



Edge Cloud and Strategic Capacity Building in the EU Policy Context on Cloud

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1. Introduction

The pressures of the pandemic have shown the importance of a reliable and secure digital infrastructure and the need to avoid dependencies in strategic supply chains. Next to communication networks, cloud services form a critical part of the infrastructure that enables the proper functioning of our economies and societies in an increasingly digitized world. For the European Union, access to secure and state-of-the-art cloud infrastructure has therefore become a crucial policy objective to support the Union's digital ambitions and to facilitate the data economy.

The increasing attention from policymakers has led to the emergence of what can be described as a first comprehensive set of regulations and initiatives aimed at the cloud market in Europe. Several initiatives with impact on cloud are either already adopted (DMA, NIS-Directive), currently being prepared (IPCEI CIS, EUCS, Data Act) or are yet to be proposed (Cloud Rulebook, Cloud Marketplace, Data Act sector-specific regulations). Amidst this rapidly evolving policy landscape, this paper aims to explain what edge cloud is, why it is relevant, and how it fits into the larger EU policy context. In addition, this paper elaborates on the unique role of European telecommunication providers in delivering an edge-cloud continuum.

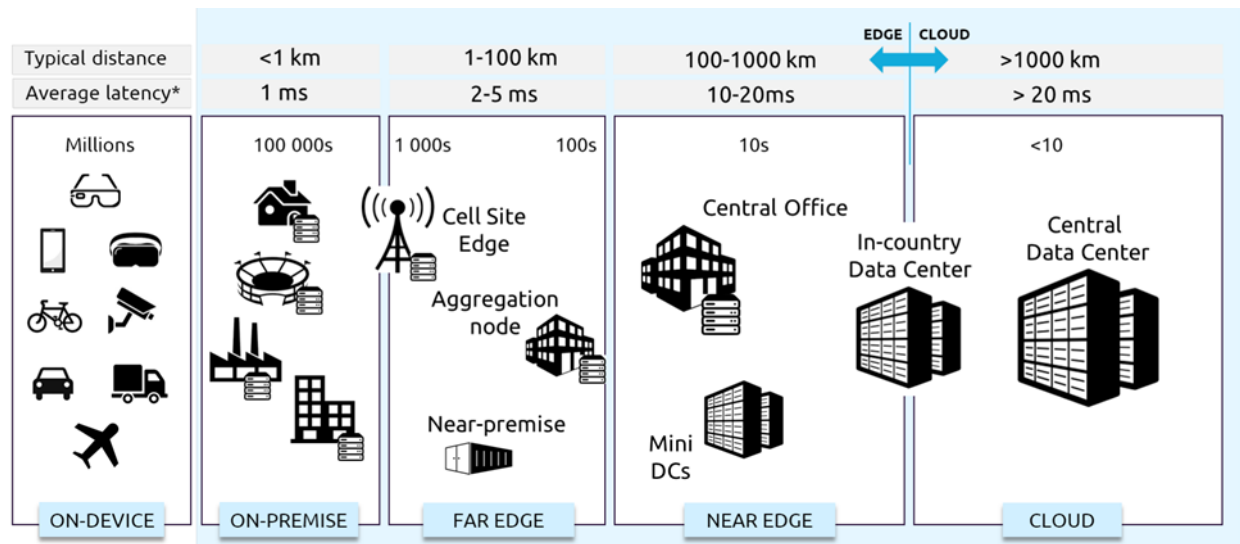
2) From Cloud Computing to Edge Cloud

Even though the market for cloud computing continues to grow, requirements are increasingly evolving. Demand for distributed data storage and processing is rising, driven by the deployment of fibre and 5G, the consequent emergence of more advanced use cases and the continuous increase in the number of connected devices. To fulfil the evolving requirements and to address the constantly growing amount of data produced, more and more data needs to be processed closer to where it is generated (at the edge of the network).

The European Commission refers to “*a shift in the data paradigm*”, moving from a centralised to a distributed model of data processing, ultimately expecting **80% of data to be processed at the edge**.¹ By moving data processing closer to end users and by leveraging synergies with 5G networks, edge computing will improve performances, in terms of latency and quality of service, enabling demanding use cases that require near real time processing. The idea of processing data locally, where it is generated, therefore represents an evolution from the centralised data processing model, which can see data travelling for hundreds of kilometres and sometimes between countries and even continents to reach the host data centre.

While the concept of “edge cloud” has rapidly gained popularity over the past few years, there is no uniform or commonly agreed definition today. In its essence, edge cloud describes the provisioning of distributed computing, storage, and network resources closer to the location where data are being generated or used. Depending on the specific requirements of the use case(s), an edge deployment can comprise several different modes ranging from on premise to “far edge” and “near/regional edge”. An exemplary overview of the different modes is shown in the figure below.

¹ Commission Staff Working Document, “Strategic Dependencies and Capacities”, SWD(2021) 352, 2021.



Source: “European industrial technology roadmap for the next generation cloud-edge offering”, May 2021²

3) Edge Cloud and Mobile Communication Networks

The transition from a centralized cloud computing model to processing data where it is generated or used, implies the emergence of a new model where cloud services will no longer run in central data centres only, but will span across multiple locations, providing at same time the benefits of large-scale computation capabilities and the readiness and privacy of small remote cloudlets close to the users. This architectural vision of cloud evolution is called “edge/cloud continuum”.

The concept of “Multi-Access Edge Computing” (MEC) enables service providers to access and use the edge / cloud continuum in an easy way to implement and activate/ run services. A common “Edge Cloud Federation” layer which is currently targeted by IPCEI-CIS is an essential part when it comes to span services using infrastructure of multiple infrastructure providers including telecommunication providers.

As Telcos have in their assets a capillary in-field connectivity infrastructure (thousands of points-of-presence in an EU Member State) they are well placed to implement the cloud / digital communication symbiosis of edge computing. In its analysis of the cloud market, the European Commission has also highlighted this strategic position of telecommunication companies: *“Utilizing the expertise of European telecom providers combined with the specialization of European cloud providers, Europe can build telco-cloud solutions notably at the edge – leveraging the joint deployment of 5G and edge computing infrastructures – in a way that meets the security and environmental requirements of the European market.”*³

European telecommunication operators are ready to play a key role in the transition towards an edge-cloud continuum. In this context, it is important to note that the deployment and management of optimised beyond 5G and standalone radio systems by telco operators will be an essential

²[https://ec.europa.eu/newsroom/repository/document/2021-18/European CloudEdge Technology Investment Roadmap for publication pMdZ85DSw6nqPppq8hE9S9RbB8_76223.pdf](https://ec.europa.eu/newsroom/repository/document/2021-18/European%20Edge%20Technology%20Investment%20Roadmap%20for%20publication%20pMdZ85DSw6nqPppq8hE9S9RbB8_76223.pdf)

³ Commission Staff Working Document, “Strategic Dependencies and Capacities”, SWD(2021) 352, 2021.

prerequisite for true low-latency infrastructure, as latency can be best reduced by a combination of physical proximity and optimisation of the radio air interface. Moreover, edge computing and network slicing will also be important and complementary features, particularly where IoT is concerned, for example when operators provide connectivity for smart devices located in a factory.

4) Situating Edge Cloud in the wider EU policy context on Cloud

Europe is competitive when it comes to the generation of industrial data, for example in the area of IoT. However, data storage and processing of data continues to be carried out largely by non-European companies, based on an infrastructure of which European providers have only a marginal share: In its in-depth review of the cloud market accompanying the EU Industrial Strategy (2021), the European Commission notes that “the public cloud infrastructure market is converging globally around four large non-European companies”, accounting for over 80% of global revenues in 2021.⁴

Rank	Total Europe	Germany	France	Netherlands	Rest of Europe
Leader	Amazon	Amazon	Amazon	Amazon	Amazon
#2	Microsoft	Microsoft	Microsoft	Microsoft	Microsoft
#3	Google	Google	OVH	Google	Google
#4	IBM	Deutsche Telekom	Orange	KPN	IBM
#5	Salesforce	IBM	Google	IBM	Salesforce
#6	Deutsche Telekom	Oracle	IBM	Oracle	Swisscom

Source: Based on IaaS, PaaS and hosted private cloud revenues in Q1 2020. The data come from Synergy Research Group, 7 May 2020.¹⁹⁴

Despite the fact that there are a few European cloud and telco providers, including several ETNO members, active in the market, their ability to challenge the hyperscale cloud providers is limited due to a number of structural challenges that have proven to be difficult to overcome, including:

- An estimated investment gap of EUR 11 bn annually⁵;
- Uneven distribution of network effects as a result of the scale advantages of hyperscale platforms which in turn attract developer communities;
- Commercial practices used by dominant cloud providers that inhibit the possibility of a cloud customer to switch providers and lead to lock-in, incl.:
 - bundling of services;
 - discriminatory licensing practices;
 - lack of interoperability and data switching;
 - long term contracts;
 - free-tier products⁶.

⁴ Commission Staff Working Document, “Strategic Dependencies and Capacities”, SWD (2021) 352, 2021.

⁵ Commission Staff Working Document, “Strategic Dependencies and Capacities”, SWD (2021) 352, 2021; ACM Study on Cloud Market: <https://www.acm.nl/en/publications/market-study-cloud-services>

⁶US House Judiciary Committee (https://judiciary.house.gov/uploadedfiles/competition_in_digital_markets.pdf) Discouraging switching to a new provider at the end of a free trial period as time was invested and adjusting to new provider would require resources and exit fees. Egress fees can create significant financial barriers to migrating from specific providers, along with technical design challenges to accommodate the cloud service provider’s new method of operating

As a result of these and other factors, there is a considerable market concentration around a few dominant platforms (mainly Microsoft, Google, Amazon Web Services) and with it a significant dependence on such platforms that is unlikely to change without regulatory intervention. Policymakers in Europe have stated that cloud is to be considered a technology of strategic interest⁷, meaning that such imbalances should not be left unaddressed.

The importance of avoiding strategic dependencies in the cloud market is further underlined by the risks associated with access to data. Cloud uptake depends, to a significant extent, on the cloud users' trust in the security and control over their own data. During the consultation on the Data Act, for example, 76% of the respondents (business organisations and associations) indicated that they perceive access to data by foreign authorities as a risk to their organisation.⁸

The European Union Data Protection Supervisor (EDPS), which monitors the processing of personal data by the EU institutions, bodies and agencies (EUIs), has opened two investigations⁹ respectively, regarding the use of cloud services provided by AWS and Microsoft by EU institutions and the use of Microsoft Office 365 by the European Commission. The European Data Protection Board has also launched a joint investigation into the use of cloud-based services by the public sector across EU Member States to check if they comply with privacy safeguards.

At the same time, several studies/investigations are either pending or are about to be initiated (Ofcom¹⁰) by Regulatory or Competition Authorities in relation to competition concerns in the cloud market. In October 2020, the US House Judiciary Committee included cloud computing in its [Investigation of Competition in Digital Markets](#). The report found that market leaders in cloud computing have structurally benefited from early adopter advantage, along with network effects and high switching costs that prevent customer mobility.

The US report also highlighted specific techniques used to deter customers from switching, such as long-term contracts, free-trial products (which tend to discourage switching to a new provider at the end of a free trial period, due to the investment of time and resources required to adjust to a new provider), as well as the requirement to pay exit fees to the original provider. Therefore, data switching, egress costs, and interoperability are also at the forefront of regulatory concerns, as evidenced by the political discussion on the Data Act.

In light of these persistent challenges and the strategically critical role of cloud services, policymakers have systematically turned their attention to the cloud market, leading to the emergence of a first comprehensive set of regulations targeting cloud services in the EU.

services. Therefore, portability, egress costs, and interoperability are likely to be at the forefront of regulatory concerns.

⁷ <https://digital-strategy.ec.europa.eu/en/news/towards-next-generation-cloud-europe>

⁸ <https://digital-strategy.ec.europa.eu/en/library/public-consultation-data-act-summary-report>

⁹ Investigations are currently on hold because a lawsuit on the same matter is pending. The EU court's verdict is expected to take between 10 and 16 months. https://edps.europa.eu/press-publications/press-news/press-releases/2021/edps-opens-two-investigations-following-schrems_en

¹⁰ <https://www.theguardian.com/technology/2022/sep/22/ofcom-investigate-tech-giants-dominance-cloud-computing>

4.1) Policy initiatives and regulation addressing the cloud market

The initiatives brought forward by industry, the European Commission and EU Member States dealing with cloud policy can be clustered in the following four broad categories, which will be briefly sketched in the table below: 1) EU Capacity Building; 2) Security and Data Sovereignty; 3) Fair Markets; and 4) Sustainability. While differing in scope and ambition, they all contribute to the objective of building a more competitive and sustainable cloud market in Europe.

	CLUSTER 1	CLUSTER 2	CLUSTER 3	CLUSTER 4
	EU Capacity	Security and Data Sovereignty	Fair Markets	Sustainability
GOAL	To strengthen EU capacities in cloud and edge computing by coordinating and pooling resources across the EU	To ensure that customers can rely on the highest standards of cloud security while having control and transparency over who can access their data.	To ensure a level playing field for cloud service providers in Europe. Cloud customers shall be able to switch providers more easily, avoiding a potential lock-in to the ecosystem of a single provider	To ensure that (cloud) data centres are becoming increasingly energy-efficient and sustainable, ultimately reaching climate-neutrality by 2030
KEY INITIATIVES	IPCEI CIS	NIS-II Directive, Directive on Security of Network and Information Services II	DMA: Cloud listed as a ‘core platform service’ and subject to gatekeeper provisions e.g. on data portability	EU Taxonomy
	EU Alliance for Industrial Data, Edge and Cloud	Proposal for an EU Cloud Certification Scheme (EUCS)	DGA (EU Data Governance Act): Provisions on ‘data intermediaries’ and requirement for legal separation from other businesses incl. cloud	Ongoing Review of the Energy Efficiency Directive -Proposal to introduce a reporting mechanism on the energy efficiency of data centres
	EU funding programmes such as Digital Europe or CEF II	GAIA-X Policy Rules	Data Act Proposal (Chapters VI and VIII) Sets framework regarding cloud switching and interoperability	Planned proposal for a common European labelling system on the energy efficiency and sustainability of data centres
		Data Act Proposal (Chapter VII on non-personal data) & future legislation on data spaces	GAIA-X	

Towards 2023, the European Commission is also poised to present an initiative for a cloud rulebook while accelerating the work on a cloud marketplace. While the cloud rulebook is supposed to provide a collection of common rules and standards applicable to cloud services offered in the EU, the cloud marketplace is expected to provide customers and cloud users with a platform giving a transparent overview of cloud services that are in compliance with EU rules.

4.2) Policy initiatives focused on Edge Cloud

As edge cloud forms an inherent part of the market for cloud services, all of the measures listed above also have an impact on edge cloud. The transition towards a cloud-edge continuum first and foremost requires the development and deployment of a new cloud-edge infrastructure, which presents a unique opportunity for Europe to achieve a leapfrog in technology and to lead the transition towards interoperable and federated cloud-edge environments.

Several ongoing policy and industry initiatives at national and EU level support this trend, aiming to promote the creation of a **state-of-the-art cloud-edge infrastructure in Europe**. Together, EU Member States and the European Commission have committed to **invest up to EUR 10bn** into edge and cloud technologies.¹¹ A significant portion of these funds will be channelled through the IPCEI Cloud and Infrastructure Services (IPCEI CIS), which is currently being prepared by EU Member States in cooperation with the European Commission.

In addition, European companies from the ICT and telecommunications sectors developed a **joint technology roadmap on cloud and edge**, which was presented to Commissioner Breton in May 2021. The roadmap sets out in detail an investment pathway for Europe to become the leader in cloud and edge offerings on the global market.¹² This work is now continued and further developed within the **European Alliance on Industrial Data, Cloud and Edge**, which has worked on an updated industry roadmap to be published towards the beginning of 2023.

Several ETNO Members are contributing, as members of the Cloud Alliance to the ongoing update of the technology roadmap, thus supporting the objective of **strengthening Europe's position in the global cloud and edge computing market** by ensuring supply meets heightened user demands in terms of openness, security, privacy and resilience, but also energy and resource-efficiency, and by leveraging the cloud-edge continuum to address sector-specific requirements and improve European industry competitiveness.

In its Digital Compass and the accompanying policy programme “**Path to the Digital Decade**”, the European Commission has set out the target to deploy “*at least 10,000 climate neutral highly secure ‘edge nodes’*” within the EU by 2030 distributed in a way that guarantees access to data services with low latency wherever businesses are located.¹³ Breaking this target down to a Member State level implies a much denser distribution of computing resources than what could be achieved with a traditional and centralised cloud architecture today.

¹¹ <https://digital-strategy.ec.europa.eu/en/news/towards-next-generation-cloud-europe>

¹² <https://digital-strategy.ec.europa.eu/en/library/today-commission-receives-industry-technology-roadmap-cloud-and-edge>

¹³ Proposal for a Decision of the European Parliament and of the Council establishing the 2030 Policy Programme “Path to the Digital Decade”, COM(2021) 574 final, 2021.

By deploying such a dense network of edge nodes across EU territory, the EU Commission aims to provide the processing capacity and latency that is needed to enable the next generation of use cases made in Europe. ETNO members strongly support and share the ambition to position Europe as a leader on edge infrastructure.

‘Edge nodes’ are defined as distributed data processing capacity connected to the network and located close to (or in) the physical endpoint where the data is generated. The requirement to deploy climate neutral edge nodes seems consistent with the European Commission’s goal that data centres are to be climate-neutral and energy-efficient by 2030. In reality, however, edge deployments will have to take place well in advance to reach the deployment target of 10,000 edge nodes by 2030. This means that currently planned deployments, e.g. in the framework of the IPCEI CIS need to be already designed and implemented in a climate-neutral way.

ETNO members support the objective of climate-neutrality, as it is crucial that the data centre industry contributes to the mission of the European Green Deal. When defining sustainability indicators and requirements for data centres, however, there is no one-size-fits-all. A marginalization of smaller data centres for the benefit of scale should be avoided to allow for innovation and distributed ways of data processing. Edge computing brings about efficiencies that might not be easily measured with traditional KPIs that were designed for centralised data processing (e.g. PUE).

All in all, the various initiatives and targets aimed at cloud and edge cloud show that policymakers have identified the importance of this technology for Europe’s digital future. ETNO members welcome this approach and stand ready to work together with policymakers to support the Union’s high ambitions on cloud and edge computing, bringing in their experience and capacities in managing highly distributed network infrastructure and taking a leading position in the transition towards an open, secure and sustainable cloud-edge continuum.

ETNO (European Telecommunications Network Operators' Association) represents Europe's telecommunications network operators and is the principal policy group for European e-communications network operators. ETNO's primary purpose is to promote a positive policy environment allowing the EU telecommunications sector to deliver best quality services to consumers and businesses.

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