepts that the project results

would provide as output. The presentation focused mostly on the project's objectives and technological enablers with a portion of the presentation dedicated also to use cases. The concept of Artificial Intelligent Function or AIF has also been introduced and gathered significant interest from the audience to efficiently encapsulate AI models. On this basis, future collaborations with the working group, PoC sharing, and reproduction in the context of the working group activities can be foreseen.

On June 3, 2021, RISE and I2CAT participated to a special session of the working group upon request of the FG-AN chairs to present the accepted paper in IEEE Communications Magazine entitled "AI-Empowered Software-Defined WLANs". This work took as a basis the ITU-T Rec. Y3172 document, available at https://www.itu.int/rec/T-REC-Y.3172-201906-I/en, on architectural framework for machine learning in future networks including IMT-2020. This document provides high level requirements to include the ML pipelines in the network architecture, including management of data from multiple sources, instantiation on ML models already pretrained, and the interaction of such ML models with the underlaying network functions. Moreover, it details the envisioned ML pipelines, and management subsystems for the transparent use of the models. Based on this, i2CAT presented an interpretable ML model designed and deployed on an O-RAN-based architecture for wireless networks. The presentation discussed the introduction of the scheme in the control loops, as well as possible extensions and applications of the work.

## *3.4 ETSI plugtests*

As ETSI explains, ETSI plugtests are organized several times per year and serve two main purposes: first, they provide essential feedback to ETSI technical committees to help improve standards and to accelerate the standards-making process. Second, they enable engineers to get together to test the interoperability of their implementations. The benefits of such events include improving the interoperability of products and services, supporting the deployment of new technologies, enabling networking between partners, competitors, and other experts, and validating ETSI standards.

In June 2021, Athonet participated in the ETSI Future Railway Mobile Communication Systems (FRMCS) plugtests that focused on interoperability and mission critical service harmonization, which are critical challenges for the successful deployment and operation of Mobile Communication System for various sectors. Athonet brought to the plugtests its most recent release of the 5G core network, which will be part of AI@EDGE connect-compute platform and will serve the project's use cases.

# 4 Contribution to 5G-PPP and Collaboration with Other Projects

The project has been active in the interactions with 5G-PPP/IA and with the other projects of the other calls, and especially those belonging to the call ICT-52. In this chapter the interactions are summarized in form of tables.

## *4.1 Interaction with the relevant 5GIA/PPP Working Groups*

AI@EDGE interacted with 5G-PPP and 5G-IA and with some of the working groups therein.

*Table 5: AI@EDGE interactions with 5G-PPP/IA and related Working Groups.*

| 5GPPP/IA Group | Participants | Role/Notes |
|---|---|---|
| SB | M. Pistore (FBK) | Participation to the Steering Board calls. |
| TB | R. Riggio | Participation to the Technical Board activities, especially for the White Paper on the Beyond 5G/6G evolution. Inria has participated at the "5G empowers the digital economy" webinar |
| WG Arch | ICCS, ATOS, FBK | Inria has participated at workshop (October 13th). Overall attendance at the calls and participation to the activities of the WG. |
| SW Netw | 8BELLS, CNAM | CNAM interacted |
| Auto [2] | 8BELLS | Attendance and participation to the overall activities. |
| Network Management and QoS | I2CAT, CNAM | Attendance and participation to the overall activities. |
| Security | DFKI, INRIA | Initial contact to join has been made. |
| Vision | FBK, ATOS, WI3, SPI | FBK participates to the “Needs and Value Creation” subgroup. |
| Open SNS | TIM, CNAM, FBK | The WG has just started but it is of potential wide interest for AI@EDGE especially for the disaggregation of the architectures. Inria has participated at SNS Webinar for Verticals webinar |
| WG Trials | TIM, SPI | Potential interest for the Trials activities being carried on at European level. |
| 5G ACIA | INRIA | Inria has participated at 5G-ACIA webinar |

[2] The WG Auto is now 5G for CAM WG and is a 5G AI WG. FBK is not participating in 5G for CAM WG.

## 4.2 Interaction with other projects

AI@EDGE has a clear objective to exchange views and information with the other projects that are dealing with concurrent and similar topics. A detailed list of the interactions is reported in the following.

*Table 6: AI@EDGE interactions with the other projects.*

| Project Name | AI@EDGE partners | AI@EDGE possible interaction opportunities |
|---|---|---|
| 5G-CLARITY (H2020 5G-PPP Phase 3) | I2CAT | Multi-RAT: 5G, Wi-Fi and Li-Fi<br>Multi-connectivity via MPTCP |
| 5GZORRO (H2020 5G-PPP Phase 3) | I2CAT (coordinator), FBK | Smart contracts for Edge Computing SLAs and Dynamic Spectrum Allocation. |
| 5G-CroCo, 5G-CARMEN, 5GMED (H2020 5G-PPP Phase 3) | I2CAT, 8BELLS, FBK (coordinator), CRF, 8BELLS, EAB, TIM | Useful for any possible interaction in the field of automotive applications and use cases.<br><br>INRIA has participated at 5G-CARMEN webinar (8/10/21 and 28/10/21). The objective was to understand how all the vehicle communicate each other (relative to UC1) |
| Hexa-X, Rise-6G (ICT-52 Projects) | TIM, EAB | Joint initiatives with the other projects of the same call of AI@EDGE are possible. TIM leads the dissemination and impact creation activities in Hexa-X, the "flagship" project in this phase of Beyond5G activities in Europe. EAB is the Hexa-X technical manager. |
| 5GENESIS, 5G-VICTORI, 5GVINNI, 5G EVE, 5G Tours, 5G SOLUTIONS, 5Growth (H2020 5G-PPP Phase 3) | I2CAT, ATH, SRS, TIM | Until these projects will be active, they represent the European platform to run extensive trials on 5G and beyond, and as such they could be a good opportunity of cooperation for AI@EDGE.<br><br>INRIA has participated at 5G GROWTH workshop on 29/10/21. The objective was to understand the E2E deployment of the infrastructure. |
| CARAMEL (H2020) | I2CAT (coordinator), 8BELLS | Useful for any possible interaction in the field of automotive applications and use cases. |
| 5GCity (H2020 5G-PPP Phase 2) | I2CAT (coordinator) ITL | Finalized.<br><br>Multi-RAT Neutral Hosting platform. Some outputs are being exploited in the 5GaaS project (see below). |
| 5G ESSENCE (H2020 5G-PPP Phase 2) | FBK, I2CAT, ATH, 8BELLS, ITL, SPI | Finalized.<br><br>Some outputs from different partners will be used/evolved in AI@EDGE (e.g., I2CAT's non-rt RIC, FBK's 5G-Empower…) |
| 5G PICTURE (H2020 5G-PPP Phase 2) | I2CAT | Finalized.<br><br>Converged fronthaul and backhaul infrastructure integrating advanced wireless and novel optical network solutions. No interaction with AI@EDGE is envisioned. |

| Project Name | AI@EDGE partners | AI@EDGE possible interaction opportunities |
|---|---|---|
| SaT5G (H2020 5G-PPP Phase 2) | I2CAT, SPI | Finalized.<br><br>No further interaction with AI@EDGE is envisioned. |
| MAESTRO-5G[Text Wrapping Break](ANR APG 2018) | CNAM | This French collaborative project works on multi-resource allocation algorithms and control architectures. It ends in June 2022. These algorithms may be considered in a later stage in AI@EDGE. |
| SPARTA (H2020) | INRIA | This European project is a cybersecurity competence network tackling four main programs: Continuous assessment in polymorphous environments, Full-Spectrum Cybersecurity Threat Intelligence, High-assurance intelligent infrastructure toolkit, Secure and reliable AI systems for citizen. The project is in its last year and so interaction might be limited. |
| CONCORDIA (H2020) | INRIA | This European project is a cybersecurity competence network. One key element of this project where INRIA third party partner (UL) is involved is the development and deployment of cyber range for cybersecurity test. Cooperation needs to be investigated (maybe to test AIF in this kind of environment) |
| BRAINE (H2020 ECSEL JU) | ITL | BRAINE (Big data processing and Artificial Intelligence at the Network Edge) aims to boost the development of the Edge framework and specifically energy efficient hardware and AI empowered software systems, capable of processing Big Data at the Edge, supporting security, data privacy and sovereignty in the case of new 5G networks. Possible interactions in the areas of AI empowered software systems and HW accelerated platforms (GPUs) for running AI based applications at the edge. |
| Smart5Grid (h2020) | ATOS, ATH. i2CAT, 8BELLS | Open experimental platform for the Energy vertical.<br><br>Possible interaction in the field of Energy verticals. |
| 5GaaS (h2020-fti) | i2CAT | The project seeks to unlock the massive deployments of cellular networks by leveraging the concept of neutral hosting and developing a decentralized marketplace for the telecom ecosystem to enable a value chain of stakeholders where different MNOs and infrastructure providers can perform business deals using blockchain technology.<br><br>Possible collaborations are limited but may be found in the field of applications and service orchestration. |
| Affordable5G (h2020) | ATOS, ATH. i2CAT, 8BELLS, | The project aims to deliver an affordable 5G private network leveraging edge computing and hardware acceleration solutions. Moreover, it envisions the embedding of the AI pipelines promoted by O-RAN and its use to optimize aspects such as network slicing.<br><br>Possible liaison in the incorporation of native AI pipelines (training and inference) and in terms of resource proactive allocation at the edge. |

| Project Name | AI@EDGE partners | AI@EDGE possible interaction opportunities |
|---|---|---|
| IoT-NGIN (h2020) | ATOS, i2CAT | The project also optimizes IoT/M2M and 5G/MCM communications, including using secure-by-design micro-services to extend the edge cloud paradigm. Moreover, it enables user and self-aware, autonomous IoT systems through privacy-preserving federated ML and ambient intelligence, with AR support for humans.<br><br>Possible interaction in the field of IoT. |
| CPSoSaware (h2020) | i2CAT, ATOS, 8BELLS, FCA, | We envision the CPSoSaware solution as a framework that will span horizontally and vertically on the overall CPSoS architecture thus providing a holistic, cognitive, and decentralized way of designing, running and decommissioning CPS components of the system or even the CPSoS. Since such an endeavour is highly complex and hard to manage, in CPSoS aware we use AI and ML assistance to make the above-mentioned procedures feasible and pragmatic.<br><br>Possible interaction in the field of IoT (Manufacturing Environment) and V2X. |
| 5GMED | 8BELLS, i2CAT | 5GMED aims at validating 5G as the main technological enabler for Cooperative, connected, and automated mobility (CCAM) along cross border scenarios in a variety of use cases. AI@EDGE can leverage the practical know-how and the enabling technologies developed in the project to design and develop the AI@EDGE platform effectively enabling zero-perceived latency services. |
| 5G-INDUCE | 8BELLS | 5G-INDUCE is an open cooperative 5G experimentation platform for industrial-sector NetApps. The project focuses on the industry 4.0 vertical sector, as one of the fastest growing and most impactful sectors in European economy with high potentials for application software development SMEs and with the capability to tackle all diverse cases of service requirements. The development of an open, ETSI NFV compatible, 5G orchestration platform is an issue AI@EDGE tracks for ML purposes; updates on its technical specifications and achievements are of interest to the project. |
| Evolved-5G | 8BELLS | In a similar vein to 5G-INDUCE, Evolved-5G focuses on Industry 4.0 and designing NetApps to serve vertical application domains and exposing 5G Core via Network Visualization Functions. The main drive of Evolved-5G is the development of a complete suite of tools to design, develop, validate, verify, and certify NetApps.Evolved-5G touches on the concepts of network virtualization and exposing the functionality of the underlying 5G network which can be beneficial and impactful for use cases, such as in-flight entertainment and drone BLOS data transfer. |
| 5G-EPICENTRE | ATH | 5G-EPICENTRE will deliver an open end-to-end experimentation 5G platform focusing on software solutions that serve the needs of PPDR. One of its specific |

| Project Name | AI@EDGE partners | AI@EDGE possible interaction opportunities |
|---|---|---|
| | | objectives is to leverage AI for achieving cognitive experiment coordination and lifecycle management, including dynamic 5G slicing, application awareness and insightful ML-driven analytics. Possible interactions may include, if both projects allow it, testing AI@EDGE's AIFs over 5G-EPICENTRE's platform or testing 5G-EPICENTRE's applications over the AI@EDGE's platform. |
| 5G-DIVE | RISE, EAB, ULUND, INRIA | 5G-DIVE is an end-to-end Platform-as-a-Service (PaaS) build on top of an Edge and Fog computing platform (developed by the project 5G-CORAL). 5G-DIVE aims to enhance the management and automation of business processes of the 5G-CORAL platform using data analysis and Artificial Intelligence (AI) to maximize the value proposition of 5G for different type of vertical industries.<br><br>5G-DIVE targets end-to-end 5G trials aimed at proving the technical merits and business value proposition of 5G technologies in two vertical pilots, namely (i) Industry 4.0 and (ii) Autonomous Drone Scout. These trials will put in action a bespoke end-to-end 5G design tailored to the requirements of the applications targeted in each vertical pilot, such as digital twinning and drone fleet navigation applications.<br><br>INRIA has participated at 5G-DIVE workshop on 29/10/21. The objective was to understand the E2E deployment of the infrastructure and to have feedback from the SMEs. |
| 5G-HEART and 5G TOURS | INRIA | INRIA has participated at the Workshop on "Tele-Health Solutions Powered by 5G". The objective was to have an initial overview of the proposed architecture of the project and the 5G functionalities it leverages such as slicing. |
| 5G-SMART | INRIA | INRIA has participated at the Online webinar "Demystifying 5G and Industrial Networks slicing, from theory to practice". INRIA is involved in UC2 on attack detection industrial systems. INRIA was interested to acquire additional knowledge about the application of slicing in these types of networks. |

# 5 IPR Management

AI@EDGE is a project with participants from many different countries but with complementarity among them. A strategy to properly handle the data management and the IP ownership is then essential to fulfil any access rights that is in the Consortium Agreement (CA) (signed on March 2021) about the background knowledge and for the results obtained during the execution of the project. In this document, 8 project partners have described specific limitations and conditions for implementation and exploitation, which are in line with the royalty-free basis access to results needed for implementing their own tasks under the actions (Articles 31.2 of Grant Agreement document). Access rights to any Background and Results of the execution of the project, the protection of Intellectual Property Rights (IPRs) and confidential information management are addressed efficiently in detail within the CA (Section 8, pages 24 – 28), which is based on the MCARD-2020 model template provided by Digital Europe and signed by all partners. All IPR provisions follow the spirit of the H2020 programme framework. Any proposed and performed tasks should be of a nature allowing the consortium to fully exploit their knowledge and provide the maximum freedom to operate for the consortium members with respect to the prior art.

The Consortium Agreement (CA) document specifies in detail the procedure needed for the approval of a joint ownership. More specifically, in accordance with the first paragraph of Article 26.2 of the Grant Agreement, two or more Parties shall own Results jointly if: (a) they have jointly generated them; and (b) it is not possible to: (i) establish the respective contribution of each Party; or (ii) separate them for the purpose of applying for, obtaining, or maintaining their protection. The procedure includes three steps and is described within page 24 of the CA document. In the end, the General Assembly (GA) will decide if the Action Results can be considered as Joint Result or not.

In the case of a new IP generated by one owner, the key question should be: “Is the IP being protected by the owner?”. If no, then one committee comprising the lead researchers will be invoked to discuss the options and decide how the material is to be protected. In the case that too much new IP generated should be examined, we would consider that a new (and flexible) committee (not the GA) should take care and handle the procedure.

Hence, internally generated IP may be highlighted at any time via email, but it is officially discussed in this proposed Innovation and Exploitation Committee (InEC).

This is a proposition proposed by the IPR Management team and it might be discussed to the next General Assembly meeting in February 2022. In case that the InEC has been selected as the key committee to handle new IP material generated by one owner, we are proposing the following strategy:

- All generated IP is formally reported as part of the partner survey, which contributes to each exploitation deliverable.
- The responsibility for identification and management of internally generated IP is devolved to the Principal Investigators. IP may be identified to the InEC chairman at any time.
- All identified IP will be tracked and reported at each InEC meeting.
- The InEC itself is also used to identify newly created IP.
- The protection mechanism is identified as: Patent, Trade Secret and Open.

During the first 12 months, the AI@EDGE Foreground IPR management strategy has been proposed and will be agreed by the AI@EDGE consortium members. The InEC would set a target

for patent filings to be achieved by the end of the project. In case a partner wants to submit a patent application, they will in this respect inform the GA.

## 5.1 IPR and publications watch

The IPR Management Team is putting into place a comprehensive IPR monitoring process with extended search criteria. A preliminary (indicative) set of comprehensive prior art reports will be generated in specific key AI@EDGE IPR fields, starting from these identified in Table 7 and disseminated to relevant experts and stakeholders in these fields. The table will be filled-in, updated during the upcoming work for D6.4 and D6.5 and considering the ongoing results and outcomes of other WPs.

The search terms used will be defined over the project from partner feedback. A first search was carried out yielding, in some cases, to several thousands of results. To narrow down the search to manageable numbers the search terms the fine-tuning is needed e.g., by excluding patents that contained irrelevant terms. The narrowed-down lists will be distributed to the partners for in-depth analysis. The project partners are consistently tracking IP generation worldwide and updating the consortium regularly on their findings. This is a continuous task and will be reported accordingly to D6.4 and D6.5. All project partners will be invited to participate, starting from Month 13 (January 2022).

*Table 7: 1st period AI@EDGE IPR monitoring report.*

| IPR field | Query string | No. search matches | Reviewing partner | Direct/potential conflicts |
|---|---|---|---|---|
| Artificial Intelligence | | | | |
| Mobile Edge Computing | | | | |
| Closed-loop Automation | | | | |
| Perceived Zero Latency, | | | | |
| Serverless Platform | | | | |
| Disaggregated RAN | | | | |
| Hardware Acceleration | | | | |

# 6 Impact Assessment and Exploitation

As introduced in the description of AI@EDGE project, one of the objectives is to ensure the long-term success of the project through standardisation and dissemination in scientific and industrial fora, and by exploiting synergies with other 5G-PPP initiatives and projects. This deliverable summarises our first-year efforts to disseminate project results and create awareness, to work towards contributions to international standards in telecommunications and automotive sectors. More generally, the achievements we presented so far aim to support the exploitation of the knowledge generated in the project.

AI@EDGE plans to use a diverse and comprehensive set of means to disseminate and communicate the achievements, the results and the knowledge acquired during the project. We communicate relevant outcomes to target groups and attract their interest and generate engagement that will influence the overall impact of the project. To assess the effectiveness and efficiency of the communication and dissemination channels, a series of Key Performance Indicators (KPI) are detailed below. These KPIs will help us to evaluate the overall impact of our dissemination efforts.

*Table 8: AI@EDGE key performance indicators.*

| Key Performance Indicators | Project targets | Achieved 2021 |
|---|---|---|
| Number of events organized by AI@EDGE (webinars, workshops, etc.) | 3 | 0 |
| Number of press releases | 3 | 1 |
| Number of participants to webinars and workshop | 300 | 0 |
| Number of attendees in dissemination campaign, webinars, peer networking events | > 1.000 | 28[3] |
| Size of the community (incl. Twitter followers, mailing list subscribers, website visitors) | > 1.000 | 1.494[4] |
| Number of unique website visits | > 1.000 | 1.996 |
| Number of scientific/technical publications | > 30 | 4 |
| Number of conference presentations | > 20 | 4 |
| Number of contributions to standards | > 3 | 0 |
| Number of newsletters | 3 | 1[5] |
| Number of views on YouTube | > 300 | 0 |

[3] Newsletter subscribers.
[4] Of which 1.352 website visitors (up to 30/12/2021) and 142 Twitter followers (up to 31/12/2021).
[5] The second newsletter is expected in January 2022.

The KPIs achieved within 2021 are a bit far from the target objective. At M12 we have not yet realised events or webinars, because of both the pandemic and the lack of project results to be disseminated to the wider community; therefore, the KPI devoted to the number of events organised by the project and the number of participants to these events are still at 0. The same, the scarcity of project results has not allowed the project to contribute to standards, therefore the KPI is still 0. Anyhow, as seen within Section 3, AI@EDGE has already worked for the definition of possible future contribution to standards. As for the KPI regarding the views of Youtube, we are preparing the project video, which will be available in January 2022, so we expect the views to increase within next year.

Other indicators are still low, such as number of scientific/technical publications and number of conference presentations, but these numbers are expected to increase within this second year of the project, the pandemic permitting.

## *6.1 Initial exploitation plan*

The initial exploitation plans for the four partners, drivers of the projects' use cases, are already defined as follows.

**CRF** sees the AI@EDGE project as an important step forward on the following topics related to connected vehicles: (i) facilitate the design and development of new connected services; (ii) reduce physical testing (cost and time) and reduce time to market; and (iii) assess KPIs (latency, reliability, mobility, device density, type of traffic). CRF, acting as FCA Advanced Technology Centre, will take care of transferring the project results to the relevant FCA engineering teams for their exploitation.

**DFKI** plans to transfer and adapt the AI@EDGE outcomes, especially new security insights, to other application areas, such as industrial networks and Cyber Physical Production Systems. AI@EDGE results will also serve as input for the development of new technologies in forthcoming projects. The results can also be commercialized, e.g., through new start-ups (56 currently running DFKI spin-offs). Results of AI@EDGE will also be exploited at the academic level and be integrated in teaching and training courses at the University of Kaiserslautern as well as help to educate PhD students. Also, the dissemination of the results through the publication of scientific articles in relevant journals and international conferences is an important aspect.

**EAB** Ericsson Research drives technology leadership for Ericsson Mobile Networks impacting product design in the 3-5 years perspective. Ericsson's leading market position is based on providing world-class system concepts, technology innovations, and methodologies. The rapidly increasing demands for mobile broadband access in combination with needs for new technology and solutions for the digitalization of industries and societies create challenging and exciting opportunities. Within AI@EDGE, the Research Area Networks - Management and Automation intends to explore AI-based operations and "AI by design" network architectures, applying, e.g., reinforcement learning towards automation of network operations. To strengthen Ericsson's position in the competitive global market, AI@EDGE's outcomes should support new service offerings over existing commercial products and solutions, but particularly pave the way edge-computing-based service offerings on future edge infrastructure. The project results are also to be used as input to relevant standardization organizations' work, such as 3GPP, ONAP, O-RAN, etc., where EAB is an active contributor.

**SPI** as a worldwide leading company in In-flight Entertainment & Connectivity solutions to aircrafts. To ensure a continued leadership in this market segment SPI intends to trial full-fledged 5G technology and network slicing capabilities. Therefore, SPI will leverage the knowledge gathered through AI@EDGE to scout the next generation of connectivity solutions trialling URLLC and eMBB services for the purpose of in-flight entertainment and on-flight work. This will allow SPI to put IFEC devices aeronautically certified with 5G connectivity in the product roadmap and on the market.

## *6.2 In-progress exploitation plan*

For the next period, an exploitation questionnaire will be sent to all AI@EDGE partners.

A preliminary questionnaire suitable for AI@EDGE consortium is shown below in Figure 11, still to be improved before being sent to the partners.

The intention of this activity is to reflect continuously the progress of each partner in terms of new derived technology, to estimate the total addressable market, to perform an efficient market search (competitors etc), to gauge project exploitation potential and alignment with market trends and partner roadmaps.

All partners are expected to fill out the exploitation questionnaire.

All consortium members will perform a continuous market and research watch to identify early on the state of the art in AI@EDGE targeted scientific fields, as well as to constantly be aware of the market/research trends in AI and edge computing related markets. The most frequent means of competition monitoring will be market intelligence, scientific and technical publications, press notices and other sources. Each AI@EDGE partner will be responsible for monitoring the form of competition that is more appropriate for its interest, i.e., academic partners will focus more on journal and conference publications, while market watch, patent watch and standardization tracking will be handled mostly by IPR Management team.

The success of AI@EDGE's exploitation strategy relies on the very same elements that make the project a strong candidate for putting the European industry in the driver's seat of the AI and edge computing applications in several use cases (markets). The innovative exploitation approach proposed in AI@EDGE, which answers directly to market needs and future roadmaps, and the strong commitment of the consortium's members are the key elements of AI@EDGE for success.

The time plan is scheduled as follows:

1. Improvement of proposed questionnaire at Month 13 (January 2022)
2. Sending of the questionnaire to the partners by end of Month 13 (January 2022)
3. Collection of first responses by Month 15 (March 2022)
4. First version of a detailed exploitation plan by Month 17 (May 2022)
5. Second request of updates on the material at Month 21 (September 2022)
6. Collection of second responses by Month 23 (October 2022)
7. Second version of a detailed exploitation plan by Month 23(November 2022), to be included into Deliverable 6.4.

1. Summarize your "**AI@EDGE story**", one exploitation opportunity or route to market for your technologies that stands out for the project. This will be highlighted in the main document.

2. What **business opportunities** do you see in AI@EDGE (overall or individual tasks)?

3. Can you describe any **potential products**, **services or other marketable IP** that could result from the project work?
   a. How could they fit within your current (or targeted) product/service portfolio?

4. Could you describe a **credible path** to deliver the targeted innovations to the market, as related to your role in the project?
   a. Do you foresee any significant intermediate steps?

5. Is there any aspect of the AI@EDGE technology you have developed so far which may be suitable for near term applications?

6. Could you estimate the **Total Addressable Market (TAM)** that will be affected by the outcome of AI@EDGE? Please include market size and key locations.

7. What is your organization's current **position in the market**? Please mention market shares in market segments relevant to AI@EDGE

8. Could you make an estimate of the effect that the targeted technology will have on your organization's business performance? Please include:
   a. Estimated revenue, gross margin and net profit
   b. Market standing

9. What is your organization's **Roadmap** in AI@EDGE -related products?
   a. Please provide roadmap diagram
   b. Please provide detailed description

10. How do the **Targeted Fields** and your specific tasks in AI@EDGE align with your roadmap?

11. Please identify which **AI@EDGE Technologies** you are developing and which Work Package it is associated with.

12. What is the current **State of the Art** in the Targeted Fields you are addressing in AI@EDGE?

13. Who are the leading **Competitor Organizations** in these Targeted Fields (Academic and/or Industrial)?
   a. What market areas do they operate in?
   b. What are the key features of their technology offering?
   c. What would you need to achieve to take business from them?
   d. How does your participation in AI@EDGE reinforce your advantages over your competitors?

14. What **Standards** have been proposed or implemented for the target technology area?
   a. What controlling body covers this area?
   b. Could they affect the commercial uptake of the project?

15. Can you identify any publications (Journal/Conference Papers), or published IP that may impact the technologies you are addressing in AI@EDGE and the exploitation thereof?

16. Can you identify any changes in the **Application Environment** which may impact the current AI@EDGE Objectives?

17. Are there any **Opportunities or Threats** in Exploitation, IP or Standardization not covered by the above questions?

18. Please provide your organization's exploitation plan (1/2-1 page per partner)

19. Could you please fill out the table below in relation only to your organization's technology contribution and path to market? This is the original DoW table. Can you fill in more extensive/updated detail?

*Figure 13: AI@EDGE exploitation questionnaire.*

# 7 Conclusion

In the first project period (M1-M12), all WP6 have started as planned. The dissemination and communications activities have been focused on online presence (website, social medias) and remote participation to events with 4 scientific publications. Project launching has been announced in partners' website as news or press release. 1 newsletter has been published in the last reporting period according to our target of a yearly newsletter. Regarding standardization, concrete actions in 3 SDO/SDA groups have been engaged (IRTF NMRG, ITU-T FG AN, ETSI plugtests). AI@EDGE interacted with 5G-PPP and 5G-IA projects. In this first period, it is focused on identifying potential interaction and contribution through the attendance on online webinars. A numerous number of interactions with other projects have been identified from the beginning of the project. During the first reporting period, we intended to reach those projects for preliminary interaction. It was based on opportunity to participate to open workshops. Finally, an initial strategy for IPR management and potential exploitation have been proposed, that is under discussion within the consortium and will be refined and agreed in the next months.