CELTIC-NEXT
eureka Cluster

Project Achievements

Automation of Network edge Infrastructure & Applications with aRtificiAI intelligence

AI-NET-ANIARA

AI-NET-ANIARA

Project ID: C2019/3-2

Start Date: 3 June 2020

Closure date: 30 April 2024

Partners:

Arctoslabs AB, Sweden
Chalmers University of Technology (CTH), Sweden
Delta Electronics AB, Sweden
Enoc System AB, Sweden
Ericsson AB (EAB), Sweden
Fraunhofer IPT, Germany
Fraunhofer IST, Germany
HAL Robotics Ltd, UK
Hopsworks AB
IconPro GmbH, Germany
Kings College London, UK
Konica-Minolta, UK
Opel Automobile GmbH, Germany
Qamcom Research and Technology AB, Sweden
RISE Research Institutes of Sweden AB, Sweden
Kungliga Tekniska Högskolan, Sweden
Systemair AB, Sweden
Technical University Braunschweig, Germany
Univrses AB, Sweden

Co-ordinator:

Ali Balador

Ericsson AB, Sweden

E-Mail: ali.balador@ericsson.com

Project Website

www.celticnext.eu/project-ai-net-aniara

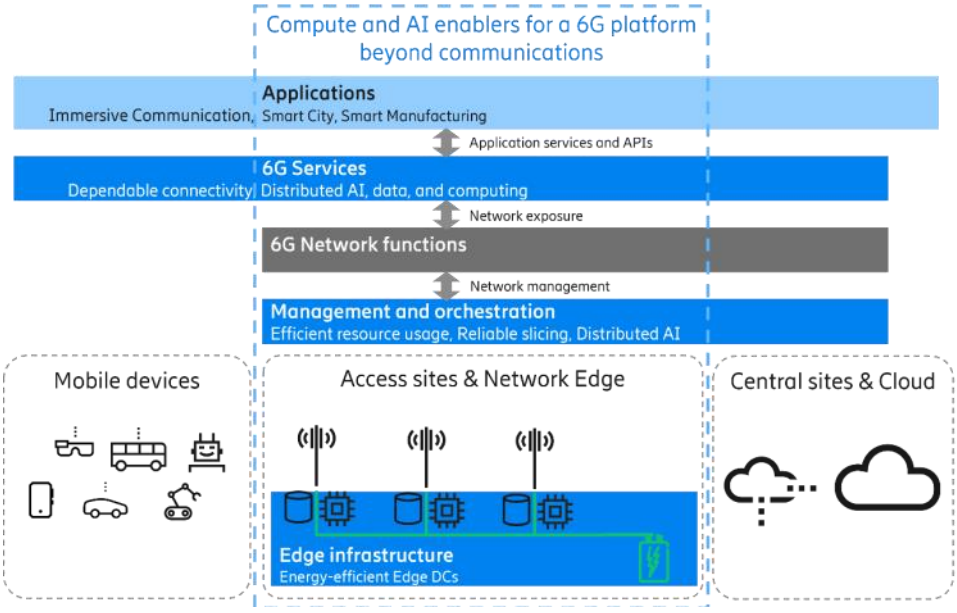
AI-NET-ANIARA is one of three sub-projects of the CELTIC-NEXT AI-NET Flagship. In AI-NET-ANIARA, three EU countries were involved including Sweden, Germany, and UK. The project ended in April 2024. The project goal was to complement the evolution of 5G with crucial technical enablers towards an intelligent and sustainable 6G platform, offering services beyond pure communication, including compute & AI.

Main focus

The ANIARA project develops compute and AI enablers for future mobile networks. In the figure below, we provide a simplified view of a mobile network with its sites and functional layers. ANIARA project contributions are shown in blue color and the dashed box indicates the focus of these contributions at network edge sites. Starting from the bottom-up, the project contributes to a sustainable and intelligent 6G network platform with the following: a) Energy efficient edge infrastructure; b) Automated management of the distributed platform, which includes both resource orchestration for distributed edge resources as well as intelligence support for 6G network functions; and c) 6G platform services on the edge exposed for society, enterprise, and industrial applications. While the enablers on these layers are applicable to many emerging use-cases, we chose Smart City and Smart Manufacturing applications as two highlighted use-cases to exemplify the value proposition and usability of the proposed technology innovations.

Approach

The use cases developed in the project were used as driving scenarios and the enablers and solutions were used in demonstrations of the use case implementations. To test the most promising results/ solutions in a real-world environment, ANIARA developed a number of proof-of concept demonstrators, leveraging on the



Overview of a mobile network with the ANIARA project focus highlighted in blue.

testbed facilities present at the premises of some of the partners in the consortium.

Based on experiences from similar projects, we initially started to provide enablers that can be used in several use cases. In parallel, use cases had more time to be mature and being analysed how to be benefit from enablers. Towards the end of the project, we had several workshops to identify relevant enablers and map and integrate them to different use cases. As a result, we managed to show several PoCs during the final review of the project including the project technology enablers. We also showed how our technology enablers can be re-used in different use cases and application domains.

Achieved results

- Carrier grade AI technologies for telecom edge automation, and intelligent management in support of services with guarantees on performance and energy consumption.
- Novel AI concepts such as robust and reliable federated learning, reinforcement learning for service mesh, intelligent feature selection, and transfer learning.
- MLOps infrastructure for AI. ANIARA extended the Feature store solution by ANIARA partner Hopsworks to support real-time model serving all the way to the edge.
- Execution runtime to process edge applications using WebAssembly. A dynamic computational offloading solution was developed and its potential as a future 6G service has successfully been demonstrated on the SmartCity application by ANIARA partner Univrses AB.
- A modifed Kubernetes scheduler enabling the allocation of workloads based on the energy state of nodes and/or devices. This modification improved the energy efficiency of the system. Furthermore, the project designed a new resource scheduling mechanism for Kubernetes that can closely match the time-varying traffic profile of users. This led to a 30% improvement in resource efficiency.
- Designed, built, and operated two versions of Aniara Edge node data center demonstrators. These demonstrators include a fresh air cooling approach, where the cooling system is highly integrated in the Edge node design. An intelligent power system ensures that the servers are provided with enough power also during periods of limited external power supply and a photovoltaic system to reduce the amount of power from the grid, improve the sustainability and maximise robustness.
- Developed new edge processing devices deployed in Stellantis manufacturing sites that monitor energy consumption and machine condition. This data is then transmitted wirelessly to, for example, optimize the energy consumption in the paint shop.

Impact

The project contributed with organization of a wide set of dissemination activities, aiming at dedicated workshops with involvement of SMEs, workshops and demonstrations at major conferences to share the results of the project beyond the project partner organizations. Several talks have been given in different venues such as industrial and scientific venues, which can potentially impact the long- and short-term development plans of the relevant industry domains.

We also established collaboration with different national initiatives to enhance the reach and impact of the project results and promoted AI & compute enablers that has been developed by ANIARA.

Overall, AI-NET-ANIARA was successfully living up to its project promises of accelerating digital transformation by the efficient use of a highly integrated and flexible edge infrastructure that is programmable across all its components.

About CELTIC-NEXT

CELTIC-NEXT is the EUREKA Cluster for next-generation communications enabling the digital society. CELTIC-NEXT stimulates and orchestrates international collaborative projects in the Information and Communications Technology (ICT) domain.

The CELTIC-NEXT programme includes a wide scope of ICT topics based on new high-performance communications networks supporting data-rich applications and advanced services, both in the ICT sector and across all vertical sectors.

CELTIC-NEXT is an industry-driven initiative, involving all the major ICT industry players as well as many SMEs, service providers, and research institutions. The CELTIC-NEXT activities are open to all organisations that share the CELTIC-NEXT vision of an inclusive digital society and are willing to collaborate to their own benefit, aligned with their national priorities, to advance the development and uptake of advanced ICT solutions.

CELTIC Office

c/o Eurescom, Wieblinger Weg 19/4
69123 Heidelberg, Germany
Phone: +49 6221 989 0
E-mail: office@celticnext.eu
www.celticnext.eu

eureka