

# Technology preview #3

## “Draft on deploying large-scale decentralised and federated Edge-computing Infrastructure and Services (ECI)”

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The objective of this infrastructure-focused Initiative is **to deploy a large-scale European Cloud-Edge Computing infrastructure** to guarantee sufficient computing and ensure its integration in high-end communication networks (5G/6G). Data driven use cases, such as digital twins or AI requires unprecedented computing capacity. While High-Performance Computing plays an important role for training large AI models, cloud and increasingly also edge computing are essential for AI inference and for unlocking innovative AI use cases. The objective of this initiative is to provide ultra-low latency (a few milliseconds) access to data services across the EU and to combine this with the necessary cloud capacity to equip European industries, public administrations and society at large with smooth and non-discriminatory access to meet the data processing needs. In the current market environment, the operators of existing capacity in the EU do not have sufficient incentives to invest largely in the expansion of cloud and edge capacity (including the geographically balanced deployment of edge nodes across the EU territory) as well as the necessary interconnection and edge-compute capacities at European scale. As a consequence, the EU today lacks sufficient access to compute capacity in a federated manner and at scale.

Today, the necessity to gather, process, and transmit massive amounts of data to the central cloud at high speed is a roadblock for many future use cases. In this context, Edge computing is starting to act as a critical component for execution closer to where data are generated as part of a distributed edge and cloud environment. This encompasses multiple use cases like video surveillance and analysis and asset/equipment monitoring, tracking, or performance optimization, to cite a few. Edge computing enables more immediate processing of the massive data volumes generated at the Edge, the intelligent interpretation of this data in minimal processing times (milliseconds), while providing a more secure processing environment and lowering data transmission costs.

As laid out in the February 2024 “White Paper on Europe’s digital infrastructure needs<sup>1</sup>”, the initiative should **complement existing IPCEIs in the area of microelectronics (IPCEI ME/CT) and next-generation cloud infrastructure and services (IPCEI-CIS)** and contribute to creating the next generation European computing ecosystem. While the focus of the IPCEI-CIS was on R&D&I and the first industrial deployment of beyond-state-of-the-art infrastructure and services, this initiative should focus on the deployment of cloud and edge computing infrastructure that serves the present and future needs for data processing in the EU. Furthermore, the objective is to identify other edge-based infrastructures

<sup>1</sup> Source: <https://digital-strategy.ec.europa.eu/en/library/white-paper-how-master-europes-digital-infrastructure-needs>

and tools and ensure the integration and interoperability among different types of existing infrastructure solutions (such as European blockchain service infrastructure solutions based on decentralized and distributed nodes, data spaces in their function as tools and governance models and decentralized AI solutions).

With integration into the European connectivity network, beyond global state-of-the-art solutions will contribute to a more resilient and robust infrastructure, fostering the **efficiency and competitiveness of the European economy and its strategic autonomy**. It would also contribute directly to the balanced deployment of climate-neutral highly secure edge nodes across Europe, as targeted by the European Digital Decade Policy Programme, through the combined deployment of computing and communication technologies to respond to the large-scale data processing needs and will continue to bring in the future at an even larger scale.

#### Basis infrastructure for data driven digital economy (s.a. AI solutions):

The deployment of a large-scale European Cloud-Edge Computing infrastructure will form a critical building block for Europe's ability to meet the ever-increasing compute demands. **It serves as basic infrastructure for AI-Services and solutions.** Diverse types of AI models and processing pose different requirements to compute infrastructures to execute them: generative AI and large language models demand for high-performance computing that is only available at large scale clouds and specialised data centres, while edge and cloud are suitable for inferencing over these large models as well as predictive AI processes. **The large-scale European Cloud-Edge Computing infrastructure, when highly performant cloud computing capacity becomes federated, will provide the necessary computing power for the computing requirements of the diverse types of AI models and for the complete AI lifecycle – from training to deployment to inference – and at scale.** Through federation, the aim is to enable smooth access to computing capacities that span across different levels of the computing continuum. Leveraging a European Cloud-Edge Computing infrastructure for inference of generative AI and large language models, along with the execution of predictive AI processes will help ensure that EU businesses of all sizes have access to the necessary range of computing capacities for specific AI solutions.

Moreover, the **execution of inference of generative AI and large language models, along with the execution of predictive AI processes requires the types of computing resources often available in Edge computing environments.** These processes obtain enough computational resources by relying on general purpose hardware enriched with lower-end hardware accelerators, for instance, in GPUs, smart network interface cards (smartNICs) and field programmable gate arrays (FPGAs). Future market predictions indicate that **the AI and edge computing will continue to converge**, enabling more powerful real-time analytics and decision-making at the edge. Furthermore, today's computation is not necessarily depending on dedicated computing environments, such as data centres, which would need additional power to transmit all the data coming with AI use cases. **Therefore, the initiative would also combine on-device edge with the rest of the computing categories and different types of cloud-edge services in collaborative, decentralized and distributed computing environments.** The orchestration of the different computing resources and devices will require intelligent, beyond state-of-the-art solutions.

From a competitiveness standpoint, leveraging cloud and edge computing strengthens the EU's position by fostering innovation and technological leadership. It could reduce dependency on foreign cloud providers which currently dominate the market and tackle the associated risks for EU users and developers to be locked into the infrastructure of a specific cloud provider. As a result, this initiative would enhance data sovereignty and economic security. Furthermore, it unlocks new economic opportunities for European edge services and technology providers, opportunities for innovative SMEs on the supply side, promoting growth and job creation within the EU. By integrating edge computing into the digital infrastructure strategy, the EU can establish itself as a leader in advanced technologies, ensuring sustainable economic development and maintaining global competitiveness in the digital age.

#### Examples of Use-Cases (s.a. Robotics):

- In **manufacturing**, where efficiency, precision, and real-time responsiveness are paramount, edge computing offers transformative benefits. By processing data closer to where it is generated, such as on factory floors or within robotic systems, edge computing reduces latency and enables faster decision-making. This capability is crucial for optimizing production processes, predicting maintenance needs, and improving overall operational efficiency.
- In **robotics**, edge computing enhances autonomy and responsiveness of robotic systems. Robots equipped with edge computing capabilities can analyse sensor data in real-time, enabling them to adapt swiftly to changing environments and tasks. This results in more agile and efficient manufacturing operations, ultimately leading to higher productivity and lower costs.

Summary:

Edge computing holds immense relevance for industries and is pivotal for enhancing the competitiveness of the EU in the global landscape. The Initiative will deploy a large-scale European Cloud-Edge Computing infrastructure, with the additional integration in high-end communication networks (5G/6G) to ensure access to data services with latency and bandwidth guarantee across Europe. This large-scale and open edge-node infrastructure, based on IPCEI-CIS and IPCEI ME/CT, could be the core infrastructure for future data-driven business cases on European scale.