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

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EIGHTBELLS
Independent Research & Consultancy

AI@EDGE

Project Background

- Artificial Intelligence has been a major innovative force as one of the pillars of the fourth industrial revolution. Its use has been expanded beyond academic purposes and AI enhancements have been integrated in our everyday life.
- This trend has been acknowledged by the European Commission, as high-performance, intelligent, and secure networks can be greatly benefited by the breakthroughs brought into the scene by AI.
- This kind of AI integration in potentially autonomous decision-making systems or even critical infrastructures requires end-to-end quality assurance, in order to build robust systems and reliable services
- Motivated by the need to support elastic and demanding real-world use cases, the AI@Edge project aims to develop a connect-compute fabric for creating and managing resilient, elastic, and secure end-to-end services at the edge of the network.

AI@EDGE Consortium

- ✓19 partners, spanning across 8 countries
- ✓Six research centers (FBK, RISE, I2CAT, DFKI, CNAM, INRIA)
- ✓Six industrial companies (CRF, EAB, ATOS, WI3, SPI, ITL)
- ✓Three university departments (POLIMI, LUNDU, ICCS)
- ✓Four SMEs (8BELLS, ATH, SRS, AERO)

Project Summary/Goals

AI@EDGE aims to deliver a platform which will implement:

- secure and automated large-scale edge and cloud compute infrastructures, close to zero-touch of the underlying heterogeneous MEC resources

To do this, AI@EDGE will develop and use:

- a serverless computing paradigm to automate the deployment of distributed applications at scale
- native hardware acceleration (e.g. GPU and FPGA)
- cross-layer, multi-connectivity radio access

Supporting systems:

- architecture and method development to manage heterogeneous MEC resources
- development of low-overhead communication schemes for distributed algorithms at massive scale
- security aspects, covering service isolation and protection for federated learning and data sharing

Project Goals →

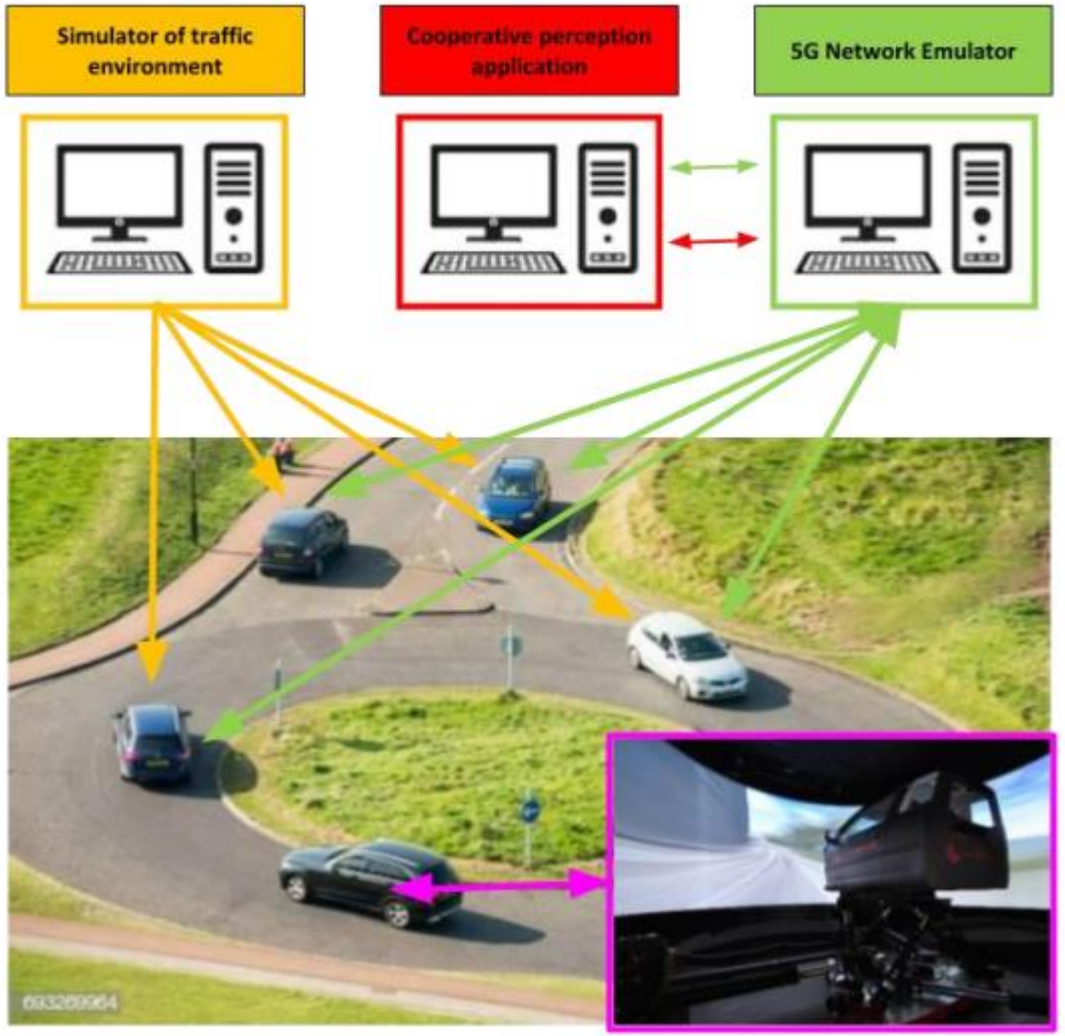
- ✓ To leverage the concept of reusable, secure, and trustworthy AI for network automation to achieve an EU-wide impact on industry-relevant aspects.
- ✓ To prove this impact by providing Use Cases scenarios that concretely demonstrate how the AI@EDGE platform can be embedded in modern industrial applications.
- ✓ To assess the impact of AI@EDGE from the societal standpoint and to integrate the lessons learned into the final solution.

Use Case 1:

Virtual validation of vehicle cooperative perception

- In this use case we interconnect a dynamic driving simulator operated by a real human driver with a traffic simulator.
- We design, implement, and test the digital twinning of a mix of real and emulated vehicles.
- The goal is to recreate the network-level data exchange required to build a cooperative perception between emulated vehicles and a human-driven vehicle.

Test Cases: Fiat (CRF), Univ. Milano (POLIMI)

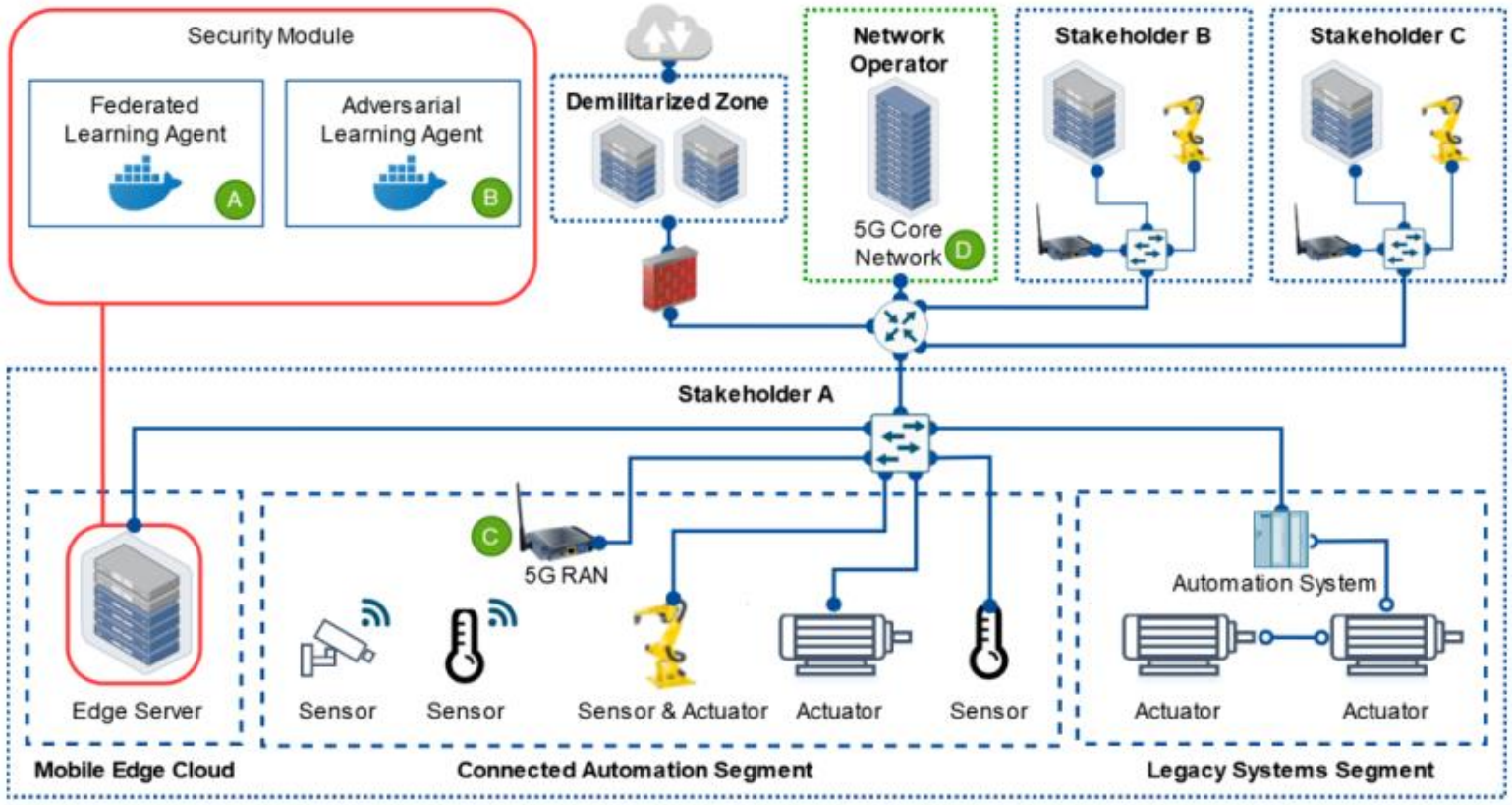


Use Case 2

Secure and resilient orchestration of IoT NWs

- In this use case, we focus on smart factory 5G environments.
- We exploit augmented edge equipment and devices augmented with AI/ML solutions to detect anomalies and attacks.
- Classical device-level attacks exploiting vulnerabilities, botnets, 5G authentication serve as paradigms

Test Cases: German Research AI (DFKI)



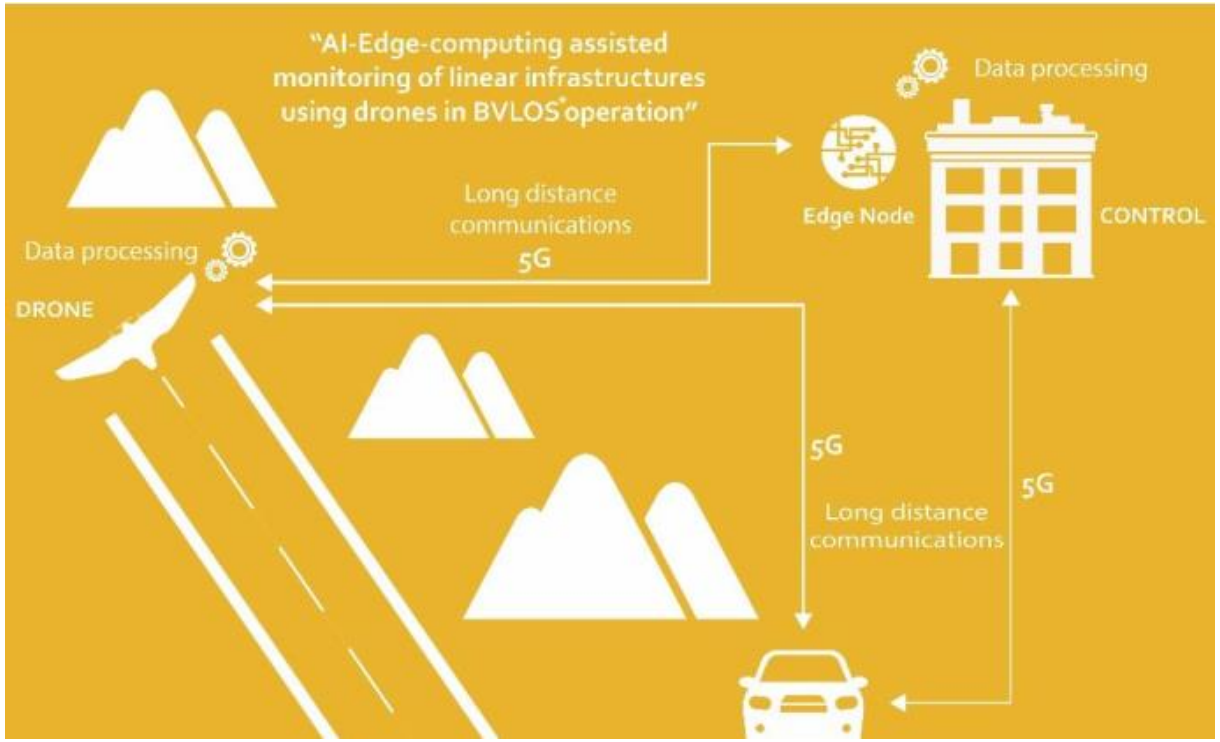
**BVLOS= Beyond Visual Line-of-Sight*

Use Case 3

Edge AI assisted monitoring of linear infrastructures using drones in BVLOS* operation

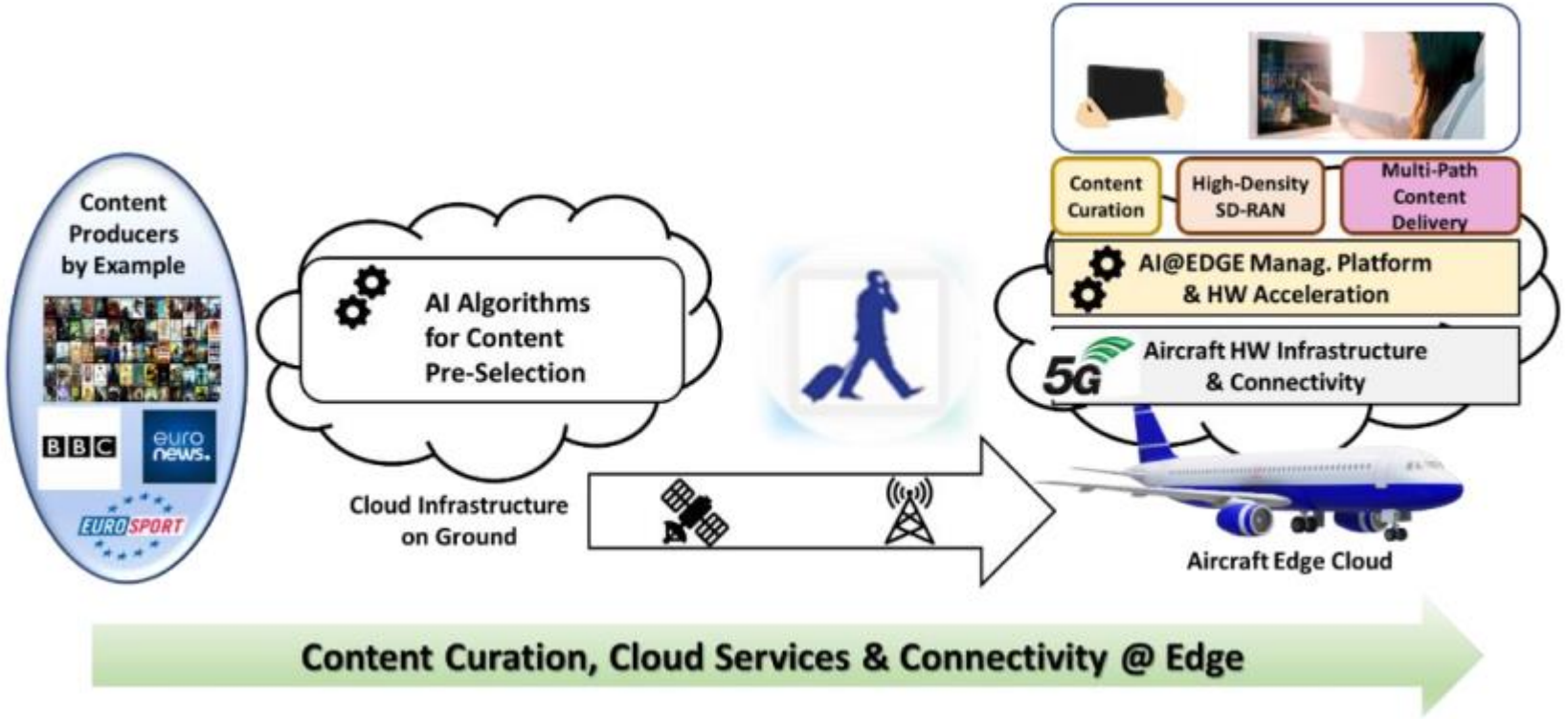
- A small drone fleet creates terabytes of data per day, only 5% is processed due to bandwidth limitations.
- To manage this volume of data in a production setting drones require a combination of on board and on the ground edge-computing capabilities.
- AI@EDGE will leverage 5G to support faster data transfer as well as advanced AI-enabled edge image and video processing.

Test Cases: Ericsson (EAB)



Use Case 4

Smart content & data curation for in-flight entertainment services



→ In-Flight Entertainment and Connectivity focuses on delivering entertainment and engagement to airline passengers.

→ With the rise of 5G and network softwarization, the cabin infrastructure, composed of servers, wireless termination points and seat embedded screens, has the potential to transform itself into a full edge cloud.
Test Cases: TriaGnoSys (SPI)

**KPI= Key Performance Indicator*

8Bells Key Contributions

- **Leading Task 2.3**: KPIs*, socio-economic impact assessment and techno-economic analysis

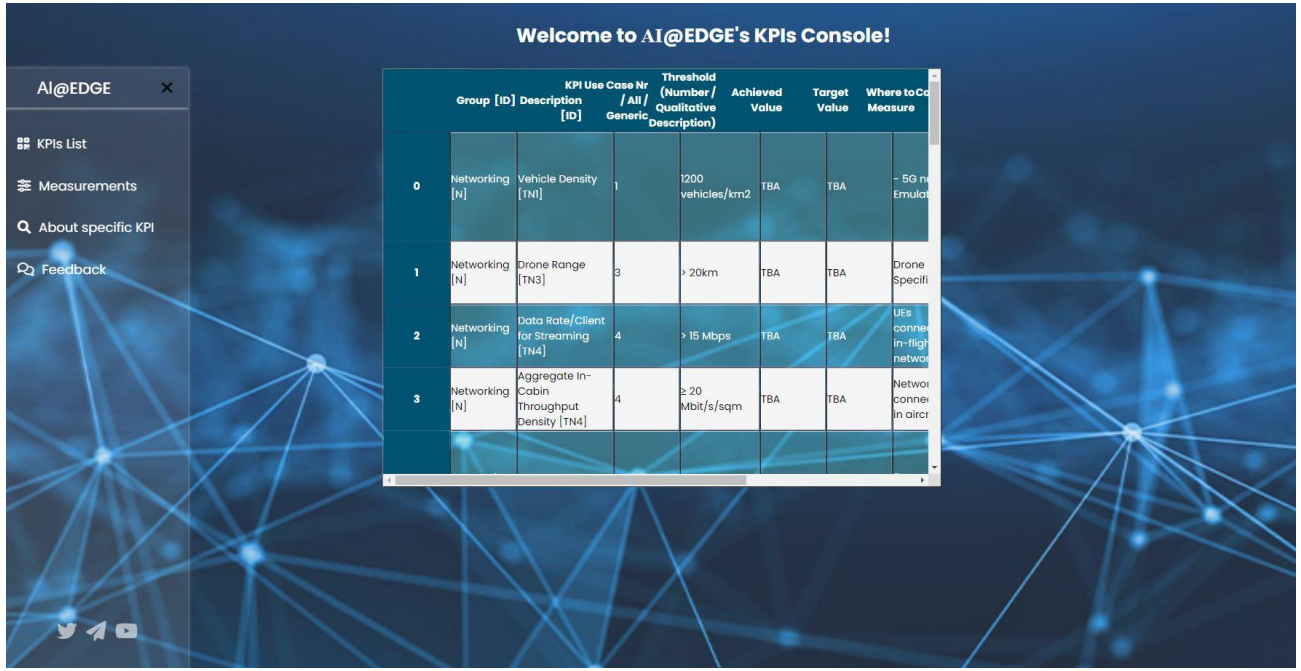
- KPIs are at their core quantifiable values, associated with a metric that evaluates a **critical parameter of a system component**.
  - Hence, in order to properly assess the performance of a system in development, the definition of crucial KPIs is in a way as important as the technical development itself.

- Following the same train of thought, the definition of a product's socioeconomic and technoeconomic impact is the **gateway between RnD and industrial production/market.**

8Bells Technical Involvement (so far)

KPI Monitoring Console

- A **web application** in the form of a KPI Console acts as a centralized hub of information regarding every aspect of the KPIs (definition, measurement etc).
- This application provides a user-friendly GUI, through which a user can:
  - ✓ **Navigate through the KPI Matrix online**
  - ✓ **Get the latest measurements regarding the KPIs**
  - ✓ **Query about information over a specific KPI**
  - ✓ **Connect with the AI@EDGE project through the links to its social media**
  - ✓ **Contact the consortium and provide feedback over the KPIs or suggest useful tips and advice**



Next steps

- ✓Further expand the KPI Console to connect in real-time with the AI@Edge connect-compute platform, in order to perform **real-time monitoring of technical KPIs**.

- ✓Thorough analysis of the Use Cases from a socio/technoeconomic point of view, in order to further plan the exploitation of the AI@EDGE platform in a vast number of both industrial and commercial applications.

- ✓Assess the societal impact of the project, and how the innovative solutions and enhancements to the already established 5G networks can **actively benefit societies as stakeholders**.

Thank you for your attention!

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