BEREC
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BEREC Report on the outcome of the public consultation on the draft BEREC Report on Cloud and Edge Computing Services

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Contents

Executive Summary

During its 58th Plenary Meeting (7-8 March 2024) BEREC approved for public consultation the draft BEREC Report on Cloud and Edge Computing Services (hereinafter, the draft report). The aims of the public consultation include to provide BEREC with valuable feedback from all interested parties to deliver better informed reports and increase transparency on BEREC's work.

In accordance with BEREC's policy on public consultations, the current report is a summary of how stakeholders' views have been considered and it is published together with the final report updated with the feedback and information received during the public consultation. In addition, BEREC also publishes all individual contributions on its website, taking into account stakeholders' requests for confidentiality. The public consultation was open from 13 March until 24 April 2024.

In addition to the comments on the draft report, BEREC sought more concrete information by proposing the following questions:

Question 1 Chapter 6.2 (of the draft report) develops on electronic communication networks migration to the cloud. One of the preliminary considerations pointed out in this section regards to the scalability constraints that face Electronic Communication Networks (ECN) that might hinder taking fully advantage of network cloudification benefits. It is also argued that mobile networks may face less limitations than fixed networks. Do you agree with these preliminary findings? Please, explain your answer. Are there other scalability constraints to be considered?

Question 2 Is there a risk that investments in cloud-based networks crowd out private investments in network coverage and network capillarity? Are investments in network innovation and network coverage substitutes or complements?

Question 3 What are your expectations on the evolution of competition in the electronic communication markets given network cloudification? Can market failures in the cloud market affect competition and investment in the provision of electronic communication networks and services? To which extent?

Question 4 Are all operators and service providers equally equipped to take advantage of network cloudification? What would be needed to ensure that the transition to cloud networks does not create an uneven playing field in electronic communication markets?

Question 5 Chapter 7 (of the draft report) develops on regulatory considerations related to the different trends described along the report (e.g. the characteristics of the cloud markets, cloud and Electronic Communication Networks and Services (ECN/S) convergence, synergies and dependencies among players and technologies, etc.). Do you agree that those are potential relevant regulatory matters in the coming

years? Is there any other potential risk (or opportunities) that regulators should consider?

Question 6 What is your opinion on the different hypothetical situations mentioned in Chapter 7.2.2 of the draft report, point vi. “Application Programming Interfaces (APIs) openness and APIs exposure” in which potential issues related to API exposure may arise? Are these hypothetical situations relevant and if so, in what timeframe?

Question 7 Technical developments allow for increased connectivity specialization tailored to specific services. From a forward-looking perspective, is there a risk that network capabilities enabled by cloudification, in the context of the observed digital market trends (ecosystems, concentration, network effects, potential for leveraging market power into adjacent markets, etc), could lead to a reconfiguration of the Internet towards separated, proprietary and non-interoperable, environments?

This document summarises the responses received to the public consultation and presents BEREC’s position with regard to suggestions and proposals put forward in those responses, as relevant. In total 14 responses were received, 3 of them considered as confidential based on the request of the respective respondents (see ANNEX I for the list of contributors and their acronyms). The contributions received within the consultation procedure have been published on the BEREC website. The main issues raised by the stakeholders relate to the following topics:

- Electronic communications and cloud convergence
- Network cloudification including considerations related to the migration to the cloud by ECN/S providers; APIs openness and interoperability issues; implications for infrastructure sharing; impact on specialized services; deployment of private networks; roles and value chain; references to interconnection and the need for indicators related to virtualization
- Competition dynamics: both competition implications on the ECN/S markets and in the cloud markets as well as the role of partnerships and agreements
- Investment in edge computing
- Interplay amongst the different EU legislations impacting cloud and ECN/S
- Sustainability
- Digital sovereignty

In more general terms, most of the responses provide positive feedback on the draft report and regard it as timely, relevant, generally accurate and well balanced. BEREC thanks all the stakeholders for their contributions.

1. Electronic Communications and cloud convergence

Several stakeholders provided their comments on the report findings related to convergence trends, the ECN/S definitions and the scope of the sectoral regulatory framework and their connection with the principles of level playing field and technology neutrality.

In this regard, the joint **GSMA/ETNO** response points to the increased interlink between cloud and edge service with ECN/S. Along the same lines, **Respondent "X"** remarks that network virtualization is required for the provision of any fixed or mobile ECN/S and signals the mutual interdependency of both services. Furthermore, from **Respondent "X"** s point of view, cloud and edge computing services, at least in the IaaS and even in the PaaS levels, are not anything different from a type of electronic communications that go beyond the traditional fixed/mobile connectivity scheme. **Respondent "Y"** also observes increasing convergence between 'compute' and 'telco', and a blurring of the demarcation points between what a cloud provider and a network provider do in the delivering of connectivity. **AIIP** agrees with BEREC that ECN/S and cloud and edge computing services are converging. However, **AIIP** sees such convergence as one-way only direction, from cloud and edge services towards ECN/S and the boundary between ECN/S and cloud providers is rapidly blurring.

On the other hand, **Google, Microsoft, ITI, CCIA, Respondent "Z"** and **CISPE** consider the claim of convergence overstated and find that the ECN/S sector does not differ from other sectors benefiting from the use of cloud services. **Google** and **Respondent "Z"** further argue that not all the range of services offered by cloud providers are offered by ECN/S operators nor all the services offered by ECN/S are offered by cloud undertakings. **ITI** signals that there has not been a convergence of the relevant underlying technologies, which remain distinct and should be regulated distinctly. **Respondent "Z"** and **CCIA** view ECN/S and cloud computing as complementary but different services.

CISPE points that while cloud providers are increasingly offering ECN/S those are limited when considering the full size of the market (as a space probe landing on Mars makes the red planet "increasingly heavy") and, when they do, they fall under the rules applicable to traditional providers.

From the opposite perspective, **Respondent "X"** understands that B2B communications have evolved to include high speed connectivity combined with IT services. Against this backdrop, **Respondent "X"** advocates to shift the focus of market 2 analysis from pure connectivity markets to include IT and cloud/edge complementary services and assess whether competition problems might arise from the possible dominant position of a few cloud and IT providers.

More generally but from a similar standpoint, **Respondent "Y"** proposes to expand the access regulation regime to prevent hyperscalers leverage their market position into the provision of ECN/S thanks to their control of cloud inputs.

Google, Microsoft, Respondent "Z", ITI and **CISPE** share the same view on the risks for the development of cloud services in the EU that the potential expansion of the definition of ECN/S to subsume cloud services at large would entail pointing to additional overlapping and duplication of regulation, unfitted to cloud services. Additionally, **Google, CCIA**, **Respondent "Z"** and **CISPE** retain that a broader scope of the definitions and scope of the framework does not respond to a concrete policy problem or market failure to be addressed.

Microsoft refutes the assumption that digital services such as Software Defined Networking (SDN) and Virtualization are largely similar to and indistinct from telecom services (and therefore should be regulated similarly with telecom services). **Microsoft** and **ITI** regard that those remain distinct from traditional telecommunication services as they operate on the application layer, as opposed to the network layer. **ITI** further indicates that Telecom law should regulate the hard infrastructure or 'carriage' layer, and not the software layers above. That would include all application layer services such as Over-The-Top (OTT) communication and video services, cloud computing, edge computing, machine-to-machine communication, artificial intelligence systems, IoT, and AR/VR communication and applications.

Respondent "Y" points to the opposite direction and calls for the review of ECN/S definitions to acknowledge the significant role of software providers and hyperscalers in network management so that compliance burden is allocated more proportionately. **Respondent "Y"** also refutes the possibility of a case-by-case assessment as it can become complex and act as a barrier to innovation.

A third perspective is provided by **ECTA,** supporting the draft report conclusions that current definitions are sufficiently flexible to be applied as well on cloud-based networks. Therefore, **ECTA** welcomes the approach to assess future developments on a case-by-case basis although, as of today, **ECTA** does not acknowledge any cases that would require a review of European Electronic Communications Code's (EECC) scope of application due to network cloudification or virtualization.

GSMA/ETNO underline the importance of technology neutrality so that providers can choose the technology they consider most suitable and users are provided with equal benefits and protection regardless of who is providing the underlying connectivity services.

ITI understands that the principle of technology neutrality should not apply to different underlying technologies that extend network functionality but rather to classes of technologies.

GSMA/ETNO and **AIIP** call to ensure a level playing field for all market players. According to **GSMA/ETNO,** regulation cannot be separated from the concrete provision of services in the value chain and must be consistently applied across sectors and stakeholders. **Respondent "X"** sustains the same view and indicates the importance of keeping the same competition rules on the entire value chain involved. Similarly, **Respondent "Y"** notes that, despite of convergent trends, there is significant asymmetry between the regulatory obligations that apply to 'traditional' network operators, versus the other operators now involved in the delivery

of end-to-end connectivity or data transport and, thus, consideration must be given to how to level the regulatory playing field.

Microsoft and **Respondent "Z"** describe the role of cloud providers as suppliers to ECN/S providers, akin to vendors or towerco. **Respondent "Z"** indicates that it partners with other players (e.g. telcos, vendors) but does neither provide network functions itself nor private wireless networks in the EU. **Microsoft** and **ITI** regard that, even if some cloud or edge-based computing services are engineered to provide some functions traditionally provided by telecommunications providers, those should not be viewed as equal "replacement options" for the underlying core telecommunications network infrastructure. Along the same lines, **Microsoft** and **ITI** remark that the 'same service, same rules' narrative is misleading as these services' infrastructure and delivery methods are fundamentally different.

BEREC's response

BEREC welcomes the observations provided by stakeholders in relation to convergent trends and the scope of the ECN/S regulatory framework. In this regard, the following clarifications are provided:

What is meant by convergence in the ECN/S sector?

Convergence has been defined by BEREC as *the technological improvements by which a number of networks arise with enhanced capabilities to provide multiple services. This implies, at the same time, that one service may be provided over a number of different networks*.[1]

Traditionally, ECS were directly linked to a specific ECN. As technology evolved, these boundaries blurred giving the possibility of providing multiple services over a single type of network infrastructure, not requiring a specific device for their reception and facilitated the emergence of new ECN capable of providing not only traditional ECS but new ones.

Along the years, convergence has taken place in relation to different networks and services (e.g. fixed/mobile communication; broadcasting and IPTV; Television and Internet/Voice on CATV; etc.). These developments have been closely followed by BEREC (and the former ERG) and the NRAs[2] and led to evolution of the regulatory framework. In the ECN/S regulatory context, convergence is not understood as different networks and services fully becoming the same one. Convergence can be partial and, as noted by **AIIP,** not necessarily bidirectional.

From a technical perspective, different levels and types of convergence have been identified in these previous reports:

- Convergence on service: provision of integrated services.

  While convergence facilitates the bundle provision of services, the aggregation of services with the added value being merely the marketing of the various offers by a

[1]BEREC report on convergent services https://www.berec.europa.eu/en/document-categories/berec/reports/berec-report-on-convergent-services

[2] See, for instance, ERG (08) 08 Convergence Report (internal) or the BEREC Report on the convergence of fixed and mobile networks (https://www.berec.europa.eu/en/document-categories/berec/reports/berec-report-on-the-convergence-of-fixed-and-mobile-networks)

single retailer is not, by itself, considered a convergent trend. However, the bundled provision of ECN/S with Information Technology (IT) and cloud services by means of service integration can entail more complexity as well as synergies among the services and additional value than a mere joint reselling of different products doesn't provide.

- Convergence on device: provision of several services on the same device
- Convergence on platform: a single platform offers one or several services through several core networks or a single core network connected to a number of access networks.
- Convergence on core network: The transport of several services is performed through a single core network infrastructure. The platforms that support the provision of the services are connected to the converged core network.
- Convergence on access to network: Several services are provided on a single access loop or a single radio access network.

From a market perspective, while the initial convergent trends regarded the approximation of different ECN/S (e.g. fixed/mobile) or from infrastructure specific ECN/S to the provision of other services, more recent developments show a movement from IT services towards traditional ECN/S (e.g. NIICS). The impact in terms of blurring the traditional boundaries of the services remains the same, regardless the direction of the convergence trend.

The extent and features observed in relation to cloud and ECN/S leading to the identification of convergent trends are described in Chapter 6 of the report. While BEREC agrees that cloud services are used in a broad range of sectors, these developments are specific to the electronic communications one. For instance, other sectors do not entail such client/provider interdependencies, nor their services are integrated with cloud services when provided to third users.

Finally, recital 7 of the EECC acknowledges this convergence by stating that *convergence of the telecommunications, media and information technology sectors means that all electronic communications networks and services should be covered to the extent possible by a single European electronic communications code established by means of a single Directive, with the exception of matters better dealt with through directly applicable rules established by means of regulations.*

Regulatory scope: ECN/S definitions (objective scope)

BEREC notes that cloud services provided to ECN/S operators are typically part of a large portfolio of services, not all of them falling into the ECN/S definitions in the EECC, and not necessarily designed for ECN/S. Nevertheless, this does not pre-empt the possibility that determinate cloud services could also be considered ECN/S.

The scope of the ECN/S regulatory framework is generally determined by their definitions in article 2 EECC[3]. ECN are defined as transmission systems and, where applicable, switching or routing equipment which permit the conveyance of signals[4]. ECS are classified in 3 categories: internet access services; interpersonal communication services and services consisting wholly or mainly in the conveyance of signal.

As mentioned in the report, recital 14 EECC indicates that *definitions need to be adjusted to ensure that they are in line with the principle of technology neutrality and to keep pace with technological development, including new forms of network management such as through software emulation or software-defined networks*.

Recital 10 EECC clarifies that a service can be at the same time ECN/S and an information society service. Those services are, thus, subject both to the Information Society Services Directive[5] and to the EECC as *lex specialis,* among other legislations.

In light of the EECC, cloud infrastructure used as a transmission system permitting the conveyance of signals would fall within the definition of ECN. Along the same lines, cloud services (e.g. SaaS) allowing interpersonal communication services (e.g. voice, messaging, emails, etc.) or consisting wholly or mainly in the conveyance of signals are considered ECS and, thus, fall within the scope of the regulatory framework.

Regulatory scope: providers of ECN/S (subjective scope)

Some respondents indicate the need to delimitate the subjective scope of the regulatory framework (i.e. once defined what is an ECN/S, determine who can be considered an ECN/S provider). While this is a relevant question, this is an assessment than can only be done in a case by case basis as it depends on how the services are provided and what it is the role in the vale chain of each of the undertakings involved in their provision.

There are different criteria to be followed for this assessment. For example, recitals 10 and 11 EECC are relevant in this context. They refer to the possibility that an undertaking offers both ECS and services not covered by the EECC. Thus, the circumstance that a provider offers a diverse portfolio of services, not all of them ECN/S, would not be determinant to conclude that it cannot be identified as ECN/S provider.

Another important guidance has been provided by the ECJ in the case C-475/12, *UPC v. Nemzeti Média- és Hírközlési Hatóság Elnökhelyettese*[6]. The ECJ considered a determining criterion the responsibility for the transmission of the signal *vis-à-vis* the end-users. The Court puts forward a broad interpretation to avoid compromising the achievement of the objectives pursued by the framework. The fact that the transmission of signals was achieved by means of an infrastructure that did not belong to the service provider did not impede the undertaking as being considered an ECN/S provider.

[3] The ex-ante market regulation is, however, determined following the market analysis procedure put forward in Chapter III of the EECC. BEREC develops on this matter under chapter 3.1 responding to the remarks shared by **Respondents "X"** and **"Y"** and **ECTA.**

[4] See full definition in art 2.1 EECC.

[5] Directive (EU) 2015/1535 of the European Parliament and of the Council of 9 September 2015 laying down a procedure for the provision of information in the field of technical regulations and of rules on Information Society services.

[6] ECJ, 30 April 2014, C-475/12, *UPC v. Nemzeti Média- és Hírközlési Hatóság Elnökhelyettese* https://curia.europa.eu/juris/document/document.jsf?docid=151525&doclang=EN

The external study on the trends and cloudification, virtualization, and softwarization in telecommunications[7] commissioned by BEREC describes the evolution on the value chain stemming from these technological changes and the new markets and services that it enables. NRAs will have to consider this new context in their analysis.

Level Playing Field

In relation to the possible review of the scope of the framework put forward by the draft White Paper[8], some respondents have asked for the consideration of a level playing field between providers while others raised concerns about extending the scope leading to the application of rules that can be unsuitable to cloud services.

Debates around level playing field are not new and have taken place in the context of previous regulatory reviews (e.g. OTT services)[9]. On this topic, BEREC has previously stated the following general considerations:

- The regulatory framework does not only entail obligations but also rights such as the access to scarce resources or the negotiation of access and interconnection.
- Being within the scope of the framework does not imply that all services are subject to the same obligations. For example, in the case of Interpersonal Communication Services (ICS), Number-Independent Interpersonal Communication Services (NI-ICS) are subject to a lighter regime than Number-Based Interpersonal Communication Services (NB-ICS).

BEREC agrees that the regulatory framework shall not establish an uneven playing field nor imposing rules that could not be enforceable or suitable. In order to avoid such outcome, consideration to the public aims, values and objectives to be achieved (e.g. competition, end-users' rights and welfare, end-to-end connectivity, internet openness, security, sustainability, etc.) by efficient and proportionate rules are to be considered when determining the scope of regulation. Such analysis shall assess if the current rules are still fit for purpose to meet these public regulatory objectives (or newly defined ones, e.g. environmental sustainability) in light of technical and market developments and adjust the rules and their scope accordingly.

[7] https://www.berec.europa.eu/en/document-categories/berec/reports/external-study-on-the-trends-and-cloudification-virtualization-and-softwarization-in-telecommunications

[8] White Paper - How to master Europe's digital infrastructure needs? https://digital-strategy.ec.europa.eu/en/library/white-paper-how-master-europes-digital-infrastructure-needs

[9] See for example, BEREC Report on OTT services BoR (16) 35 https://www.berec.europa.eu/en/document-categories/berec/reports/berec-report-on-ott-services

2. Network cloudification

2.1. Migration to the cloud

GSMA-ETNO and **Respondent "Z"** underline the impact of network cloudification in terms of shift from Capex and internal operations towards Opex and externalization leading to hyperscalers becoming key stakeholder in this process. Network virtualization and softwarisation and edge computing are two of the interrelated key technologies that will drive telecom transformation together with 5G standalone, FTTH and FTTx roll out, Open RAN, quantum encryption and integration of low earth orbit satellite communications. Among those, **GSMA-ETNO** estimate that infrastructure technology will represent the most significant investment area for EU operators until 2030. **Respondent "Z"** states some further benefits of cloud for the ECN/S in terms of reduction of cost, time to deployment, and energy consumption, while enhancing security and resilience. Moreover, it allows ECN/S providers to develop and scale Generative Artificial Intelligence (Gen AI) applications securely and privately.

GSMA-ETNO, Respondent "Y and **Respondent "X"** suggest BEREC to highlight in the report that investing in network transformation technologies is not a choice for telecom operators, but a necessity due to increasing network traffic and new data driven use cases that will drive the redesign of network operations. However, they point to significant financial pressure faced by EU ECN/S providers reducing their ability to invest in new network technologies. **GSMA-ETNO** and **Respondent "X"** conclude that these investments will depend on the financial health of the industry and on its ability to monetize new services. Gaining scale and scope is also key for EU ECN/S providers and, consequently, cooperation among those by means of commons platform or federation models is vital. **Respondent "Y"** further develops on the financial situation of ECN/S providers and their difficulties to obtain a ROCE to compensate network investments in updates that would enable a transformational activity and create value (such as network APIs and network cloudification), whereas at the same time Content and Application Providers (CAPs) put an increasing cost-burden on the network.

Respondent "X" identifies the risk that cloud-based networks crowd out private investments at the expense of network expansion and capillarity. However, **Respondent "X"** as well as **ECTA, AIIP, ITI**, **Respondent "Z"** and **Respondent "Y"** see both types of investment as complementary as cloud technology can optimise investments, make these deployments sustainable and scalable. **ECTA** argues that, as they are complementary, the cloud-based networks cannot crowd out coverage investments. **Respondent "Z"** regards that cloud-based networks cannot 'crowd out' investments because those derive from the private sector. Moreover, the greater efficiency enabled by cloudification allow more resources to be available to invest in network coverage and capacities.

In relation to the challenges for network cloudification, **Respondent "X"** indicates that ECN/S providers deliver critical infrastructures, with specific needs (SLAs, network redundancy, backup systems, etc.) for the provision of their services. As cloud providers become key providers of digital infrastructure, they should offer ECN/S providers certain service level agreements (SLA) which are specific to meet ECN/S needs. Interoperability of cloud infrastructures would be essential not only in terms of competition and user lock-in but also in the field of cybersecurity to ensure full redundancy and back up on another platforms. **Respondent "X"** underscores the relevance of designing cloud native network functionality (CNFs) to benefit from the efficiencies that come with a multisite cloud hybrid architecture, and this will foster innovation and enhance coverage in a dynamic way. This is not typically the case today as CNFs have typically been implemented as containerization of existing software applications that inherit dependencies on the environment (hardware and virtualization infrastructure), where this software has been certified and/or has included application-specific extensions to upstream Kubernetes with no guarantee of portability, thus requiring specific certification with additional costs in efficiency and deployment time. **Respondent "X"** sees as the main obstacle to a cloud-native architecture these dependencies between workloads and infrastructure/hardware and reference to open-source projects like SYLVA as a useful common place where stack providers can discover the telco grade functionalities required and workload providers demonstrate they have no attachments to specific hardware or infrastructure configurations.

Respondent "Y" describes network virtualization as a process initiated nearly 10 years ago leading to about 70% of network functions in Europe being now 'cloudified'. The cloudification process has continued to evolve on the mobile network, with 'cloud native' 5G networks and supported by containerisation. Virtualisation facilitate use cases such as network automation and new ways of delivering connectivity (e.g. network slicing or network APIs). **Respondent "Y"** identifies a number of challenges impacting this process: i) changes in licencing practices (e.g. by Broadcom after the acquisition of VMware) impacting cloud software used for network cloudification; ii) practical issues in switching provider (rather than contractual 'lock in') such as ensuring security and effective functioning of critical infrastructure during the migration that may lead to the locking of ECN providers; iii) lack of vendor choice as some vendors are not ready to deliver complex functionalities or support migration from 4G to 5G and the lack of interoperability of equipment and software; iv) dependency on hyperscalers leading to reinforcing their market position; lock-in; security and control issues and increasing direct control of network functionality by hyperscalers . All in all, these challenges, together with the financial situation of the sector entail that network softwarisation is taking longer than initially expected and is being pursued unequally.

ECTA points that some specific operators may not need a total cloudification and virtualization of their networks (e.g. some of them operate in specialized parts of the value chain, or do not see a business need for it). **ECTA** and **Windtre** also point to the security authorizations required a factor that may slow down or hinder the cloudification of the networks.

ITI considers that cloudification results in a more diverse, secure, and resilient supply chain as the barrier to entry for new vendors is lower in a software-driven environment, compared to a tightly integrated hardware-software ecosystem. The disaggregation of these components allows for greater flexibility, competition, and innovation across the technology supply chain.

Windtre does not see a risk of cloud providers entering the ECN/S sector. The investments in cloud-based infrastructure in a hybrid cloud environment will enable ECN to concentrate on their communication business, focusing on quality of service and customer management. The challenges observed by **Windtre** to benefit from cloudification are that despite marketing announcements, many network functions are not yet available on the market as cloud native functions really compliant with Cloud Native Computing Foundation guidelines; risk of lock-in in case that migration to public cloud is not guaranteed in a completely standard environment and the threat that dominant positions in the cloud market would be leveraged into the ECN/ECS markets.

Respondent "Z" agrees that cloudification of telecom networks is at an early stage and every telco's cloud journey is unique and also observes the reluctance to move network workloads to the public cloud. However, the reasons would not be lack of control, resilience, security, and indeterminable costs as public clouds offer cost control, resilience and sovereign-by-design solutions. Therefore, migrating to the public cloud entails an increase in security. According to **Respondent "Z",** the slow uptake of public cloud for network workloads is due to: i) the early stage of the process with ECN/S providers focusing on less critical BSS - business support/ operation and orchestration (BSS/OSS) systems; ii) the need of a transformation of organisational culture which includes upskilling the workforce, and adopting new tools and methodologies that takes time; iii) legacy systems that are harder to cloudify due the technical debt accumulated over the years and iv) ECN/S providers dependency on network function vendors.

Disruptive Analysis regrets that the report is mostly oriented to mobile networks (e.g. "telco cloud" is largely a mobile-only term) as disaggregation and virtualisation differs in fixed networks. **Respondent "X"** considers that fixed and mobile networks face similar problems when introducing cloudification. The core of the fixed and mobile MNOs networks has the same level of maturity and very likely there is no difference between them. Core network cloudification clearly improves the scalability of the solutions along with other advantages. For access networks, cloud RAN will face several challenges in the coming years related to the maturity of the technology and scalability due to the need to deploy a larger footprint. **Windtre** expects that cloudification will simplify scalability and redundancy capabilities for ECN both for fixed but particularly for mobile networks. On this matter, **ECTA** acknowledges the limits to scalability faced by ECN as networks required local unused resources to support unexpected peak demands. **Respondent "Z"** agrees with the draft report assessment that network functions that are latency-sensitive need to run locally and therefore benefit less from cloudification.

Respondent "X" further develops on the differences between public and private cloud in terms of scale as each private cloud is actually a limited set of resources. Such limitation can

be overcome through proper capacity planning at each site and the use of a multi-site architecture, where the resources in all available sites are managed as a global pool for all workloads in the operator's footprint. **ECTA** agrees with the draft report analysis regarding the reluctance of ECN/S providers to move to public clouds due to lack of control, resilience, security or costs uncertainties issues.

BEREC's response:

Stakeholders generally agree with BEREC's view on the progressive cloudification of ECN, where network operators are at different stages on their transition to cloud. Although the migration process towards virtualized and cloudified networks is considered challenging, it improves the operational efficiency with faster network deployment and orchestration flexibility at a lower cost and enables the development of enhanced connectivity services, such as network slicing or network APIs (NaaS) provision, as highlighted by several ECN providers. These aspects are broadly covered in chapter 6 of the report. Further insights about the necessity of investing in network cloudification, due to network traffic and new data driven use cases, have been added.

BEREC further welcomes the additional information regarding the advantages of ECN migration to the public cloud in terms of energy consumption reduction and enhanced security and resilience mentioned by a cloud provider. However, as stated by other contributors' views, careful security and control mechanisms are required to guarantee the delivery of critical infrastructure, service resilience and EU legal data protection requirements when shifting network functionality to public cloud, being some of the reasons for the migration preference to private cloud by operators. In this regard, the EU cloud rulebook could help to provide more visibility on the best approaches to handle these issues.

Stakeholders agree with the scalability limitations of private cloud compared to public cloud resources availability and their global footprint. Although capacity planning and global workloads management with multi-site architecture can help overcoming this drawback, several respondents point out that investment and cooperation among operators is needed to build common platforms or federation models. BEREC recognises these challenges in the report and will continue monitoring the EU initiatives to foster interconnected and interoperable cloud environments, such as the public investment programs launched for common edge cloud federation pursued by Important Project of Common European Interest on Next Generation Cloud Infrastructure and Services (IPCEI) and other potential actions foreseen at European scale, touched by EC in their White Paper. In any case, BEREC considers the Digital Markets Act, and particularly the Data Act, key legal frameworks to overcome the challenges of switching cloud providers and avoid vendor lock-in strategies in the migration of ECN to the cloud.

In this field, BEREC report also highlights the initiatives led by industry to provide common access to network capabilities across different operators and interoperable cloud platforms in telecom networks, such as Open Gateway and Sylva. Regarding the latter, BEREC acknowledges this kind of interoperable framework would mitigate the current challenges

mentioned by several ECN/S providers about the lack of vendor choice and lack of interoperability between different equipment and software providers. Innovation and stakeholders collaboration will be key to unlock the significant opportunities that cloudification of networks can offer. Further, BEREC acknowledges network APIs can also be developed in-house, without collaboration with other operators, as noted by one telecom operator.

Although several respondents agree that migration to cloud is differently addressed by ECN operators, depending on their business case, stakeholders do not seem to support the preliminary view of the report regarding the lower scalability constraints faced by mobile networks compared to fixed networks.

BEREC acknowledges the comment received on the large orientation to mobile networks throughout the migration to cloud chapter. This is due to the more widespread information available about mobile network cloudification path compared to fixed network evolution, also noticed in the external study on the trends and policy/regulatory challenges of cloudification, virtualisation and softwarisation in telecommunications published by BEREC.

Finally, although some stakeholders express that EU telecom sector faces difficulties, most stakeholders consider cloud-based network investment as complement and not substitute for network coverage and capillarity extension.

2.2. APIs openness and interoperability

Disruptive Analysis considers that Communication Platform as a Service (CPaaS) has limited relevance to network APIs or overlap with it, despite Ericsson's acquisition of Vonage. **Disruptive Analysis** believes that that APIs such as those defined within CAMARA project do not typically cover all relevant networks (e.g. legacy 4G networks, WiFi networks used for more than 80% of traffic, satellite, etc.), thus there will need to be extra aggregation / simplification roles to connect applications to a wide range of both public and private networks where 5G will likely have only a secondary role, at least at first. **Disruptive Analysis** is of the view that this is particularly relevant for applications / devices used indoors or on enterprise sites, especially industrial locations. In addition, according to **Disruptive Analysis**, the draft report over-emphasizes the role of standardization and interoperability considering that standard APIs are only useful if developers actually want them, and they fulfil the roles and expectations and support required. Many developers are comfortable with proprietary APIs (notably on devices, or for cloud platforms).

Respondent "X" indicates that the Open Gateway project will allow telcos to offer API solutions in a common framework. According to **Respondent "X"**, providing harmonised interfaces to as many telcos as possible to foster global uptake by operators, hyperscalers and software developers, is a key success factor in such initiative. This is particularly relevant for network APIs and Network as a Service (NaaS) to unleash their full potential. **Respondent "X"** considers that industry collaborations for development and implementation of related frameworks should be actively encouraged from a policy perspective. **Respondent "X"**

considers that the hypothetical situations mentioned in Chapter 7.2.2 are theoretically possible when the different APIs (SBIs, NBIs, E/WBIs) are not based on standards and Open Architectures. Considering the relevance of these hypothetical situations in the context of Open Gateway, **Respondent "X"** is of the view that their relevance is different due to the technical agreements and decisions taken in the GSMA Open Gateway Technical Workgroup. For example, according to **Respondent "X"**, the case 1.a (illustrated in figure 9 of the draft report) won´t happen with the use cases defined now, where the channel partner always looks for the right provider that has the connectivity and cloud resources for a given user. Likewise, **Respondent "X"** considers that cases 1.c or 2 are not a priority today, however it would probably be necessary to review both in the future, to provide global services regardless of the area where the user request the service. Regarding the NBIs, **Respondent "X"** indicates that the potential issues exposed in the cases 3 and 4 are theoretically possible if the APIs were not standardized, pointing out the coordination between GSMA and TMForum to avoid these kinds of problems, so that both Service APIs (defined in CAMARA) and Operate APIs (defined in TMForum) are consistent, based on Open standards, and complete for the relationships between Channel Partners and Operators.

Respondent "Y" agrees with BEREC description of the hypothetical situation referring to Cloud provider/hyperscaler lock-in as illustrated though case 1.c in figure 9. **Respondent "Y"** expresses its wish for the promotion and the contribution to the development of open API definitions to facilitate interoperability and avoid lock-in, citing the work conducted in Open RAN as an example to avoid vendor-locked interfaces. In addition, **Respondent "Y"** promoted the ongoing work under the 5G Future Forum around bi-directional APIs to enable information sharing between the cloud provider and the ECN/S provider in the provision of edge services to customers.

On potential issues on API exposure, regarding the hypothetical situation illustrated through case 2, **Respondent "Y"** does not view this as an API specific issue, rather it relates to procurement and competition law. Regarding the risk of discriminatory or unfair behaviour from ECN/S provider when implementing the NaaS model (as illustrated through case 3), **Respondent "Y"** agrees that this could be a risk, it can easily be mitigated through API policy enforcement and simply presenting the same offering to both customers. However, **Respondent "Y"** points out that there may in fact be a valid business reason in some scenarios for such a differentiation (e.g. tiered level of API service with a premium offering granting more access than a free or cheaper tier). Regarding the role of CPaaS providers (in relation to case 4) in facilitating the access to ECN/S APIs to developers, **Respondent "Y"** confirms that this reflects the common industry state now through initiatives such as GSMA Open Gateway. **Respondent "Y"** considers the interaction of CPaaS providers with ECN/S providers as an opportunity to chain together API calls from different sources to compose a service, in addition, according to **Respondent "Y"**, ECN/S can themselves present service APIs that invoke their own APIs as well as those of CPaaS partners or other sources. Regarding the risk of lock-in associated with case 4, **Respondent "Y"** agrees with this hypothetical situation but points out that ECN/S are likely to continue to expose standard (e.g. CAMARA) APIs even if the CPaaS provider extends that offering.

ECTA believes that increasing the interoperability and standardization between cloud-based network solutions may to a certain extent reduce the operator lock-in with cloud vendors. In this sense, **ECTA** agrees with the BEREC proposal regarding adopting a common blueprint for deploying ECS on the cloud that all operators could make use of as a possible enabler to create a level playing field. **ECTA** appreciates the effort of BEREC to reflect on all scenarios related to the possible potential abusive behaviours that can threaten API openness and exposure. However, **ECTA** does not acknowledge any real cases among its membership and therefore, invites BEREC to continue monitoring while the market will further evolve, and APIs may be more broadly used.

AIIP stresses the need that all information as to API be made available, at least by hyperscalers, to all the interested applicants operating in the ECN/S and/or cloud or edge services. **AIIP** agrees with BEREC view and states that without adequate transparency obligations on hyperscalers as to API and other information necessary to interoperate with their platforms there is a real risk that there will be more virtual access networks not interoperable between themselves as islands not linked to each other.

Respondent "Z" recalls that the disaggregation of hardware and software has led to a more diverse, secure, and resilient supply chain as the barrier to entry of new vendor softwarised environment. **Respondent "Z"** indicates that cloud services are typically provided as generic building blocks accessible via APIs that are not specific to ECN/S. Thus, there is no inherent dependency between cloud services and ECS/ECS applications running on top of it. Referring specifically to Case 1.c of Figure 9, **Respondent "Z"** highlights that a well-architected Network Function – leveraging open-source container orchestration platform such as Kubernetes – could be transposed among different cloud environment thereby minimizing the dependency between a NF and the underlying cloud. In addition, regarding the interactions between CNFs (e.g. Access Management Function (AMF) from Vendor A interacting with a Location Management Function (LMF) from vendor B), **Respondent "Z"** points out that this happens through standards-based interfaces such as service-based interfaces as defined by 3GPP. **Respondent "Z"** recalls that multi-vendor environments have existed in telecom networks for multiple decades as well as established interoperability test to ensure that multivendor networks are feasible, and the risk of incompatibilities are minimized. **Respondent "Z"** supports its claim by citing the case of the US-based DISH Network implemented a multivendor 5G Stand-alone network.

BEREC's response:

BEREC welcomes the feedback provided by the different stakeholders and their comments on the potential regulatory risks associated with API openness and API exposure.

BEREC notes that there is a general consensus among responding stakeholders on the importance of ensuring openness of APIs to avoid various forms of lock in effects. BEREC shares this view and encourages from a policy perspective ongoing or planned efforts for that sake through further standardization of APIs and wider adoption of industry-led initiatives

aiming at promoting a harmonized development and exposure of APIs (such a GSMA Open Gateway Initiative).

BEREC also proposes to amend the report by citing the 3 different types of APIs defined by the GSMA open gateway project (i.e. service API, operate API and technology specific API) as they may go through distinct development paths while being interlinked.

While agreeing on the importance of API openness and exposure, BEREC notes that the majority of responding stakeholders are unable to categorically qualify the criticality of each case (some cases are viewed as more important than others). This is due mainly to the fact that the development of APIs, as hypothetically depicted in Figure 9 of the draft report, and their exposure are rather at an early stage. For instance, regarding API exposure, different approaches are still ongoing including direct exposure through an aggregator (e.g. Hyperscalers, OTT) or through operator federation, the latter approach will shed the light on the role of E/W APIs to enable the interconnection between the operators. Because the majority of the depicted cases are theoretical, BEREC is of the view to continue monitoring and would probably need to review in the future as the market matures and the adoption of APIs gets wider in the ecosystem and gains further traction.

2.3. Open Internet: specialized services and IP interconnection

Respondent "X" considers key not to over-legislate in terms of net neutrality and/or pervert this concept. **Respondent "X"** affirms that the medium-term business sustainability of telco operators will depend on monetizing the use of networks according to the provision of specialized services in terms of quality and capabilities, clearly facilitated by cloudification and calls for regulators not to hamper it. Along the same lines, **Respondent "Y"** is concerned that the current Open Internet Regulation (OIR) approach to specialized services could hinder the innovations introduced by the Open Gateway initiative. In this regard, **Respondent "Y"** provides the example of 'Quality on Demand' use case, enabled by Open Gateway, optimising specific content or categories of content over the network. **Respondent "Y"'**s concern is that the ambiguity and case-by-case nature of specialized services evaluations may act as a barrier to Open Gateway innovations.

CISPE and **Respondent "Z"** report that interconnection markets are working well and reject the possibility of establishing a conflict resolution mechanism in this field. **CISPE** and **Respondent "Z"** stress that interconnection disputes are rare and, when they arise, the origin is the access provider leveraging its market position, such approach would increase disputes and would effectively reintroduce network fees. A similar concern related to the introduction of network fees via conflict resolution mechanism is shared by **CCIA. CISPE** urges BEREC to highlight these criticalities in the cloud report as well as in its upcoming report on IP interconnection. **AIIP** holds a different view on the topic and proposes a general obligation to provide access and interconnection between different systems and platforms.

BEREC's response:

BEREC takes note of the issue reported by **Respondent "Y"** regarding the potential conflict between the Open Gateway initiative and the current OIR rules. In this regard, BEREC points out that an exhaustive analysis of the mentioned topic exceeds the scope of this report. A focus on the Open Gateway initiative may be included in the future BEREC's work programme, also considering the open internet rules.

With regard to IP interconnection, BEREC points out that this topic is out of the scope of the present Report. Moreover, a thorough assessment of this market will be provided in its upcoming "BEREC Report on the IP Interconnection ecosystem".

2.4. Private networks, roles and value chain

Disruptive Analysis regrets that the draft report does not address the role of cloud/edge based solutions for indoor and on-site networks, critical for the economic benefits of 5G and other advanced wireless solutions such as Wi-Fi and broader NaaS platforms.

A similar standpoint is provided by **GSMA/ETNO** who describe how the business market demand is evolving with rising significance of IP products and integrators increasingly relying on IP services and WAN as inputs. **GSMA/ETNO** explain that OTT and IP services are reshaping market boundaries, expanding them, and altering competitive constraints on traditional high quality dedicated connectivity services. Furthermore, many high-quality business services no longer need specialized network infrastructure or bespoke hardware based solutions. Instead, they are increasingly being built on software solutions that can use plain broadband IP networks to deliver high quality virtual private network services tailored for business users. These software-based solutions, built on broadband IP products, are replacing traditional offerings, with OTT based solutions gaining significant traction and playing a major role in service provision.

Disruptive Analysis also points to the absence of mention of the role of vendors, systems integrators, OT (operational tech) suppliers etc. Along the same lines, **Respondent "Z"** considers that the draft report misunderstands the role of cloud providers in the value chain and, in particular, with regard to the provision of private wireless networks.

BEREC's response:

BEREC agrees with the remarks regarding the importance of cloud and edge computing services in the context of 5G and private network solutions. While this is mentioned across the report (for instance, in chapter 6), it does not develop a fully fletched analysis as 5G private networks have already been analysed in the *"BEREC Report on the 5G Ecosystem"* (BOR 22 (144)[10]). Moreover, an upcoming *"BEREC Report on the evolution of private and public 5G*

[10] https://www.berec.europa.eu/en/document-categories/berec/reports/berec-report-on-the-5g-ecosystem

networks in the Europe"[11] is expected in 2024 aimed to report both on the drivers for, and requirements of, private networks and on the evolution of public networks towards meeting new user demands, examine 5G case studies to ultimately provide a factual overview on the extent of the use of private and public 5G networks in Europe.

BEREC has adapted Chapter 6 in order to mention the role of system integrators and operational tech suppliers but refers as well to the analysis of the different roles in the 5G ecosystem also provided in the *BEREC Report on the 5G Ecosystem*.

BEREC welcomes the information provided by **Respondent "Z"** regarding cloud providers' role in the provision of the service. BEREC develops in this regard in Chapter 1 of this report, in connection to the scope of definitions and services.

2.5. Indicators related to virtualization

Disruptive Analysis points out that there is no mention of collection of proper data and metrics on virtualised networks, or the use of cloud-based approaches such as crowdsourcing to help regulators obtain better and more detailed Key Performance Indicators (KPIs). It should be considered whether it would be possible to collect new data types (e.g. location of data traffic use, indoor vs outdoor or urban vs. rural) with less effort by telcos.

BEREC's response:

Indeed, the BEREC report does not mention any collection of data on virtualized networks, nor how crowdsourcing may enable NRAs to obtain KPIs. These topics were not in the scope of the report, that meant to overview cloud and edge computing services with a dedicated focus on their impact on the electronic communication sector and the possible competition dynamics arising thereafter.

BEREC appreciates the interest to gather data on virtualized networks that would allow to extent to which those are being virtualized and the criticality of this phenomena. It also recognises that it would be best for those metrics to be agreed collectively so that resulting data would be possible to aggregate and compare across European countries. BEREC has worked for years on the harmonization of the electronic communication sector indicators, producing definitions for many of the measurements that are being used in Europe to understand the evolution of the sector, with a special focus on new phenomena. However, BEREC would need to consider developing metrics in the future under the light that any data request that NRAs pose on operators would need to be clearly substantiated with a sound legal basis and be proportionate to the informational needs to be fulfilled.

[11] Insert link when published

3. Competition

3.1. Competition implications on the ECN/S markets

The feedback gathered during the public consultation include diverse references to the competition implications on the ECN/S markets in the context of network cloudification. Those are related to the potential leverage market power into ECN/S markets, level playing field considerations in this context and implications of cloudification for big and smaller operators.

GSMA-ETNO, AIIP and **Respondent "X"** develop about the dependencies between ECN/S and cloud providers. As the latter offer inputs crucial for network evolution, a lack of competition in the cloud markets can indirectly impact ECN/S markets. **GSMA-ETNO** and **Respondent "X"** concretely point to the hyperscalers' position that can potentially lead them to leveraging market power from adjacent markets, and also into the ECN/S market. Furthermore, in **GSMA-ETNO** and **Respondent "X"** 's views, the unbalanced bargaining power in favour of cloud providers allows them to impose unfair conditions in agreements with ECNs. Consequently, the competition in ECN markets could be distorted. From **Respondent "X"** 's perspective, hyperscalers would be in position to decide which ECN/S provider succeeds and which fails or to carry out a vertical integration that could potentially devastate ECN/S markets competition. Moreover, **Respondent "X"** proposes changing the focus of Electronic Communications regulation towards assessing hyperscalers in consideration of their impact on the market. According to **AIIP**, there is a serious risk of monopolization of ECN/S by virtualized networks carried and managed by US hyperscalers. While ECN/S are key for the provision of cloud/edge services, hyperscalers have strong market power on the demand side. **AIIP** expects that in the short run the relationship between "telcos" and "hyperscalers" will be collaborative, of the type "supplier - customer", in the medium run and, in the long run and in the absence of effective regulation, a more competitive relationship with EU telcos losing the match. **AIIP** asks BEREC to take further consideration in the report of the risks that convergence would bring to the monopolisation (or oligopolization) of the ECN/S by hyperscalers and that facilitating the development of cloud and edge services in EU should be preceded by the adoption of specific pro-competitive measures for ECN/S.

Against this backdrop, **Respondent "X"** puts forward some regulatory suggestions on hyperscalers provision of services for ECN/S in the context of the public designation of the ECN/S as critical services. Among others, such regulation would encompass: the obligation to negotiate in good faith with ECN/S providers; minimum requirements to adapt to network cloudification needs (e.g. the design of workloads as cloud-native and portable from scratch to allow reducing the need and cost of certifications, accelerating deployment of services, and promoting competition); non-discrimination obligations; control of "technological retention" as strategic management of times for launch and adoption of innovations and the supervision of vertical integration to control other parts of the ECN/S value chain (network logical or physical infrastructure, mobile or fixed end-customer services, etc.). **AIIP** also proposes regulatory interventions aimed at the publication of API and all information necessary to interoperate with

hyperscalers and possibly with cloud services providers in general, together with a general obligation to provide access and interconnection between different systems and platforms.

ECTA also notes that the market failures in the cloud market could affect competition and investment in the provision of ECN/S and considers that some additional pro-competitive provisions in addition to those already in place (i) the technology neutral application of the EECC and ii) the data portability/switching measures of the Data Act (DA) and iii) the interoperability and API related provisions of the Digital Markets Act - DMA). The measures proposed by **ECTA** mainly relate to reduce lock-in risks by strengthening telco's ability to switch providers; addressing licences policies by vertically integrated providers and developing a common blueprint for deploying ECS on the cloud increasing the interoperability and standardization between cloud-based network solutions.

Windtre notes that cloud providers are in some markets entering the electronic communication sector. However, it expects that cloud-based infrastructure will enable ECN to concentrate on their communication business, focusing on quality of service and customer management.

From a different perspective, **Google, Respondent "Z"** and **ITI** underline the partnerships reached among the different providers and, in general, collaborative dynamic that has characterized the relationship between cloud and ECN/S providers and considers limited and speculative the possibility that cloud providers may compete with traditional telcos in the ECN/S markets. On the contrary, **Google** emphasizes the benefits that cloudification brings to ECN/S providers in terms of efficiency, flexibility, innovation (e.g. in the field of Artificial Intelligence -AI) and lower costs.

Respondent "Y" also welcomes the partnerships reached between telcos and cloud providers. However, it also points to the risks that hyperscalers leverage their position thanks to their control of the cloud inputs (e.g. establishing unfair access conditions of refuse to provide access). In this regard, **Respondent "Y"** calls for a close monitoring of these developments and consideration in future regulatory updates.

As mentioned above, **CISPE** points that while cloud providers are increasingly offering ECN/S those are limited when considering the full size of the market and consider greater the risks that ECN/S providers leverage their position for advanced use cases (for instance, for the provision of edge computing) thanks to their extensive network and capillarity. From a similar standpoint, **ITI, Respondent "Z"** and **CCIA** signal the dependence of services present on the upper layers on telecommunications infrastructure to reach end-users.

Respondent "Z" considers that the use of cloud services in the telecom sector does not invoke any specific concern from either an economic or security perspective that would require intervention. Public cloud services and ECN/S remain complementary and distinct services. The connectivity infrastructure used by cloud providers for self-provision does not replace the connectivity that ECN/S providers supply. **Respondent "Z"** underlines that network cloudification increases choice for telcos both in terms of software and cloud services

suppliers. Moreover, **Respondent "Z"** trusts that existing regulatory tools help ensure market remain contestable and there is no economic incentive for cloud service providers to depart from a horizontal delivery model across economic sectors to serve and carve out one telco segment. **Respondent "Z"** argues that the opportunity cost would simply be too high, augmented by cost of duplication of internal resources (telco versus other sectors), and transition cost through internal (technical) coordination mechanisms.

In the context of market analysis, **Respondent "X"** advocates to shift the focus of market 2 analysis from pure connectivity markets to include IT and cloud/edge complementary services and assess whether competition problems might arise from the possible dominant position of a few cloud and IT providers. More generally but from a similar standpoint, **Respondent "Y"** proposes to expand the access regulation regime to prevent hyperscalers leverage their market position into the provision of ECN/S thanks to their control of cloud inputs.

ECTA reminds that effective access to electronic communications infrastructures is and will remain a fundamental pillar for competition in the ECN/S markets also after the advent of cloudification and virtualization. That is, in networks based on SDN and Network Function Virtualisation (NFV), civil engineering infrastructure, physical networks (and access), and, where needed in addition, wholesale active access are still essential, in the same way as in the networks of today. **ECTA** invites BEREC to clearly specify this consideration in the report as follows: *irrespective of the virtualization and cloudification trends of the networks, the networks do rely on civil engineering and physical infrastructure which remains non-substitutable by higher layers (virtual layers where cloudification occurs) and remains essential for access to the networks, and to have greatest control over the networks. Where needed in addition, wholesale active access, also remains key.* Along the same lines, **ECTA** proposes to reiterate the BoR (16) 974 Input paper findings: *"In networks based on SDN and NFV, passive network infrastructure is used in the same way as in the networks of today. Therefore, SDN and NFV do not have any impact on the access to passive network infrastructure"*. ECTA considers also that the conclusions on (active) fixed network access also remain valid: *"SDN and NFV have the potential to enable new forms of fixed network access which provide alternative network operators with more control over the network of the incumbent compared to current Layer 2 wholesale access products (e.g. VULA). However, today this is not the case and it needs to be seen whether SDN and NFV will be developed further in order to enable such new forms of fixed network access".*

From another perspective, **Disruptive Analysis** points to the relevance of cloud-based solutions for enabling more flexible & innovative MVNOs or for fibre open-access providers which is not explored in the report. It provides the example of the use of cloud-based mobile core networks and BSS/charging solutions to enable a variety of new competitors in the telecoms marketplace, which may not own their own RANs or spectrum.

Disruptive Analysis also regrets the limited discussion in the draft report about the role of cloud in enabling new forms of network infrastructure-sharing or virtualised providers, such as the role of neutral hosts. There are multiple possible architectures, including those where one provider owns a "whitebox" server, hosting multiple MNOs as tenants with virtualised

centralized (vCUs) and distributed units (vDUs) for OpenRAN. This can apply for both wide-area RANs or indoor systems.

All in all, **ECTA** highlights the success of the current regulatory framework and warns of the risk for competition in case it was dismantled. Namely. **ECTA** believes that there is a serious potential risk connected to introducing cloudification / cloud markets in the EC Recommendation on Relevant Markets and/or in the EECC. Alleged blurring of the borders between cloud and electronic communications services, without showing concretely how this blurring trend would de facto affect wholesale network access markets, may be instrumentalised to push for the dismantling of the current regulatory framework.

With regard to the possibility for all providers to benefit from network cloudification on equal footing, **Respondent "X"** regards that the risk is not about the creation of an uneven playing field among operators but between the different players in the value chain, notably cloud providers and telcos. On the other hand, **ECTA** sees a risk that the virtualization/cloudification of network functions may create asymmetries among network operators, as not all are equally equipped to face the inherent challenges or move to the cloud. Some (smaller) ECN/S operators may be less able to bargain good deals with cloud providers, resulting in distortions on ECN/S markets to the detriment of competition. **ECTA** believes that a common blueprint for deploying ECS on the cloud available to all operators can act as enabler to create a level playing field and calls on the institutions, including the standardization bodies to reflect on this proposal. **Respondent "Z"** considers that, in principle all telco operators are equally equipped to benefit from network cloudification.

BEREC's response:

BEREC notes the diverging views among stakeholders regarding the impact of the transition to cloud-based networks on the competition evolution of the ECN/S markets. Some consider that cloud providers, in particular, hyperscalers, are in a position that allows them to leverage their market strength in the cloud markets into adjacent markets including ECN/S, impose discriminatory conditions or carry out a vertical integration leading to increased concentration of ECN/S markets. On the other hand, other stakeholders underline the collaborative dynamics taking place among the different players and the complementarity of the services. They also note that vertical integration towards the provision of publicly available ECN/S by cloud providers is very limited at this moment and unlikely to grow significantly in the future due to the lack of economic incentives for cloud providers to move forward to the provision of ECN/S.

BEREC considers that the draft report gathers both perspectives in a balanced manner as well as the arguments provided by the two different standpoints. Therefore, no changes are proposed to be introduced in the document. Nevertheless, BEREC will continue closely following the evolution of the services to identify any competition bottleneck related to these network upgrades.

The regulatory suggestions put forward in the responses are twofold: some are horizontal and relate to transparency, interoperability and, in general, the design and features needed for

cloud products to be implemented for the provision of ECN/S; the others are related to ex-ante market regulation.

With regard to the first category of measures, article 39 EECC provides EC, Members States, NRAs and standardization bodies with relevant tools to foster standardization (explicitly mentioning network functions) and almost all the stakeholders remind the importance of the enforcement of DMA and the DA to address some of the competition issues identified. In general terms, stakeholders agree on the importance of standardization and the relevance of open APIs as described in the draft report. BEREC further notes that while cloud providers conceive their services as horizontal and telco cloud products as one of the many services included in their portfolios, ECN/S providers request availability of cloud services specifically designed for ECN/S needs. Due to the potential impact on network upgrades, this is an issue to be further considered in BEREC's future work.

With regard to the measures related to *ex-ante* market regulation, BEREC supports ECTA's proposal to make more explicit in the document that network virtualization/cloudification does not imply that the physical layer disappears and, thus, access regulation remains relevant.

BEREC also agrees that connectivity offers are, in the broad sense, increasingly including IT and cloud/edge complementary services. As mentioned in the report, a recent study for BEREC on communication/ connectivity services for businesses in Europe[12] showed that, indeed, as of mid-2022, 50% of the business consumers have subscribed to bundled offer with connectivity and IT services. One of the most frequent combinations bought in the European markets comprises connectivity and security services, together with cloud solutions and SD-WANs. Furthermore, providers think that such trends will be strengthened in future to comply with the customers' requirements, with universal fibre rollout making it easier to supply additional services such as UCC (Unified Communications and Collaboration) and IT.

In any event, as the current regulatory practice shows, such trends are being considered already by NRAs, for instance, in the context of replicability tests[13]. The current *ex ante* market regulation allows for the application of the competition analysis in a hypothetical scenario were a vertically integrated provider for ECN/S and cloud services is identified as holding significant market power (SMP). If so, NRAs would be empowered to intervene on the connectivity part through *ex ante* regulatory remedies. Additionally, if impeding of competition related to other services (i.e. cloud, in this case) would be found by the same hypothetical vertically integrated provider, the competent authority in the respective MS could use other provisions and tools (e.g. DMA, DA, competition law) to tackle the identified market issues. However, the two

[12] Study on Communication Services for Businesses in Europe: Status Quo and Future Trends, available at https://www.berec.europa.eu/system/files/2022-12/BoR%20%2822%29%20184%20External%20Study%20on%20Communication%20Services%20for%20Businesses%20in%20Europe%20Status%20Quo%20and%20Future%20Trends_0.pdf

[13] These bundles are analysed by NRAs to ensure that alternative operators using regulated wholesale offers are able to replicate the connectivity related service.

categories of regulatory interventions should be coherent, especially because they approach the same entity from different angles.

In the light of above, BEREC acknowledges in the draft report the essential need for a coordinated approach by all relevant, national and EU, competent bodies to be able to address emerging issues in the digital ecosystem in a coherent and efficient manner. This would be an example of the importance of such coordinated approach. Nevertheless, such scenario is still hypothetical, and no market 2 analysis made so far has led to the conclusion that intervening on the cloud/IT side is required at this moment to address the bottlenecks encountered in the market for the provision on ECN/S.

Moreover, BEREC has advocated for further consideration of ecosystem effects in the digital markets. As stated in the BEREC Report on the *ex ante* regulation of digital gatekeepers[14], BEREC believes that being part of an ecosystem reinforces the platform's gatekeeping role when it allows a platform to leverage its power onto additional services, or to have privileged/exclusive access to key inputs/assets raising further barriers to entry or expansion. BEREC proposed further consideration of this aspect in the DMA both when designating gatekeepers and when designing the corresponding regulatory measures.

Finally, stakeholders do not see clear signs of challenges for ECN/S providers to benefit on equal footing from cloudification as long as common standards and open APIs are available, as suggested in the draft report.

3.2. Competition in the cloud markets

GSMA-ETNO, AIIP and **ECTA** develop on the dependency on very few cloud giants that dominate the global cloud market raising vendor lock in, bargaining power, privacy, and transparency concerns that may also impact the ECN/S markets and welcome the introduction of the DMA and DA to address these concerns. **GSMA-ETNO** and **Respondent "X"** stress the disparity of negotiating power between hyperscalers and European telecom operators. While the DA or the DMA aim to curtail their market power, further clarify on how these general rules will be applied in specific cases by regulators would be required. Along the same lines, **Respondent "Y"** calls BEREC to provide further clarity on the scope of application of the Data Act in particular in the context of the cloudification of networks.

Respondent "Y", **AIIP** and **ECTA** welcome the DA provisions on cloud switching and interoperability to reduce the barriers that currently exist to switching of cloud service providers and address the risk of vendor lock in. **GSMA-ETNO** consider that the telco cloud benefit from switching and interoperability DA provisions, provided they do not fall under the exception for

[14] https://www.berec.europa.eu/en/document-categories/berec/reports/berec-report-on-the-ex-ante-regulation-of-digital-gatekeepers

customized cloud services. They encourage policymakers to have an open dialogue with the industry when developing guidelines on interoperability.

Respondents "X" and "Y" remark that no cloud service provider has been declared as a "gatekeeper" for the time being no DMA obligation applies to them at the present. **Respondent "Y"** further proposes BEREC to note in the report that this situation should be kept under review by BEREC and the EC and considers that while intermediation/gatekeeping dynamics may not be present at the IaaS layer, there could be ample scope to designate gatekeepers at the PaaS/SaaS level.

Respondent "Y" identifies risks stemming from the use of public cloud for the cloudification of networks: reinforcing hyperscalers' market position; lock-in'; security and control issues and increasing direct control of network functionality by hyperscalers. Should the existing legislation (DMA and DA) cannot address those, **Respondent "Y"** suggests the introduction of new mechanisms such as rules facilitating fair access to cloud technologies / inputs.

AIIP proposes complementing the DMA and DA to limit at the EU level the recourse to "cloud credits" offered by hyperscalers and the reinvestment in the EU of a large share of their revenues.

Google appreciate BEREC's focus on the importance of an open cloud ecosystem for customers, preventing and reducing lock-in effects and provide some good practices it applies as cloud provider with regard to switching and interoperability ultimately promoting open ecosystem. On the other hand, **Google** regards that the cloud market pricing models provide users more freedom of choice compared to ECN/S.

Google, **ECTA, CISPE** and **Respondent "Y"** are concerned about unfair software licensing practices in the cloud market. CISPE considers licensing practices of Microsoft as well as Broadcom/VMware being unfair. **Google** points to practices such as punitive pricing when moving to alternative providers or aggressive tying and bundling, legacy software providers that are leveraging their market dominance in productivity software and on-premise operating systems to create a new dominant position in cloud. **Respondent "Y"** describes the changes, of VMware licencing agreements after its acquisition by Broadcom as hardly viable and financially unsustainable for the users. **ECTA** indicates the importance of prohibiting lock-in clauses including limitations to the "bring your own license" principle, ensure that there is no retaliation in licencing portability and establish transparent, fair and non-discriminatory licences conditions.

In **Respondent "Z"** and **ITI's** views**,** it would be inaccurate to affirm that cloud providers hold a dominant position, as the ultimate ability to intervene and influence the quality and the prices of telecommunications services for customers lies with ECNs as they own the last mile network infrastructure and hold a gatekeeping position in controlling or managing the delivery of network services to end users. **Respondent "Z"** sustains that cloud providers do not control any bottleneck infrastructure.

BEREC's response:

BEREC thanks the stakeholders for their feedback and has carefully considered respondents' views related to competition in cloud markets. Concerning the scope of the report BEREC notes that many inputs highlight the relevance of interoperability, open standards and the reduction of switching barriers as means to foster market entry, expansion and competition in cloud markets. Those inputs refer to the DA and the DMA which are in expected to address many of the identified concerns. Therefore, BEREC considers that the topics are well covered in the report.

BEREC welcomes the comments on the importance of direct and indirect network effects, especially regarding Independent Software Vendors (ISVs) using cloud market stores to reach customers, as pointed out by AIIP but sees no need to change the report.

BEREC thanks respondents for the comments received on unfair licensing practices and updates the report in Section 4 in order to cover recent developments regarding changes introduced to VMware services by Broadcom. BEREC considers that the ability of Broadcom to suddenly raise prices and degrade quality indicates that competitive pressure can be quite low and alternatives hardly available.

BEREC also recognises that there is no gatekeeper designated yet in relation to cloud services as core platform services in the DMA and changes the report in chapter 3.2.3 to highlight the possible ways of designation with quantitative or qualitative criteria according to the DMA.

BEREC agrees that there is uncertainty on the scope of the Data Act (e.g. regarding telco cloud and the exception for customized cloud services as highlighted by GSMA/ETNO). BEREC therefore adapts the report to cover in more detail how the possible relations between the measures in the Data Act may relate to private or telco clouds, customized cloud services. BEREC has setup a group of NRAs' experts aimed to keep contributing, in close cooperation with the EC, to the harmonized implementation and interpretation of the Data Act in different ways, for example with knowledge-building workshops among NRAs and with stakeholders in 2024 and will, at least, continue with a workshop with external experts and stakeholders in 2025.[15]

3.3. Partnerships and agreements

GSMA/ETNO and **Respondent "X"** report that more specialized services will be required in light of the new demand arising from the digitization as well as of the increasingly larger segment of the business market. **Respondent "X"** considers that EU operators cannot negotiate on equal footing with the hyperscalers due to their enormous market power.

[15] Outline BEREC Work Programme 2025, BoR (24) 03, https://www.berec.europa.eu/en/document-categories/berec/berec-strategies-and-work-programmes/outline-berec-work-programme-2025

Google, ITI and **Respondent "Z"** signal the cooperative dynamic between cloud and ECN/S providers and the relevance of partnerships. In this context, **Google** provides, on one hand, several examples of partnerships with telecom operators to deploy submarine cables and, on the other hand, of partnerships with ECN/S and vendors in the delivery of ECN/S. **Respondent "Z"** lists numerous examples of partnerships with ISV to provide VNF/CNF solutions as well as provides several examples of partnerships with telcos in the context of Multi-Access Edge Computing (MEC) the provision of private network connectivity to enterprises and NaaS.

Respondent "Y" regards the partnerships and synergies that come from combining cloud services with network connectivity as one of the key opportunities arising from the expansion of cloud services and cloud capabilities. **Respondent "Y"** provides also some examples of the partnerships reached with cloud providers to be able to provide bundled connectivity and cloud services to enterprises; act as a 'Cloud Broker', bringing together the customer and the various cloud providers it uses to host its applications seamlessly or for the provision of edge computing services. However, while welcoming such agreements, **Respondent "Y"** sees the risk that those could be used to leverage market power in the cloud markets towards the ECN/S sector.

BEREC's response:

BEREC welcomes the information provided on the different partnerships reached between cloud and ECN/S providers that helps for a better understanding of the current dynamics taking place in the sector.

4. Investment in edge computing

Interestingly, no cloud provider has commented on the topic of investment in edge computing, but a few operators/operator associations (**ETNO/GSMA, Respondent "X", Respondent "Y"**) have provided feedback regarding the opportunities that it may bring about for their business. Their shared assertion is that edge computing has a limited business case, due to the lack of (industrial) demand and because of technical and cost considerations. First, its number of use cases is very limited and cloud service offerings can support most uses, especially since hyperscalers increasingly deploy regional cloud instances. Second, although telecommunication networks enjoy sufficiently capillarity, enabling edge computing comes at a substantive cost as it requires a reconfiguration of the access network, results in additional security requirements which are dear to implement and entails a surge in the demand for energy. All in all, the operators' outlook is relatively pessimistic and speaking of small incentives to invest, at least for the short and mid-term, and some operators explain that they are limiting their expenditure in edge computing after having experimented with some failed commercial possibilities.

An operator explains that observes an emerging demand for "dedicated edge"- a highly secure and exclusive edge, which consists of a cloud server being deployed in the premises of an

industrial consumer. However, this operator explains that those commercial demands are directed to cloud providers, rather than to operators.

Disruptive Analysis is of the view that the EU target of 10.000 edge-nodes is not justified, unconnected to the industry and developers needs and that it should be downsized.

BEREC received several positive comments on the IPCEI CIS initiative and its pursual of a common edge could federation. Three contributions explain that the IPCEI CIS is an important step to boost large scale investment in edge. This is a partnership of 19 companies of 7 European countries to enable federated, energy-efficient and trustworthy cloud and edge distributed data processing technologies and related services by developing an open-source software that allows for real time/low latency services by distributed computing resources.

Moreover, several comments require the IPCEI CIS public funding to increase, for a quick approval of projects and for a close coordination of those at the EU level in order to ensure a level playing field between companies and Member States so as to avoid a subsidy race in the internal market.

BEREC's response:

BEREC acknowledges the difficulties and uncertainties that operators face to invest in edge computing and has reported on this in sections 2.1.2 and 7.2.2.viii of the revised BEREC report on cloud and edge computing.

BEREC cannot assess the future profitability of edge computing but has already acknowledged in its report that currently it has a small number of use cases. BEREC agrees with operators that nowadays the lack of development and the low visibility of the possible uses of edge computing implies that one should not expect that the large-scale investments required by the Digital Decade Policy Programme (DDPP) by 2030 goals be funded privately in its entirety.

BEREC is of the view that the very ambitious political objective of 10,000 climate-neutral and highly secure edge nodes by 2030 puts the focus on the need to make public efforts to overcome the difficulties in a widespread investment in edge computing, especially at the first stages as this can alleviate the risk of private investors and help overcome the "chicken and egg" problem. However, public funds have a shadow cost and need to be used cautiously, examining their possible uses and evaluating the adequacy and possible social return of projects. In BEREC's opinion, in a dynamic marketplace like the digital one and for "emerging" technologies, any target figure should be examined and contrasted with reality continuously. In this sense, BEREC appreciates the need expressed by some operators that the success of edge computing be measured and judged by the usage of existing nodes and not only by the number of deployed nodes.

BEREC agrees that the IPCEI CIS initiative is key and, in particular, stresses the criticality of the idea of "federation" promoted by this initiative- i.e. the interconnection / interoperability between data processing services of different providers. As one contributor explains

operators' edge offerings are marketed as a disadvantage with respect to standardized public cloud hosting solutions, because they force developers to re-structure their applications to be hosted on different operators' edge nodes. In BEREC's view all efforts to overcome this disadvantage can only result in a more competitive and open edge and cloud market.

BEREC concurs with the contributions that tax and financial incentives, such as Research and Development (R&D) tax credits, may be a considered to encourage private investment in critical and emerging infrastructures. BEREC also acknowledges the comments made about the need to increase the public funding of IPCEI CIS and for a quick approval of its projects and a close coordination of those at the EU level. These comments are beyond the scope of the current report.

Finally, BEREC is of the opinion that public funding and incentives are necessary to develop appropriate edge infrastructures in the initial phases of development and to address any regional/local disparities in access to edge computing resources at a later stage. However, public bodies also have a role in sponsoring use cases and making them visible and available to industry.

5. EU legislations impacting cloud and ECN/S interplay

GSMA-ETNO describe the complexity and interconnection of the digital environment. Again there is an urgent need for a simplified and streamlined regulatory framework. Such a framework is essential to ensure coherence and consistency among the various legislative pieces already in place. On the other hand, **ITI** holds an opposite opinion indicating that, instead of bringing in a completely new structure by way of an overarching converged legislation, the primary focus should be on ensuring that such regulators have the relevant tools to regulate these new and emerging technologies independently on a case-to-case basis.

Google, Microsoft and **CISPE** emphasize the existing numerous EU regulation with respect to cloud services and alert that expanding the ECN/S regulatory framework would add more regulatory burden, and further complicate concerns about regulatory jurisdiction and oversight, without contributing any ostensible benefits to the citizens and businesses of the EU. Along the same lines, **CISPE** and **Microsoft** make a call to avoid overregulation and requests BEREC to assess the effects of the current regulation on cloud services before the adoption of further regulatory burden on EU cloud providers.

Microsoft additionally points that, given that cloud services are used by a great variety of industry sectors, they should be regulated horizontally instead of by sectoral regulation. **Microsoft** and **ITI** consider that the draft report appropriately acknowledges the intricacies involved in the interaction among various new EU regulations, emphasizing the need for meticulous consideration to ensure their effective implementation and legal clarity, while also preventing the imposition of unnecessary bureaucracy on users and providers. In this respect, **Microsoft** believes that introducing additional layer of sectoral regulation could inevitably lead to overlaps and regulatory inconsistencies.

BEREC's response:

BEREC extends its sincere gratitude to all stakeholders for their valuable comments and insights on the interplay amongst the different EU legislations impacting Cloud and ECN/S.

Industry input underscores the need for a balanced and coherent regulatory approach that fosters innovation while ensuring operational efficiency and security. BEREC concurs with these insights and emphasises the need for a regulatory framework that is streamlined, avoids redundancy, and leverages existing industry initiatives to foster a more dynamic and competitive market.

Stakeholders emphasise the critical infrastructure needs of telecom operators, including SLAs and network redundancy, highlighting the necessity of cooperation from cloud providers for advancing European digital development. The concern about maintaining consistent competition rules across the value chain underscores the need for a coherent regulatory framework. The call for simplified and streamlined regulation aligns with the industry's need for operational efficiency and resilience against cyberattacks. The feedback reflects the necessity for interoperability and redundancy in cloud services and underscores the complexity of the regulatory environment, highlighting the need for a more integrated regulatory approach to ensure consistency and reduce complexity.

Responses from industry underline the mutual benefits of agreements between ECN/S providers and cloud providers while questioning the need for expanding the definition of ECN/S. Concerns are raised about adding regulatory burdens that might overlap existing frameworks, such as AI, cybersecurity, and interoperability regulations, arguing that this could complicate regulatory oversight without providing clear benefits. These concerns about regulatory overlap are acknowledged, and a careful evaluation of the implications of redefining ECN/S is needed to avoid unnecessary regulatory complexity and ensure that any new regulations provide clear and tangible benefits.

There is also a recognition of the importance of understanding the impact of new legislative proposals before adding further regulatory burdens. Ongoing industry efforts to enhance interoperability, particularly those under major industry initiatives, are highlighted. The emphasis on the need for a measured approach to new regulations and recognition of industry-led interoperability initiatives should be acknowledged. There is benefit from closer collaboration with such initiatives to leverage existing solutions and avoid redundant regulations.

Additionally, feedback highlights the diversity of cloud service applications across sectors and the sufficiency of existing horizontal regulations, such as those addressing digital markets, data, and network security. Arguments against additional sector-specific regulations suggest they could stifle innovation and create regulatory inconsistencies. BEREC agrees with the perspective that existing regulations should be effectively implemented and harmonized across sectors, and this approach should be prioritized.

Aligned with BEREC, industry stakeholders highlight the range of existing and upcoming regulations affecting cloud service providers and advise against further regulatory intervention until the impact of these laws is thoroughly assessed. Recommendations for a comprehensive understanding of how current regulations interact before introducing new ones are prudent, and priority should be given to this assessment to ensure that any new regulatory frameworks complement rather than complicate the existing landscape.

BEREC agrees with the collective feedback, underscoring the critical need for a balanced and coherent regulatory approach that fosters innovation while ensuring operational efficiency and security.

6. Sustainability

According to the **Shift Project**, cloud and edge computing must be considered within the framework of a currently unsustainable digital transition. They advocate for a more central consideration of environmental aspects. The **Shift Project** points out that is crucial to bring data centers and edge computing growth under control, especially when it contributes to increasing the market power of actors whose business models are primarily responsible for the escalating energy footprint of the digital realm.

GSMA-ETNO also support the objective of climate neutrality and describe the advances made by ECN/S provides to reducing carbon emissions by decreasing energy consumption and augmenting the share of consumption from renewable sources. However, **GSMA-ETNO** call to develop indicators and requirements for data centres taking into account the features of smaller data centres and the specificities of edge computing.

Respondent "Y" links energy and environment with the 'fair share' debate. The increased consumption on the network and the expansion of computing power at cloud data centres leads to increased energy demand and thus environmental cost. **Respondent "Y"** recommends BEREC and the EC to look into measures to better encourage more efficient data consumption and data sobriety.

CISPE and **Respondent "Z"** signal that cloud adoption can help attaining sustainability goals, including the reduction of energy consumption by ECN/S providers. **Respondent "Z**" lists the elements and technical developments that are increasingly favouring sustainability in the cloud provision. For example, scale, data centre performance-modelling, cooling efficiency, and power efficiency.

BEREC's response:

BEREC acknowledges that moving to the cloud may reduce, if properly implemented, the impact on the environment. This due to that less hardware would be required and thus hardware and infrastructure would be more efficiently used. Also, every new generation of hardware is more efficient per amount of data or compute than the previous generation.

Although this doesn't mean that the overall impact on the environment is reduced over the years due to the growth of the data. Therefore, a systematic view integrating the full lifecycle of the ICT infrastructure (networks and data centers) is privileged.

While this is not the focus of the cloud report, environmental sustainability is one of key strategic priorities of BEREC's 2030 Action Plan[16]. A dedicated working group has been established to support monitoring (e.g. by proposing relevant indicators), analyse in depth the digital environmental footprint or empower consumers to be able to take conscious decisions. BEREC thanks the stakeholders for the good cooperation in this field and invites them to continue following the activities of BEREC's environmental experts for further insights and proposals.

7. Digital sovereignty

GSMA/ETNO encourages policymakers to collaborate closely with the industry to identify and prioritize specific key technologies to stimulate innovation and investment to propel Europe to a global leadership position in those areas.

Respondent "X" highlights that the power of hyperscalers could allow them to impose different rates of economic development on certain countries or regions. **Respondent "X"** further argues that the lack of economies of scope and of scale of EU providers and the significant financial pressure European telco operator's face reduce their ability to invest in new network technologies. Common platforms, standardization or federation models are vital to counterbalance these disadvantages. **Respondent "X**" further calls for public funds investments to implement the 3C network projects ensuring a level playing field between companies and Member States to avoid a subsidy race. Alternatively, aid schemes could include tax and financial incentives to attract private investment in critical and emerging infrastructures, such as R&D tax credits and investment allowances for critical infrastructure investments.

Respondent "Y" calls on all policy makers to embrace a vision of digital sovereignty in the cloud domain, which is strategically open, leverage regulation where appropriate to promote security, resilience and competitiveness within the single market, while remaining open to international trade in digital services and global data flows. In particular, **Respondent "Y"** shares its concerns that the Cybersecurity Certification Scheme for Cloud Services (EUCS) could effectively discriminate against service providers based outside of the EU, even when offering sovereign capabilities in the EU.

ITI considers that an overregulated business ecosystem, make the cost of application layer services rise and ultimately impact consumers. Such an approach would have the negative

[16] BEREC Action Plan for 2030. https://www.berec.europa.eu/en/document-categories/berec/others/berec-action-plan-for-2030

effect of slowing cloud adoption by European businesses, to the detriment of their productivity, competitiveness, and opportunities for cost savings.

AIIP proposes a set of measures to guarantee the European Union Digital Sovereignty as to cloud and edge computing such as (i) a clear regulatory framework aimed at ensuring interoperability, equal opportunities and the protection of investments in local physical infrastructures, (ii) large share of revenues accrued in European Union by cloud service providers (irrespective of their effective nationality) be reinvested in European (Cloud) Service Providers and, (iii) the policy to be followed should be similar to that already followed with respect to microchips, where the EU held pivotal that Europe had to be as much as possible autonomous from foreigner suppliers. In such a way the EU would also have a clearer outlook of the start-up active on AI and might define better support policies.

Respondent "Z" indicated that some cloud providers offer sovereignty controls and features to allow that its customers have complete control over their workloads including the location of their data, how it is secured and who has access it. Their technical controls are backed by a strong set of organisational and contractual guarantees that are designed to ensure customers always retain control. Further initiatives designed to help public sector organisations and customers in highly regulated industries meet their evolving sovereignty needs are also developed.

BEREC's response:

The EU's pursuit of digital sovereignty is a comprehensive strategy aimed at reducing reliance on non-EU technologies and services, thereby ensuring greater control over its digital infrastructure and data. This initiative is driven by the recognition that digital technologies are crucial for Europe's future in terms of innovation, competitiveness sustainability and national security contexts.

Key Components of the EU's Digital Sovereignty Strategy:

- **Digital Services and Markets Acts:** The EU has implemented the Digital Services Act (DSA) and the Digital Markets Act (DMA) to regulate large online platforms, ensuring they operate fairly and transparently within the EU. These regulations aim to curb the dominance of major tech companies and foster a more competitive digital market within Europe.
- **Investment in Digital Infrastructure:** The EU is investing heavily in its digital infrastructure, including cloud computing, artificial intelligence, and cybersecurity. The European Chips Act, for example, seeks to bolster Europe's semiconductor capabilities, reducing dependency on foreign chip manufacturers.
- **Development of European Cloud Services:** Initiatives like GAIA-X are focused on developing a federated data infrastructure to ensure European companies can securely store and manage their data within Europe, thereby reducing reliance on US cloud providers.

- **Cybersecurity Measures:** The EU Cybersecurity Strategy aims to strengthen the resilience of Europe's digital infrastructure against cyber threats. This includes the establishment of the EU Cyber Solidarity Act, which proposes measures to enhance collective cyber defence capabilities across Member States.
- **Digital skills and innovation:** The EU's Digital Compass outlines goals for 2030, emphasizing the need for digitally skilled citizens and professionals, innovative digital businesses, and digitalized public services. The aim is for 75% of EU enterprises to use cloud computing, big data and AI technologies and for 80% of citizens to utilize digital ID solutions.
- **Regulations and Standards:** The EU is setting high standards for data protection and privacy through regulations like the General Data Protection Regulation (GDPR) and the annulment of the Privacy Shield agreement, which restricts the transfer of European data to the US, thereby asserting greater control over data flows.
- **Challenges and Dependencies:** Despite these efforts, Europe still faces significant challenges, particularly its dependency on foreign technologies. For instance, many critical public services, like France's Health Data Hub, rely on non-EU cloud providers due to the lack of competitive European alternatives. This dependency highlights the need for continued investment and innovation within Europe to achieve true digital sovereignty.
- **Global Collaboration:** The EU is also forming strategic partnerships with other regions, such as the Digital Partnerships with India and Singapore, to enhance its technological capabilities and secure its position in the global digital economy.

Overall, the EU's push for digital sovereignty aims to create a more secure, independent, and innovative digital environment, enhancing Europe's competitiveness and protecting its digital infrastructure from external influences.

Along these lines, the EU is in the process of debating on EU digital sovereignty. This is reflected in the draft EC white paper on "How to master Europe's digital infrastructure needs?"[17] and in the Enrico Letta report "Much more than a market"[18] commissioned by the EU Council. The outcome of this political debate may lead to further action in this field that BEREC will follow and to which will contribute to in due time.

[17] https://digital-strategy.ec.europa.eu/en/library/white-paper-how-master-europes-digital-infrastructure-needs
[18] https://www.consilium.europa.eu/media/ny3j24sm/much-more-than-a-market-report-by-enrico-letta.pdf

ANNEX I. List of contributors to the public consultation

1. **AIIP** - Associazione Italiana Internet Provider
2. **CCIA** - Computer and Communications Industry Association
3. **CISPE** - Cloud Infrastructure Services Providers in Europe ASBL
4. **Disruptive Analysis**
5. **ECTA** - European Competitive Telecommunications Association
6. **GSMA/ETNO** - Joint response: Global System for Mobile Communications Association (GSMA) and European Telecommunications Network Operators' Association (ETNO)
7. **Google**
8. **ITI** - Information Technology Industry Council
9. **Microsoft**
10. **The Shift Project**
11. **WindTre**
12. **Respondent “X”**
13. **Respondent “Y”**
14. **Respondent “Z”**

ANNEX II. Acronyms

AI – Artificial Intelligence

AMF - Access Management Function

APIs - Application Programming Interfaces

CAPs – Content and Application Providers

CIS - Cloud Infrastructure and Services

CNF – Cloud-native Network Function

CU - Centralized Units CPaaS - Communication Platform as a Service

DDPP - Digital Decade Policy Programme

DU - Distributed Units ECN - Electronic Communication Networks

ECS - Electronic Communication Services

EECC - European Electronic Communications Code

EU – European Union

EUCS - EU Cybersecurity Certification Scheme for Cloud Services

E/WBI - East and Westbound interface

GDPR - General Data Protection Regulation

IPCEI - Important Project of Common European Interest

ISP - Internet Service Provider

ISVs- Independent Software Vendors

IT - Information Technology

ICS - Interpersonal Communication Services

ISVs- Independent Software Vendors

KPI - Key Performance Indicators

LMF - Location Management Function

MEC - Multi-Access Edge Computing

NaaS - Network as a Service

NB-ICS Number-Based Interpersonal Communication Services

NBI - Northbound Interface

NI-ICS Number-Independent Interpersonal Communication Services

NRA - National Regulatory Authority

NFV - Network Function Virtualisation

OIR - Open Internet Regulation

OT - Operational Tech

OTT - Over-The-Top

QoE - Quality of Experience

R&D- Research and Development

SBI - Southbound Interface

SDN - Software Defined Networking

SMP - Significant Market Power

SLA - Service Level Agreements

UCC - Unified Communications and Collaboration