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# Exploratory Consultation

# The future of the electronic communications sector and its infrastructure

Fields marked with * are mandatory.

## 1. Introduction

At a time when digital technologies play an increasingly prominent role in social, economic, and political life worldwide, Europe's digitalisation is essential for its prosperity, as long as it is human-centric and respects our common EU values and the rights, dignity and integrity of the individual.

Digital technologies can be used to deliver services to people and make the EU's economy greener, more resilient and more inclusive, leaving no one behind. Booming technologies like connected objects, upcoming innovations in Artificial Intelligence ("AI"), or high-performance computing mean that the digital transformation will play an even bigger role in the everyday lives of Europeans; and a bigger role in securing its competitiveness. This is why the EU needs performant, sustainable digital infrastructure, starting with reliable network connections.

A sustainable digital infrastructure for connectivity is critical to take advantage of the benefits of digitalisation, for further technological developments and for the Union's digital leadership and autonomy. Reliable, fast and secure connectivity is a must for everybody and everywhere in the Union, including in rural and remote areas. The "Digital Decade" vision launched by the European Commission in 2021[1] and enshrined in the Digital Decade Policy Programme[2] in December 2022, further highlights the importance of the connectivity infrastructure, and accordingly sets political targets for 2030.[3] Concretely, by 2030, networks with gigabit speeds should become available to those who need or wish to have such capacity.

Digital markets and, in particular connectivity markets, are also facing transformative technological and market developments in the form of e.g. cloudification of networks, transition to edge computing, requirements for operation in the metaverse, for AI, etc.

Moreover, they are not isolated from the challenging geopolitical and economic situation overall.

New generations of mobile communications will require massive investments in fibre and densification of antennas. New performance will enable critical use cases and the connection of objects. These developments will likely have a significant impact on the business model of providers of electronic communications networks (“ECNs”), as well as of other actors in the value chain. In light of this, it is important to broadly reflect on how to secure a resilient connectivity architecture based on a sustainable business model able to support our digital future in the EU.

Now is therefore a key moment to have a comprehensive look at the connectivity sector and investigate where it stands, and what would be the needs for the future. The European Commission therefore launches the present exploratory consultation on the vision for the future of the connectivity sector and of the connectivity infrastructure.

Pursuant to Better Regulation rules, an exploratory consultation is preliminary in nature, and targets those that may provide insights to determine if any problem exists and could be addressed by EU action, or sketch the potential scope of a genuinely new policy.

The consultation is available in English, French and German, and it is open for responses through the EUSurvey tool for 12 weeks.

The questionnaire of the present consultation is structured along four sections and each of the sections includes a short introductory explanation of its background and rationale:

- Technological and market developments: impacts on future networks and business models for electronic communications
- Fairness for consumers
- Barriers to the Single Market
- Fair contribution by all digital players

Questions can be left blank. However, in order to be able to see different perspectives **we welcome replies from all types and categories of respondents**, also on questions that might prima facie not fall in their remit or knowledge.

Please make sure to save a draft of the questionnaire regularly as you fill it in, and to submit the questionnaire ("submit" button at the very end) before the end of the consultation period.

You can download the questionnaire in PDF format before starting to help you with the

preparations or discussions within your organisation. You will be able to download an electronic copy of your replies.

If you have any questions or problems regarding this exploratory consultation, please contact CNECT-FUTURE_OF_CONNECTIVITY@ec.europa.eu.

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[1] Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions, "2030 Digital Compass: the European way for the Digital Decade", COM(2021) 118 final, 9.3.2021.

[2] Decision (EU) 2022/2481 of the European Parliament and of the Council of 14 December 2022 establishing the Digital Decade Policy Programme 2030 ("Digital Decade Policy Programme 2030"), OJ L 323, 19.12.2022, p. 4.

[3] See Art. 4 Digital Decade Policy Programme 2030.

## 2. Background

### 2.1 Technology and market situation and challenges

As the importance of connectivity increases, massive investments in network infrastructure are needed in order to accommodate and integrate new technologies while at the same time attending to growing redundancy and cybersecurity requirements. Deployments in 5G and 6G (i.e. TeraBit capacities and sub-millisecond latency, answering to future network requirements) and new generations of mobile communications will require massive investments in fibre and densification of antennas. An increase in traffic volume, with low latency requirement is reported and this trend is likely to continue in the future. In Europe, but also elsewhere, one can witness a very fast evolving market where new revolutionary digital developments are to be expected (e.g. metaverse, Web 3.0). Network virtualisation, software defined networks ("SDNs"), private networks, network slicing and network sharing become increasingly common and one can observe the convergence between connectivity, computing (high performance computing (HPC)), edge computing, AI and storage (edge clouds).

Moreover, there is a tendency to separate different market elements (delayering), e.g. fibre and wholesale-only operators, and tower companies; while hyperscalers are investing in their own cable infrastructure. As regards data traffic, one can observe developments such as compression techniques, which allow a more efficient data transmission, as well as the practice of certain content providers to bring their content closer to the end-user by way of own infrastructure or the use of Content Delivery Networks ("CDNs").

Internet value chain has become increasingly complex, e.g. where mobile network operators are starting to deploy edge cloud infrastructure and to partner with hyperscalers. Cloud providers are beginning to offer last-mile networks to industrial clients using private 5G mobile

networks. CDNs are increasingly integrated into cloud based “infrastructure/platform as a service”. Mobile network operators are no longer the only players partnering with vertical industries to set up 5G local networks: vendors and cloud operators are equally ready and well equipped to play a role in these new markets. One can witness the emergence of vertically integrated global companies (such as Google, Amazon or Apple who also deploy their own submarine cables or backhaul).

The market of connected devices and applications is evolving very fast, with new technological developments, such as augmented and immersive reality, blockchain, digital twins, and AI. In the longer term, interoperable internet applications are expected to create consistent perceptions: this vision (sometimes referred to as “metaverse”) represents a future transformative frontier of the digital environment. Also developments such as “softwarisation” and virtualisation of networks; cloud functionalities and AI, edge computing will lead to architectural changes in connectivity infrastructure.

2.2 Demand situation

Increasingly competitive and deregulated markets have over the last decades resulted in competitive and affordable prices and choices for European consumers. Broadband coverage of rural areas remains challenging (8.5% of households not covered by any fixed network). 4G is widely available also in rural areas while 5G coverage accounts for only 34.7% of populated rural areas.[4] End-users as well as businesses are however increasingly dependent on internet access (fixed and mobile) and on the services and content available through this access. This has also resulted in an observed increased demand for faster broadband connections. The changes arising from the current market and technological developments would likely affect all European consumers and end-users, including SMEs. Rising inflation and the significant increase in the cost of energy will likely result in higher costs for internet service and content providers, despite the shift to the more energy efficient technologies of fibre and 5G.

2.3 Investment situation

Massive investments in network infrastructure are still needed to achieve Europe’s Digital Decade goals. The latest estimates quantify the investment needs until 2030 at around EUR 174 billion.[5] Some European providers of electronic communication networks and services, especially incumbents, claim that they suffer from a decreasing market valuation and lower return on investment, especially when compared to companies in the US (including both over-the-top players (“OTTs”) and infrastructure operators). They also claim that their alleged declining margins and increasing costs would put their future network investments at risk as, due to the current uncertainties (high inflation, hikes in interest rates and geopolitical tensions), capital markets appear to be more prone to focus on assets with short-term returns

/profitability and to prefer solutions that protect them from demand risk.

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[4] Digital Economy and Society Index (DESI) – September 2022.

[5] This figure includes the coverage by 5G of major transport paths and does not take into account potential cost reduction thanks to the simultaneous deployment of fixed and mobile Gigabit networks. Source: “Investment and funding needs for the Digital Decade targets“ study, upcoming.

## 3. About you

* **Language of my contribution**

- (•) English
- ( ) French
- ( ) German

* **I am giving my contribution as**

- ( ) Academic/research institution
- ( ) Business association
- ( ) Company/business
- ( ) Consumer organisation
- ( ) EU citizen
- ( ) Non-EU citizen
- ( ) Non-governmental organisation (NGO)
- ( ) Public authority
- ( ) Trade union
- (•) Other

* Please, specify "Other"

*100 character(s) maximum*

European Union body

* **First name**

Grischa

* **Surname**

Hadjamu

* **Email** (this won't be published)

PM@berec.europa.eu

* **Organisation name**

*255 character(s) maximum*

Body of European Regulators for Electronic Communications (BEREC)

* **Organisation size**

- Micro (1 to 9 employees)
- Small (10 to 49 employees)
- Medium (50 to 249 employees)
- Large (250 or more)

* **Country of origin**

Please add your country of origin, or that of your organisation.

This list does not represent the official position of the European institutions with regard to the legal status or policy of the entities mentioned. It is a harmonisation of often divergent lists and practices.

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- AM - Armenia
- AU - Australia
- AT - Austria
- AZ - Azerbaijan
- BS - Bahamas
- BH - Bahrain
- BD - Bangladesh
- BB - Barbados
- BY - Belarus

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- GR - Greece
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- HN - Honduras
- HU - Hungary
- IS - Iceland
- IN - India
- ID - Indonesia
- IR - Iran
- IQ - Iraq
- IE - Ireland
- IL - Israel
- IT - Italy
- JM - Jamaica

- JP - Japan
- JO - Jordan
- KZ - Kazakhstan
- KE - Kenya
- KI - Kiribati
- KW - Kuwait
- KG - Kyrgyzstan
- LA - Laos
- LV - Latvia
- LB - Lebanon
- LS - Lesotho
- LR - Liberia
- LY - Libya
- LI - Liechtenstein
- LT - Lithuania
- LU - Luxembourg
- MG - Madagascar
- MW - Malawi
- MY - Malaysia
- MV - Maldives
- ML - Mali
- MT - Malta
- MH - Marshall Islands
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- MU - Mauritius
- MX - Mexico
- FM - Micronesia
- MC - Monaco
- MN - Mongolia
- ME - Montenegro
- MA - Morocco
- MZ - Mozambique
- MM - Myanmar
- NA - Namibia

- NR - Nauru
- NP - Nepal
- NL - Netherlands
- NZ - New Zealand
- NI - Nicaragua
- NE - Niger
- NG - Nigeria
- KP - North Korea
- MK - North Macedonia
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- OM - Oman
- PK - Pakistan
- PW - Palau
- PA - Panama
- PG - Papua New Guinea
- PY - Paraguay
- PE - Peru
- PH - Philippines
- PL - Poland
- PT - Portugal
- QA - Qatar
- MD - Republic of Moldova
- RO - Romania
- RU - Russian Federation
- RW - Rwanda
- KN - Saint Kitts and Nevis
- LC - Saint Lucia
- VC - Saint Vincent and the Grenadines
- WS - Samoa
- SM - San Marino
- ST - Sao Tome and Principe
- SA - Saudi Arabia
- SN - Senegal
- RS - Serbia

- SC - Seychelles
- SL - Sierra Leone
- SG - Singapore
- SK - Slovakia
- SI - Slovenia
- SB - Solomon Islands
- SO - Somalia
- ZA - South Africa
- KR - South Korea
- SS - South Sudan
- ES - Spain
- LK - Sri Lanka
- SD - Sudan
- SR - Suriname
- SE - Sweden
- CH - Switzerland
- SY - Syrian Arab Republic
- TJ - Tajikistan
- TZ - Tanzania
- TH - Thailand
- TL - Timor-Leste
- TG - Togo
- TO - Tonga
- TT - Trinidad and Tobago
- TN - Tunisia
- TR - Turkey
- TM - Turkmenistan
- TV - Tuvalu
- UG - Uganda
- UA - Ukraine
- AE - United Arab Emirates
- GB - United Kingdom
- US - United States of America
- UY - Uruguay

- UZ - Uzbekistan
- VU - Vanuatu
- VE - Venezuela
- VN - Viet Nam
- YE - Yemen
- ZM - Zambia
- ZW - Zimbabwe

The Commission will publish all contributions to this exploratory consultation. Your contribution will be published as submitted. If you consider that your replies to certain questions of the questionnaire are confidential, please mark those questions as confidential in the last "Confidentiality" section of the survey. Responses to questions marked as confidential will not be published.

If you include confidential information in any position paper or document uploaded to the questionnaire, please provide both a confidential and a non-confidential version. Information marked as confidential will not be published.

Access to such information is provided to the Commission staff on a ‘need to know’ basis. External contractors engaged by the Commission services may also have access to confidential data to the extent needed, and will be bound to confidentiality obligations pursuant to specific contractual obligations. Confidential data may also be shared with BEREC or the BEREC Office for the purposes of fulfilling their tasks provided the protection of confidentiality is ensured.

You can choose whether you or your organisation agrees to have your details published (on the Internet or in any other support) or to remain anonymous when your contribution is published.

If anonymity is requested, the requestor shall make sure that he/she is not identifiable either from any comments made in the reply or from any file attachment. Anonymity will also be ensured should the Commission engage an external contractor to process the information gathered during the consultation.

Please note that, for the purpose of transparency, the type of respondent (e.g., ‘business association, ‘consumer association’, ‘EU citizen’) and country of origin, will always be published.

Opt in to select the privacy option that best suits you. Privacy options default based on the type of respondent selected. More information on the processing of personal data is available here.

* **Contribution publication privacy settings**

- ○ **Public**

  Organisation details and respondent details are published: The type of respondent that you responded to this consultation as, the name of the organisation on whose behalf you reply as well as its size, its country of origin and your contribution will be published. Your name will also be published.

- ◉ **Anonymous**

  Only organisation details are published: The type of respondent that you responded to this consultation as, the name of the organisation on whose behalf you reply as well as its size, its country of origin and your contribution will be published as received. Your name will not be published. Please do not include any personal data in the contribution itself if you want to remain anonymous.

☑ I agree with the data protection provisions.

## Section 1. Technological and market developments: impacts on future networks and business models for electronic communications

New generations of mobile communications will require massive investments in fibre and densification of antennas. New performance will enable critical use cases and the connection of objects. The growing requirement for strategic autonomy, security and sovereignty regarding key enabling technologies in the electronic communications area will also have a significant impact on future developments. In particular, the EU's 5G security toolbox[6] puts forward measures including restrictions on high-risk suppliers, some of which are likely to be present in existing networks and may require replacement over time.

Moreover, it is to be recalled that environmentally, information and communications technologies are an important enabler of emission reductions for many sectors in the economy, while at the same time they themselves need to make an effort to reduce their environmental footprint.

It is expected that technology will evolve towards the disaggregation of software and hardware. This is likely to offer possibilities to reconfigure most electronic communications assets, hence leading to an optimisation of the value chain. In turn, hardware facilities will be subject to increasing network shared use between market actors, not only among electronic communications operators but also involving industry sectors. In particular, network slicing will

enable new market actors in the sector to operate virtual networks almost as they would operate a proprietary physical network. Overall this could lead to the future network architecture becoming more a platform type of architecture.

European critical entities are more interconnected and interdependent, which makes them stronger and more efficient but also more vulnerable in case of an incident. In this context, the Commission recently proposed a Council Recommendation on a coordinated approach by the Union to strengthen the resilience of critical infrastructure. Furthermore, to respond to the increased exposure to cyber threats due to the increasing degree of digitalisation and interconnectedness of our society and the rising number of cyber malicious activities at global level, the Commission proposed in 2020, a directive introducing updated rules on cybersecurity of network and information systems. The NIS 2 Directive[7] entered into force in January 2023. The increased cyber threat may nevertheless trigger additional needs and increased costs for strengthening the cybersecurity, and the resilience and redundancy of networks.

Network virtualisation and cloudification is expected to have a similar impact on the business model of providers of ECNs as cloud computing has produced on the IT sector, i.e. transforming a large proportion of incremental investment costs into linear operational expenses (shifting CAPEX to OPEX). In this new context, other (specialised) players are likely to concentrate on hardware infrastructure investments (similarly to cloud service platforms at the moment) while a wide diversity of other players, incumbents as well as many new entrants, are likely to address market needs in the upper layers: namely software development, virtual connectivity services, and the actual applications. Already now there are new types of operators and business models (e.g. wholesale-only, independent tower companies (“towercos”), infrastructure sharing, co-investment). New cooperation models or consolidation trends might emerge from business ecosystems. Existing providers of ECNs will likely need or want to adapt to the new paradigm, possibly not only as connectivity providers but also as infrastructure-as-a-service provider or even innovative software provider.

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[6] Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions of 29 January 2020 on Secure 5G deployment in the EU - Implementing the EU toolbox, COM(2020) 50 final, 29.1.2020.

[7] Directive (EU) 2022/2555 of the European Parliament and of the Council of 14 December 2022 on measures for a high common level of cybersecurity across the Union, amending Regulation (EU) No 910/2014 and Directive (EU) 2018/1972, and repealing Directive (EU) 2016/1148 (“NIS 2 Directive”), OJ L333, 27.12.2022, p. 80.

**Questions**

**1. Which technological developments do you expect will have the largest impact on the electronic communications sector in the next 10 years?** [We plan to report on the top 5 developments]

*Use drag&drop or the up/down buttons to change the order or accept the initial order.*

- Network virtualisation
- Open networks / network disaggregation and cloud RAN
- Edge cloud
- Artificial intelligence
- Terahertz communications (6G)
- Low orbit satellite communications
- Super precise geo-location
- Blockchain technology
- Quantum encryption
- Longer lasting battery technology
- Non cellular technologies[8]
- Other

Please specify “Other”

*100 character(s) maximum*

Please explain your answer

*1000 character(s) maximum*

10 years is a long span to predict technological developments as, for their ranking to be realistic, it needs to factor-in the different dynamics including socio-economic preferences and needs; competition (for example the content/application market, further impacts developments) and availability of connectivity for many of these technologies. In addition, interdependencies exist among these (e.g., edge and cloud computing are relevant enablers for AI solutions) or may partially overlap (e.g., cloud RAN may be envisaged as a form of network virtualization); serve different purposes or complement each other. Furthermore, their importance varies depending on the specific use case (e.g., while 6G is expected to facilitate enhanced QoS, LEO satellite communications is best suited to ensure full connectivity). At the same time, VHCN, and in particular fibre, are a necessary precondition of most technological developments to be implemented and further developed.

[8] Examples of cellular networks are the well-known 2G, 3G, 4G and 5G mobile communication networks. In addition to these networks, other, non-cellular ones, exist in which the service area is not divided in separate and distinct cells. Some examples of these technologies are Wi-Fi and DECT. These non-cellular technologies are already in use for IoT and M2M connectivity (for example LoRa and Sigfox technologies) and are expected to act as predominant enablers of IoT in the future.

**2. From a global/strategic perspective, which challenges and opportunities will these technological advances entail for the electronic communications sector?**

*1000 character(s) maximum*

**3. What are the most urgent problems to address in terms of unleashing the full technological potential of electronic communications and what (structural) impact will the future developments identified in Q.1 have on electronic communications networks? (e.g. on the type/quality of the connectivity, on the networks' architecture /functioning, on the provision model for connectivity, other)**

*1000 character(s) maximum*

**4. What impact will the future developments identified in Q.1 have on providers of ECNs or on other infrastructure investors? (e.g. role, business models, investment efforts, transformation/development opportunities)** [Multiple answers possible]

- ☐ Role
- ☐ Business models
- ☐ Investment efforts
- ☐ Transformation/development opportunities
- ☐ Other

Please explain your answer

*1000 character(s) maximum*

**5. What impact will the future developments identified in Q.1 have on digital/online players or on other industrial players? (e.g. role, business model, investment efforts, development opportunities, other)** [Multiple answers possible]

- ☐ Role

- [ ] Business models
- [ ] Investment efforts
- [ ] Transformation/development opportunities
- [ ] Other

Please explain your answer

*1000 character(s) maximum*

**6. What are your views with regard to the evolution of the energy consumption and the respective environmental footprint (notably CO2 emissions) of the main technological blocks of the future networks (copper, fibre, 5G, 6G, edge clouds, etc.), notably in terms of their operation?** [Substantiate your answer as much as possible.]

*1000 character(s) maximum*

**7. Digitalisation is an important enabler of green and sustainable ambition. The increased use of digital technologies is expected to reduce the environmental footprint of many sectors. At the same time, the expected increase in data traffic may increase the environmental footprint of electronic communications. In your view, what will be the overall impact on the environment?** [Only one option can be selected]

- ( ) Significantly positive
- ( ) Moderately positive
- ( ) Negative
- ( ) Significantly negative
- ( ) Do not know

Please explain your answer, and if possible, support your answer with concrete figures and/or measurements

*1000 character(s) maximum*

**8. How do you expect ECNs to evolve/transform in the next 10 years and how will this evolution affect your business?**

Please explain your answer

*1000 character(s) maximum*

It is difficult to be precise, but it is inevitable that ECNs will, indeed, evolve and, therefore, so too must BEREC. BEREC has recently published an Action Plan for 2030 to continue contributing to a regulatory environment in Europe 2030 that will be fit for the digital age and the global context under the light of the market and technological developments. It builds in five strategic orientations:
1. Fostering national and international connectivity to reach the objectives of Europe's Digital Decade by 2030.
2. Facilitating an open, sustainable internet ecosystem and supervising the evolution of the digital landscape.
3. Providing for the security and resilience of the networks and services.
4. Contributing to the achievement of environmental sustainability goals.
5. Strengthening BEREC's agility, independence, inclusiveness, and efficiency as a centre of expertise.
Within these five strategic orientations, a total of 14 BEREC long term strategic actions have been identified.

**9. What are in your view the key future market developments that are likely to significantly impact the electronic communications networks, their architecture and/or their function?** [We plan to report on the top 5 developments]

*Use drag&drop or the up/down buttons to change the order or accept the initial order.*

- Development of independent infrastructure management companies
- Emergence of virtually integrated network management entities (virtual network operators)
- Network slicing services
- Private local networks
- Other

Please specify "Other"

*100 character(s) maximum*

Please explain your answer

*1000 character(s) maximum*

All the above listed developments, some currently active at different stages, are relevant and have a clear impact on the architecture of the networks and their functions. They facilitate the efficiency of resources and ensure the independence of the access seeker from the infrastructure owner. They deliver higher QoS for end users and allow upgrading to future technologies. BEREC is currently working on the first topic of independent infrastructure companies. In addition to the above list, other key developments include: (i) the increasing interaction between the traditional electronic communications and the digital players and (ii) the intensive deployment of fiber (and the consequent copper switch off) and 5G, aiming to achieve VHCN rollout to serve the digital transformation. From the competition and regulatory perspective, most of these developments bring efficiency gains/cost savings but may also raise new questions to address.

**10. Are there major obstacles to establish standards in relation to network access protocols and application programme interfaces (APIs) in order to support new service models and/or new network architectures?**

- Yes
- No

Please explain your answer

*1000 character(s) maximum*

**11. What additional needs compared to today's baseline do you expect will be needed for strengthening cybersecurity / network resilience and the related expected costs (e.g. in terms of CAPEX, other) for the next five years, including as regards replacement of high-risk vendors?** [Fill in the table and substantiate your answer as much as possible.]

| | Description of additional needs | Expected costs in EUR million for next 10 years |
|---|---|---|
| 1 | | |
| 2 | | |
| 3 | | |
| 4 | | |
| 5 | | |

Please explain your answer

*1000 character(s) maximum*

In the last four years the regulatory framework for cybersecurity has undergone a dramatic change, introducing several new obligations, initially guidelines but have since become largely mandatory. As such, BEREC expects significant investments in cybersecurity by the telecom industry. While technological advancements enable new services, they also increase the possibility for cyber-attacks, presenting new challenges. As a result, some market players in the EU markets struggle to maintain a competitive edge, as cybersecurity experts are scarce and expensive, and equipment choices are limited, leading to higher costs, which are compounded by the ongoing energy crisis. BEREC is closely monitoring markets to identify negative trends that could harm competition as early as possible. It is difficult to determine the precise amount that an average EU operator will need to spend on security measures, which may vary across member states but it is expected that the costs will be significant.

**12. What are the strengths, weaknesses, opportunities, and threats ("SWOT") for the providers of electronic communications networks that shape their current and future operations?**

Please describe Strengths, and explain your answer

*1000 character(s) maximum*

Please describe Weaknesses, and explain your answer

*1000 character(s) maximum*

Please describe Opportunities, and explain your answer

*1000 character(s) maximum*

Please describe Threats, and explain your answer

*1000 character(s) maximum*

**13. How could providers of electronic communications networks best adjust to the on-going and future technological and market changes and be able to better compete globally and attract investors?** [We plan to report on the top 5 developments]

*Use drag&drop or the up/down buttons to change the order or accept the initial order.*

- By delayering / asset reorganisation
- By entering new segments across the internet value chain
- By entering into cooperation/partnerships with actors from other segments of the internet value chain
- By network sharing
- By implementing innovative changes to the networks architecture or function
- No structural change required
- Other

Please specify "Other"

*100 character(s) maximum*

Please explain your answer

*1000 character(s) maximum*

Although this question is focused on the industry, BEREC holds that continuous development and competition in the sector enforce innovation, adoption of the digital transformation and technology solutions, and efficiency. The adjustment has to consider inter alia both current global positions and local characteristics. The below items may be identified as possible strategies for different challenges:
- Operating efficient, scalable and resilient networks with appropriate business models. Asset reorganization and network sharing may be seen as strategic moves.
- Entering new segments or cooperation across the internet value chain, plus increasing control over the final service provided. Operators may target new areas individually or through partnerships, using their position in the value chain and/or technological development.
- New connectivity network solutions may introduce new digital network services and build new revenue streams, leading to growth, innovation and profitability

**14. What would be the barriers to achieve the needed transformations [Use the number scale to select the level for each option]**

Legal /administrative

Economic

Technological

Lack of R&D

Other

Please specify "Other"

*100 character(s) maximum*

Please explain your answer, in particular specifying how significant the barrier would be in your view

*1000 character(s) maximum*

While there are no perceivable barriers for operators to be able to transform their business models to ensure their future competitiveness, significant investments are needed to fulfil the deployment objectives, competition being the key driver to investment. In certain areas, the lack of demand or of a business case for the networks' rollout may call for specific regulatory measures. Overall, the EU has registered concrete progress towards harmonization and a deepening of the process is expected in future. BEREC has a recognized role in helping authorities in setting a coherent and efficient level playing field for the actors of the telecom markets in Europe. Practically, there is a balance to keep between the benefits of more harmonization (and the achievement of the EU agenda goals) and the costs associated with imposing the same approach when national specificities exist and need to be accounted for.

**15. What would be the expected yearly investment required to achieve the needed transformation of your company over the next five years? (In EUR million, and in % as percentage to the company yearly revenue).**

% of yearly investment required relative to company yearly revenue

Average yearly investment required in EUR million

Please explain your answer

*1000 character(s) maximum*

**16. In your view, in which areas will investments be most required to achieve the needed transformation? Please quantify, where possible, the investment in each area [Use the number scale to select the level for each option]**

Connectivity infrastructure

Edge cloud

Cybersecurity

Network management

Other

Please specify "Other"

*100 character(s) maximum*

Connectivity infrastructure investment required in EUR million

Edge cloud investment required in EUR million

Cybersecurity investment required in EUR million

Network management investment required in EUR million

Other (as specified above) investment required in EUR million

Please explain your answer

*1000 character(s) maximum*

BEREC points out that while connectivity infrastructure is expected to require the largest investment in the future, especially as regards access, such investments-to-date did not result in a radical transformation of the ECNs position into the ecosystem. Investing in services-based R&D on existing and upcoming technologies (SA5G, Cloud, EDGE, AI, private networks) may help ECNs to grow revenues and consolidate positions. On the operation of future-fit networks exploiting new functions and architectures (through delayering, international networks, etc.), new network management initiatives will also need investments (cybersecurity, softwarisation of the network, AI/ML network).

**17. What will be the sources of revenues of the electronic communications sector and the ways to monetise the investments in business transformation over the next 10 years?**

Please explain your answer

*1000 character(s) maximum*

BEREC is of the view that retail revenues from residential and business services (fixed and mobile internet access, voice services, TV, leased lines, etc.) will continue to be an important source of revenue in the electronic communications sector in the coming years. In particular, business services may provide an increased potential as digitalization of businesses is progressing and new networks offer wider possibilities of tailored connectivity services. Providers of NI-ICS may increasingly monetize their activities e.g. based on advertising and/or subscription fees, as well as data. Digital and IT services could also be a relevant source of revenue in the future if operators manage to succeed in their business cases in services such as cloud, data-based and/or online advertising.

**18. Which cooperation models would you expect to see emerging or growing the most in the next 10 years?**

*Use drag&drop or the up/down buttons to change the order or accept the initial order.*

- Network sharing
- Co-investment
- Cooperation with towercos
- Cooperation with vertical industries
- Cooperation with online players

Cooperation with neutral hosts

Mergers & acquisitions

Other

Please specify "Other"

*100 character(s) maximum*

Please explain your answer, and describe what would be the challenges of these cooperation models?

*1000 character(s) maximum*

The cooperation models mentioned are all important, being (mainly) related to infrastructure cooperation to various extents. Network sharing, co-investments, cooperation with towercos and/or online players are already in the market and their expansion is expected. On the contrary the cooperation with vertical industries and neutral hosts is at its early stages and more dependent on the massive deployment of VHCN. M&A is a trend towards consolidation that is taking place at a relatively moderate step in Europe and which BEREC has studied. BEREC advises for a case-by-case scrutiny given the importance of the details of the cooperation agreements. While the EECC allows for the non-imposition of SMP regulation in certain cases, network sharing and co-investments may be challenging when it comes to supervising and tackling the deviation from the approved agreements. M&A may impose challenges if they result in the reduction of the number of relevant competitors and/or create market barriers.

**19. What funding mechanisms do you foresee as being currently able to finance the needed extra investments?**

Please explain your answer

*1000 character(s) maximum*

ECN/S providers are already investing in network upgrades (competition as a key driver) for several years and those are, in general, profitable. The necessary investments could be financed from ongoing retail and wholesale revenues (section 5 of BEREC preliminary assessment of the underlying assumptions of payments from large CAPs to ISPs BoR(22)137). Apart from the Gigabit connectivity targets, NRAs should pursue efficient and sustainable promotion of competition, incl. infrastructure-based, by addressing the existence of SMP in certain markets. BEREC believes that revenues from residential and business ECN/S will continue to be an important source of financing for future investments, especially as higher quality services may be sold (at least temporarily) at higher prices. If the network roll-out to certain (e.g. rural) locations is not profitable e.g. due to high costs and low economies of scale, this may be addressed e.g. with state aid schemes, which could be financed differently.

**20. Do you expect vertical industries to contribute significantly to investments in new digital infrastructures (e.g. for automated driving, manufacturing & logistics, health applications)? If so, please describe how this may develop in terms of business /cooperation models. Mention also any obstacles that may exist to the development of such forms of raising financing, and how they could be resolved.**

- Yes
- No

Please explain your answer

*1000 character(s) maximum*

Different developments are possible. Verticals could use telcos' networks and may demand services with a particularly high quality. Quite generally, the more efficient use of the limited resources (such as spectrum), the higher the quality of the services delivered. At the same time, the telcos may need to charge verticals for the provision of higher quality services or innovative ad hoc services. To some extent, vertical industries may also develop infrastructures themselves, in particular in cases where only regional/local coverage is needed (e.g. campus networks), but they are not expected to deploy networks at national scale. In any event, the interplay between traditional telcos and vertical industries will become closer, with their interdependencies (including from the financial standpoint) growing. As of now, BEREC cannot pronounce itself on the extent of the future significance of these investments.

## Section 2. Fairness for consumers

Under the current regulatory framework for electronic communications, the universal service rules ensure that the public sector provides a safety net, set at the Union level, to ensure that at least the minimum electronic communications services (broadband internet access and voice communications) are available to all consumers and at an affordable price. Member States can fund these "**universal service obligations**" using public funds or by setting up a sharing mechanism between providers of electronic communications.

Universal service focuses on the **affordability** to consumers with low income or special social needs. The current rules require Member States to ensure that consumers have access at an affordable price to an available adequate broadband internet access service at a fixed location. Affordability is ensured with support to consumers or with special tariff options or packages. The adequate broadband has been defined in different Member States to correspond to different bandwidths currently up to 30 Mbps for download.

To ensure general coverage, the market has a leading role to play in ensuring the **availability** of broadband. In areas where the market would not deliver, there are Union and national funds available. Universal service is used for the availability of a connection only where neither the market nor public funds have provided a connection and following an end-user

request.

According to the 2022 Digital Economy and Society Index ("DESI") report,[9] at least one broadband internet access network is **available** to all households in the EU when considering all major technologies. Coverage of next generation access ("NGA") technologies capable of delivering download speeds of at least 30 Mbps reached 90% in 2021. Fixed very high capacity networks covered 70% of EU homes in 2021. Mobile 4G coverage of populated areas reached 99.8%. Broadband coverage of rural areas remains challenging as 8.5% of households are not covered by any fixed network. The **take-up** of fixed broadband was 78% of EU households in 2021. In 2021, 87% of people used a mobile device to access the internet.

However, some consumers, in particular persons with disabilities, still face barriers to access those networks and technological developments on equal basis with others.
In relation to **affordability**, at EU level, retail prices of fixed and mobile broadband offers became cheaper than previous year among all household baskets in 2021 [10] in each usage /speed category. The price decreases varied between different baskets from around 6.4% to over 13%.

The availability and affordability of broadband to European consumers benefit a wide range of players, including providers of online content, applications and services that also benefit from the opportunities and increased demand.

However, the current economic conjuncture, the rising inflation and cost of energy for the businesses, and some of the technological and market developments indicated in the previous section are likely to lead to upwards pressure on costs for consumers at least in the short term.

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[9] Available at https://digital-strategy.ec.europa.eu/en/policies/desi.

[10] See, the 2022 Digital Economy and Society Index, Connectivity study, "Mobile and Fixed Broadband Prices in Europe 2021", available at https://digital-strategy.ec.europa.eu/en/library/mobile-and-fixed-broadband-prices-europe-2021.

**Questions**

**21. In your opinion and considering the overall economic context, is the access to broadband at an affordable price for consumers likely to evolve in the next 10 years?**

| | Price | Likely to increase | Likely to remain the same | Likely to decrease | Do not know |
|---|---|---|---|---|---|
| Broadband speed up to 30 Mbps | | | | | |
| Broadband speed between 30 and 100 Mbps | | | | | |
| Broadband speed 1Gbps or above | | | | | |

Please explain your answer

*1000 character(s) maximum*

**22. In your view, has the universal service regime been an efficient and effective tool in protecting consumers with low income or special social needs?** [Only one option can be selected]

- ○ Significantly
- ◉ Moderately
- ○ Little
- ○ Not at all
- ○ Do not know

Please explain your answer

*1000 character(s) maximum*

The protection of consumers with low income or special social needs and ensuring their access to adequate broadband is essential for Member States in the context of the universal service obligation (USO). However, the implementation of USO differs; some Member States have not imposed obligations at all, while others have imposed the obligation of special tariffs on many providers or to a specific provider. Many consumers with low income or special social needs benefit from these special rates that would be unaffordable otherwise (i.e. access with standard retail prices). Considering that the list of beneficiaries could be extended (e.g. to inhabitants of territories with low density, inhabitants with less demand for high bandwidths, people on the verge of poverty but, who exceed the criteria for low income, etc.), the affordability measures stemming from the USO are essential for the protection of these user groups.

**23. In your view, has the universal service regime been an efficient and effective tool to ensure equal access for persons with disabilities, including access to assistive equipment?** [Only one option can be selected]

- ○ Significantly
- ◉ Moderately
- ○ Little
- ○ Not at all
- ○ Do not know

Please explain your answer

*1000 character(s) maximum*

The access to assistive equipment is essential for persons with disabilities. However, the efficiency of these provisions towards ensuring equal access for persons with disabilities should be assessed together with other non-universal service-related provisions of the EECC (such as Art. 111 – Equivalent access and choice for end-users with disabilities). Furthermore, measures regarding effective access to electronic communications services for persons with disabilities are also provided by the European Accessibility Act (Directive (EU) 2019/882). Therefore, electronic communications services, including universal services, can be seen as a significant and effective complementary tool together with other related provisions in both the EECC and in the European Accessibility Act in facilitating the access of end users with disabilities and their efficacy towards equal access.

**24. In your view, does the universal service regime answer the future connectivity needs that should be ensured for all consumers?** [Only one option can be selected]

- (●) Yes
- ( ) No
- ( ) Do not know

Please explain your answer. In case of a negative reply, please indicate which are are the possible shortcomings of the universal service regime.

*1000 character(s) maximum*

The definition of adequate broadband access varies between MS based, among others, on the capabilities of the access network infrastructure deployed and the related costs. This minimum bandwidth in speeds is much lower than required for closing the digital divide, particularly in the rural, remote, or underserved areas. The definition of adequate broadband access must be revised periodically, taking into account the evolution of broadband access speeds provided under commercial conditions and market specificities in each MS. In addition, the US regime's importance should also be considered in addressing the affordability concerns. The US should be maintained as a basic safety net and thus as a complementary tool to affordable broadband access development. It should not be mixed or confused with instruments intended to facilitate network investments to achieve future connectivity ambitions, in order to avoid potential distortion in the competitive conditions in the market.

**25. In your view, what do the expected market and technological developments described in Section 1 mean for the universal service regime?** [Only one option can be selected]

- (●) The current universal service regime should be maintained
- ( ) The universal service regime should evolve
- ( ) The universal service regime will not be needed
- ( ) Do not know

Please explain your response. In case of a positive reply, please indicate why the universal service should be maintained or in what ways the universal service regime should evolve? (e. g. its scope, its purpose, the contributors to its financing, the users that benefit from it, etc.)

*1000 character(s) maximum*

In some Member States (MS) universal service is not considered necessary to ensure affordable and adequate access to consumers and, therefore, not currently applied nor have the MS plans to do so in the future. In other Member States, the universal service regime remains important for consumers since, due to geographical characteristics, network deployment status etc., there are significant difficulties for end users in remote areas to connect to an adequate broadband connection at an affordable price. Based on the above, the universal service regime should be maintained to cover the needs in the relevant cases The current US regime provides for a dynamic evolution of the adequate access in light of national conditions and the minimum bandwidth enjoyed by the majority of consumers within a MS. Since the needs and the technological/social developments may differ from one Member State to another, it is important the flexibility remains with the Member States.

**26. The current source for financing the universal service in electronic communications is public general budget and/or financing from providers of electronic communications networks and services. What should be in your view the appropriate way for financing the universal service in electronic communications in the next 10 years?** [Multiple options can be selected]

- [x] Public general budget (as currently)
- [x] Providers of electronic communications networks and services (as currently)
- [ ] Widen the range of providers to include online digital players or data generators that benefit from connectivity or only a set of them
- [ ] Other ways of financing

Please explain your answer

*1000 character(s) maximum*

BEREC considers that the two first options are appropriate to finance universal service (US) in the present moment, taking into account that USO serves both the public interest and the interests of electronic communications providers. These mechanisms ensure sufficient flexibility for Member States (MS), considering the specificities of their national markets. In addition, they allow MS to define the most suitable mechanisms, considering the principle of subsidiarity. Notwithstanding, and taking into account the long period referred to in the questionnaire and that the current scope of US brings benefits not only to the electronic communications sector but also to the wider online economy and to society as a whole (recital 242, European Electronic Communications Code), BEREC does not discard a possible future re-evaluation considering the dynamics of the economy and the iterative externalities among the different players in the Internet ecosystem.

**28. Outside universal service, could other means of support to consumers to ensure their affordable access to broadband be envisaged?** [Only one option can be selected]

- (•) Yes
- ( ) No
- ( ) No opinion

Please explain your answer; if you reply yes, please explain which other means of support could be envisaged.

*1000 character(s) maximum*

There are various tools that directly or indirectly ensure affordable broadband access. Symmetric and asymmetric regulatory measures assist the reach of affordable access to broadband. Union investments, such as Recovery and Resilience Facility or Cohesion Funds, etc., play an important role in the affordability and availability of broadband. State aid for broadband networks in areas that would not be economical or very expensive to reduce roll-out costs assists for this goal as well. More innovative funding models could be implemented to roll out broadband infrastructure in areas with low return of investments, including: co-investment models between operators and investment funds; municipal financing models, social or connectivity vouchers, and pooled financing (individual projects aimed at bridging the digital divide in a specific unserved area are usually under the minimum funding threshold that lenders provide).

**29. Would a dedicated EU-wide fund be useful?** [Only one option can be selected]

- Yes, it would be useful for support to ensure that consumers have affordable access to broadband in general
- Yes, it would be useful for support to ensure that consumers have affordable access to broadband only in specific crisis circumstances to address acute but temporary difficulties
- Yes, it would be useful for network deployment, especially in rural areas
- No, it would not be useful

Please explain your answer; If you reply yes, please explain whether a distinction should be made between all consumers and those with low income or special social needs.

*1000 character(s) maximum*

This is a complex matter that has pros and cons and requires careful assessment, as it strongly depends on how the tool is designed, the way the funds are distributed, how it would interact with national US support and how it is adapted to the national circumstances and needs. However, if a specific EU-wide fund is suggested in the future, it would have to be assessed in detail. Such a tool should be transparent and proportionate, considering the diversity of Member States and differences in national markets. Criteria for beneficiaries of such fund should be clearly defined, and there would be no restrictions due to size of the stakeholder or market share in order to ensure equal possibilities to deploy broadband in uncovered territories.

**31. From an affordability perspective, what is your view regarding the retail price cap on intra-EU communications (i.e. EUR 0.19 per minute for calls and EUR 0.06 per SMS message, both excluding VAT) introduced by an amendment to the Open Internet Regulation, and which is set to expire on 14 May 2024?**

- No need for retail price regulation in the future
- The current retail price regulation should be extended for some years
- The current retail price regulation should be maintained and adjusted

Other

* Please specify “Other”

*100 character(s) maximum*

BEREC published its opinion on Intra-EU communications regulation in March 2023 (BoR (23) 44).

Please explain your answer

*1000 character(s) maximum*

BEREC assessed the market developments and impact of the regulation during 2019-2022. The analysis was based on data and input gathered from stakeholders as well as other surveys and concluded that:

- the price caps did not significantly impact the intra-EU communications volumes or the number of consumers using these services
- end-users have shown steadily an increasing usage of free NI-ICS services as a means to communicate. However, while the overall use of traditional voice/SMS services is declining, they are still popular among those aged 55 or above
- the difference between intra-EU communications and international roaming services offered under RLAH regime should be made clearer
- for voice services there is a significant margin between the current price cap and the estimated costs
- unregulated transit and SMS termination costs might raise challenges for some operators if decreasing the caps.

## Section 3. Barriers to the Single Market

Regulatory intervention has so far been quite successful in lifting barriers to market entry in electronic communications fixed networks. The emergence of competition after regulatory intervention made it possible to reduce the number of markets that national regulators need to assess ex-ante from 18 retail and wholesale markets in the 2003 Recommendation to two fixed wholesale markets currently identified in the 2020 Recommendation. Still, some barriers persist in the fixed markets. As regards mobile markets, the ex-ante regulation of termination markets is no longer recommended due to the introduction of single Union-wide termination rates.

Looking at on-going and future developments, such as, Machine to Machine services, internet of things (IoT) deployment, virtualisation of networks, etc., the case for a full integration of the single market for electronic communications appears to be stronger. However, despite the Commission’s aim to promote the EU single market, EU electronic communications markets remain essentially national, which prevents certain economies of scale from being achieved.

Roaming policy, an important step in lowering barriers to the EU single market, reflects the existence of separate national markets by allowing “roam like at home” to address periodic travel needs. The Roaming Regulation provides for safeguards to prevent abusive or anomalous use of roaming services abroad at domestic prices (such as permanent roaming);

this is because, in the absence of a full integrated telecoms single market, such practices might put at risk the financial sustainability of such calls.

In addition, radio spectrum policy is a key element to boost EU competitiveness and innovation. Without pre-empting the need for a thorough analysis of the radio spectrum market in the EU, the question emerges to what extent the potential development of a more coherent radio spectrum market in the EU as opposed to the current fragmented national radio spectrum management practices (including e.g. concerning satellite communications and vertical use cases), can lead to more favourable investment conditions. Furthermore, in the context of a challenging geopolitical climate, the question arises whether it is necessary to update the existing spectrum governance framework so as to strengthen the EU strategic autonomy and reduce precarious dependencies.

## Questions

**32. What future developments in terms of technological developments, new applications, network architecture or functioning (or other) could further promote the development of the digital single market?**

*1000 character(s) maximum*

**33. In your view, are there obstacles to the full integration of the single market for electronic communications? If so, please explain what, from your point of view those obstacles are (do they relate to the rules governing the general authorisation, the application of the country of origin/country of destination principle with respect to supervisory rules, the bodies in charge of monitoring and enforcement, etc.)? If you consider no obstacles to the full integration of the single market exist, what would be in your view the reasons why providers of ECNs generally do not offer their services EU-wide?**

*1000 character(s) maximum*

BEREC does not consider the EU general authorisation (GA) regime presents an obstacle to the pursuit of the single market for electronic communications. The EECC has further strengthened harmonisation measures, defining an exhaustive list of information to be submitted by providers, which is complemented by BEREC guidelines on the notification template. As BEREC previously highlighted, electronic communications markets by nature do not have a prevalent cross-border dimension, as network structure and consumption models are intrinsically local and differ substantially from one MS to another. While the Country of Destination (CoD) approach is appropriate for traditional ECN/ECS providers BEREC also deems it appropriate that the EU legislation under which online digital platforms services are supervised, provides adaptations of the current CoO principle, which would allow NRAs to monitor services provided to end users in each own MS and enforce relevant rules.

**34. Are there identifiable/expected cost savings or other efficiencies that could arise from the EU-wide deployment of infrastructure and/or provision of services by providers of ECNs? If so, please describe the type/category of cost savings (e.g. in terms of network management, service provision, regulatory cost savings, administrative burdens, etc.).**

[Fill in the table and substantiate your answer as much as possible.]

| Type/category of cost savings | Expected cost savings in EUR million for the next 10 years |
|---|---|
| Network management | |
| Service provision | |
| Regulatory | |
| Administrative burdens | |

Provide further responses if necessary

| | Type/category of cost savings | Expected cost savings in EUR million for the next 10 years |
|---|---|---|
| 1 | | |
| 2 | | |
| 3 | | |
| 4 | | |

Please explain your answer and provide a quantification, if possible.

*1000 character(s) maximum*

While some costs may be reduced if synergies are determined by a wider-than-national scale of deployment, there is no evidence that EU-wide rollout would generate any significant cost savings. They will continue to require local civil works which constitute by far the majority of rollout related costs. Competitive fibre-deployment by local and regional operators has showed that economies of scale could be achieved at subnational level. The operation of Gigabit networks is likely to result in long term cost savings as compared to NGA networks, independent of the deployment scale. Likewise, there is no evidence that the costs of mobile networks would significantly decrease if roll-out is cross-border. The costs of mobile networks are largely driven by (i) spectrum, which is assigned in competitive auctions and (ii) backhaul and base stations, which cannot be reduced by enlarging a networks footprint beyond national borders, whereas economies of scale can be achieved on a national level.

**35. In your view, do obstacles exist to cross-border consolidation of electronic communications providers in the EU? If you consider that obstacles exist, please describe the type/category of obstacles and indicate what steps/actions could be taken to remove these. What opportunities for cost savings could result from cross-border consolidation if those obstacles were removed?**

*1000 character(s) maximum*

No significant barriers to cross-border consolidation exist. This is evidenced by the past cross-border M&A activity and by operators providing services on a larger-than-national scale, operating under ‘umbrella’ groups and complying with regulations of the countries where present. Besides, all NRAs operate under the same European legal framework and BEREC plays a very important role in harmonising practices. The SMP regulation, together with the symmetric regulation of the access to physical infrastructure, has also been crucial in promoting competitiveness and removing obstacles. Regarding spectrum, it is uncertain whether some specialised services require a higher degree of harmonisation or on the contrary, depend on the (national) particularities. Therefore, BEREC does not see any need for removal of obstacles. Furthermore, consolidation requires careful observation in case of any negative impact on competition in all MS.

**36. In your view, could there be benefits from a (more) integrated radio spectrum market in the EU? If yes, please explain what those benefits would be and, as far as possible, quantify those benefits. What steps/actions could be taken to promote a more integrated radio spectrum market in the EU?**

*1000 character(s) maximum*

Spectrum is a scarce resource and a public good and, as such there is no market for spectrum. Radio spectrum integration, which could improve current market opportunities, can be supported through existing tools, by promoting co-operation and information exchange; Articles 53 and 54 of the EECC provide for coordinated timing of assignments; Article 28.5 provides for Union support in cross border interference cases, at the request of the Member State (MS); Article 35 provides for the sharing of best practices between competent authorities and participation by BEREC experts. BEREC also supports improved communication between all stakeholders, including intra-directorate at the EU Commission, MS representatives and NRAs, to help enshrine service and technology neutral policies. More EU-wide spectrum initiatives may, however, increase uncertainty and unpredictability by underserving the needs smaller operators, which compete at national and sub-national markets.

**37. In your view and without prejudging any policy direction, what would be the added value, risk and cost of implementing a common EU-level licensing/authorisation scheme for spectrum use in well justified cases (e.g. cross-border reach of infrastructure/service, significant added value of an EU joint authorisation scheme compared to individual Member State authorisations)? Please indicate the areas in which such a scheme would be most useful (e.g. in cases of satellite communications and/or vertical use cases).**

*1000 character(s) maximum*

Efficient award procedures are based on objectives and market circumstances, which vary across MS because of different market structures and conditions (competition, market demand, coverage, topological conditions, etc.). Moreover, an EU-level award procedure for terrestrial mobile ECNs, including vertical use cases, that seeks to take all national circumstances into account might result in overly complex procedures, which may not be efficiently managed by operators or administered. Technical harmonisation is key for the efficient use of spectrum and any purported benefits of an EU-level award procedure should meet the needs of all MS rather than the needs of a few and also not be to the detriment of equitable access to radio spectrum at the national level. Therefore, at this time, an indication of the areas in which such a scheme would be most useful cannot be easily provided. The examples mentioned in the question require supporting data, careful consideration and consultation.

**38. Do you consider the participation of non-EU countries or entities in technical preparatory work for EU decisions on spectrum harmonisation or international negotiation matters on spectrum (such as e.g. within the European Conference of Postal and Telecommunications Administrations (CEPT)) as a potential issue of concern for EU sovereignty, resilience or security? If yes, to what extent is it a concern? Please indicate what institutional structures or mechanisms would be best suited to allow the EU to monitor spectrum policy matters in international organisations, and to undertake the technical preparations concerning the Union's decision-making process including before and during international negotiations concerning spectrum policy matters?**

*1000 character(s) maximum*

In the field of electronic communications networks and services, BEREC supports initiatives aimed at ensuring the widest possible exchanges at technical and expert level, as this can maximise technical discussions improving outcomes overall.

In this aspect, BEREC holds technology and service neutrality in the highest regard and remains an independent source of technical expertise. In addition, BEREC welcomes that the European Union is a full Sector Members to all of ITU's three Sectors, allowing it to monitor spectrum policy matters in relevant international organisations.

**39. In your view, what would be the added value, risk and cost of addressing cases of radio frequency interference in EU Member States from third countries (notably those that may potentially have serious effects on more than one Member State) only at EU level (i.e. whereby the EU acts in unity) instead of at the level of each affected Member State (acting individually)?**

*1000 character(s) maximum*

BEREC does not have the relevant data to consider this question. BEREC supports the efficient use of radio spectrum, and the initiatives undertaken at policy level by the RSPG to address cross border coordination concerns, seem valuable to Europe.

It should also be noted that EECC Article 28.5 already provides the framework for the Union support, i.e.

"the Union shall, upon the request of any affected Member State, provide legal, political and technical support to resolve radio spectrum coordination issues with countries neighbouring the Union, including candidate and acceding countries, in such a way that the Member States concerned can observe their obligations under Union law. In the provision of such assistance, the Union shall promote the implementation of Union policies"

BEREC assumes that the principle that EC support is based on the request of the MS, shall remain.

## Section 4. Fair contribution by all digital players

The amount of data exchanged – and harvested – is larger than ever and will increase, as the global consumer internet traffic has grown with 34.4 % CAGR since 2015.[11] The metaverses and virtual worlds, the rapid move towards cloud, the use of innovative technologies online are making this even more evident. However, there also seems to be a paradox between increasing volumes of data on the infrastructures and alleged decreasing returns and appetite to invest in network infrastructure. Some electronic communications operators, notably the incumbents, call for the need to establish rules to oblige those content and application providers ("CAPs") or digital players in general who generate enormous volumes of traffic to contribute to the electronic communications network deployment costs. In their view, such contribution would be "fair" as those CAPs and digital players would take advantage of the high-quality networks but would not bear the cost of their roll-out.

Conversely, CAPs and other digital players argue that any payments for accessing networks to deliver content or for the amount of traffic transmitted would not only be unjustified, as the traffic is requested by end-users and costs are not necessarily traffic sensitive (notably in fixed networks), but would also endanger the way the internet works and likely breach net neutrality rules.

Other stakeholders caution against rushed regulatory intervention. Some stakeholders argue that an accurate management of data traffic could have a positive impact on the environmental footprint of data traffic. This discussion has to be seen also in light of the European Declaration on Digital Rights and Principles,[12] which includes a statement according to which all market actors benefiting from the digital transformation should assume their social responsibilities and make a fair and proportionate contribution to the costs of public goods, services and infrastructures, for the benefit of all people living in the EU. In the European Declaration on Digital Rights and Principles, emphasis is also put on the protection of a neutral and open internet where content, services, and applications are not unjustifiably blocked or degraded, which is already enshrined in the Open Internet Access Regulation.

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[11] GSMA: The Internet Value Chain 2022 – May 2022.

[12] Chapter II, 2(c) of the European Declaration on Digital Rights and Principles for the Digital Decade, available online at: https://ec.europa.eu/newsroom/dae/redirection/document/92399.

**Questions**

**40. Quantify (in EUR million), as in the format below, your direct investments in network infrastructure and/or other digital infrastructure capable of optimizing network traffic within or relevant for the EU Member States for every year between 2017 and 2021. Please provide separate figures for each infrastructure category, both in absolute terms and as percentage of the revenues generated within the EU each year (here "network infrastructure" is to be understood in broad terms, e.g. at several different network layers, core, distribution and access network, including even undersea cables; "other digital infrastructure" is also to be interpreted broadly, e.g. hosting, data transport, data centres, CDNs, etc.)**

Please provide estimates for every year between 2017 and 2021.

| | Specify other network /digital infrastructure you provide data for | 2017 | 2018 | 2019 | 2020 | 2021 |
|---|---|---|---|---|---|---|
| Core network | | | | | | |
| Distribution network | | | | | | |
| Access network | | | | | | |
| Undersea cables | | | | | | |
| Other network infrastructure (please specify) | | | | | | |
| Other network infrastructure (please specify) | | | | | | |
| Other network infrastructure (please specify) | | | | | | |

| | | | | | | |
|---|---|---|---|---|---|---|
| Hosting infrastructure | | | | | | |
| Content delivery networks | | | | | | |
| Data centres | | | | | | |
| Data transport | | | | | | |
| Other digital infrastructure (please specify) | | | | | | |
| Other digital infrastructure (please specify) | | | | | | |
| Other digital infrastructure (please specify) | | | | | | |

**Total direct investment in network infrastructure and/or other digital infrastructure made in 2021 capable of optimizing network traffic in EUR million within or relevant for the EU Member States.**

million EUR

**In 2021, as a percentage to the revenues generated within EU Member States:**

- 0-5%
- 6-10%
- 11-15%
- 16-20%
- Over 20%

Please explain your answer

*1000 character(s) maximum*

**41. What are your total planned future investments in network infrastructure and/or other digital infrastructure capable of optimizing network traffic from today until 2030 within or relevant for the EU Member States? Please specify both in absolute terms (in EUR million) as well as percentage increase compared to previous years.**

Please provide estimates for every year between 2022 and 2030.

| | Specify other network /digital infrastructure you provide data for | 2022 | 2023 | 2024 | 2025 | 2026 | 2027 | 2028 | 2029 | 2030 |
|---|---|---|---|---|---|---|---|---|---|---|
| Core network | | | | | | | | | | |
| Distribution network | | | | | | | | | | |
| Access network | | | | | | | | | | |
| Undersea cables | | | | | | | | | | |
| Other network infrastructure (please specify) | | | | | | | | | | |

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Other network infrastructure (please specify) | | | | | | | | | | |
| Other network infrastructure (please specify) | | | | | | | | | | |
| Hosting infrastructure | | | | | | | | | | |
| Content delivery networks | | | | | | | | | | |
| Data centres | | | | | | | | | | |
| Data transport | | | | | | | | | | |
| Other digital infrastructure (please specify) | | | | | | | | | | |

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Other digital infrastructure (please specify) | | | | | | | | | | |
| Other digital infrastructure (please specify) | | | | | | | | | | |

**Total direct investment in network infrastructure in million EUR within or relevant for the EU Member States in 2022**

EUR million

**Planned future total direct investment in network infrastructure in million EUR within or relevant for the EU Member States in 2023**

million EUR

**In 2023, as a percentage to the revenues generated within EU Member States:**

- 0-5%
- 6-10%
- 11-15%
- 16-20%
- Over 20%

Please explain your answer, and upload proof of data justifying it (e.g. official presentations to financial investors, board of directors, etc.)

*1000 character(s) maximum*

**42. Indicate how much the share of network investments that you indicated in response to Q40 has exceeded the investments you planned, including when they depended on regulatory obligations (e.g. radio spectrum), over the last 5 years.**

For fixed network investment costs:

- 0 - 20%
- 21 - 40%
- 41 – 60%
- 61 - 80%
- Over 80%

For mobile network investment costs:

- 0 - 20%
- 21 - 40%

- 41 – 60%
- 61 - 80%
- Over 80%

Please explain your answer, providing a separate assessment for fixed and mobile networks

*1000 character(s) maximum*

**43. Quantify the increase of traffic transmitted (inbound/outbound) through your networks over the last five years on a year-on-year basis. Please indicate the main sources of data and the share of traffic using CDNs. Please reply to this question by indicating the 10 largest contributors by name and provide the % of total traffic they generated in your network.**

1st largest contributor:

*100 character(s) maximum*

Share of 1st largest contributor:

*Only values between 1 and 100 are allowed*

%

2nd largest contributor:

*100 character(s) maximum*

Share of 2nd largest contributor:

*Only values between 1 and 100 are allowed*

%

3rd largest contributor:

*100 character(s) maximum*

Share of 3rd largest contributor:

*Only values between 1 and 100 are allowed*

%

4th largest contributor:

*100 character(s) maximum*

Share of 4th largest contributor:

*Only values between 1 and 100 are allowed*

%

5th largest contributor:

*100 character(s) maximum*

Share of 5th largest contributor:

*Only values between 1 and 100 are allowed*

%

6th largest contributor:

*100 character(s) maximum*

Share of 6th largest contributor:

*Only values between 1 and 100 are allowed*

%

7th largest contributor:

*100 character(s) maximum*

Share of 7th largest contributor:

*Only values between 1 and 100 are allowed*

%

8th largest contributor:

*100 character(s) maximum*

Share of 8th largest contributor:

*Only values between 1 and 100 are allowed*

%

9th largest contributor:

*100 character(s) maximum*

Share of 9th largest contributor:

*Only values between 1 and 100 are allowed*

%

10th largest contributor:

*100 character(s) maximum*

Share of 10th largest contributor:

*Only values between 1 and 100 are allowed*

%

Please explain your answer

*1000 character(s) maximum*

**44. New compression algorithms can (partly) compensate for the increase in data traffic demanded by the upgrades and the advancements in the relevant products and technologies. Over the last 5 years, what are the changes in your volume of data transmitted over your part of the "network layers" resulting from the evolution of compression algorithms?**

- No significant change
- Decreased up to 5%
- Decreased by 6-10%
- Decreased by 11 – 15%
- Decreased by over 15%

Please explain your answer

*1000 character(s) maximum*

**45. In your view, what is the future outlook in terms of annual peak time traffic growth until 2030?**

- ○ No change
- ○ Compound Annual Growth Rate (CAGR) up to 10 %
- ○ CAGR 11-20 %
- ○ CAGR 21-30 %
- ○ CAGR 31-40 %
- ○ Over 40% CAGR

Please explain your answer

*1000 character(s) maximum*

**46. Please specify the fees paid to providers of ECNs within EU Member States cumulatively for the last 5 years and provide an outlook for the next 5 years.**

| | 2017 (actual) | 2018 (actual) | 2019 (actual) | 2020 (actual) | 2021 (actual) | 2022 (actual) | 2023 (planned) | 2024 (planned) | 2025 (planned) | 2026 (planned) | 2027 (planned) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Transit fees (Euros) | | | | | | | | | | | |
| Transit fees as % of total revenues in EU MS | | | | | | | | | | | |
| Paid peering fees (Euros) | | | | | | | | | | | |
| Paid peering fees as % of total revenues in EU MS | | | | | | | | | | | |

Please explain your answer, and if possible indicate the data source

*1000 character(s) maximum*

**47. Indicate your share of traffic (sent or received) through transit and peering for the last 5 years and provide an outlook for the next 5 years.**

| | 2017 (actual) | 2018 (actual) | 2019 (actual) | 2020 (actual) | 2021 (actual) | 2022 (actual) | 2023 (planned) | 2024 (planned) | 2025 (planned) | 2026 (planned) | 2027 (planned) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| % of transit within inbound traffic | | | | | | | | | | | |
| % of free peering within inbound traffic | | | | | | | | | | | |
| % of paid peering within inbound traffic | | | | | | | | | | | |
| % of transit within outbound traffic | | | | | | | | | | | |

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| % of free peering within outbound traffic | | | | | | | | | | | |
| % of paid peering within outbound traffic | | | | | | | | | | | |

Please explain your answer

*1000 character(s) maximum*

**48. Indicate your charging methods and the general pricing trend(s) on the IP market (increases/decreases/stable), particularly the proportion of paid peered traffic for the previous 5 years and provide outlook for the following 5 years.**

Transit price change:

| | 2017 (actual) | 2018 (actual) | 2019 (actual) | 2020 (actual) | 2021 (actual) | 2022 (actual) | 2023 (planned) | 2024 (planned) | 2025 (planned) | 2026 (planned) | 2027 (planned) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Decrease by more than 10 % | | | | | | | | | | | |
| Decrease by 1 - 10 % | | | | | | | | | | | |
| No change | | | | | | | | | | | |
| Increase by 1 - 10 % | | | | | | | | | | | |
| Increase by more than 10 % | | | | | | | | | | | |

Paid peering price change:

| | 2017 (actual) | 2018 (actual) | 2019 (actual) | 2020 (actual) | 2021 (actual) | 2022 (actual) | 2023 (planned) | 2024 (planned) | 2025 (planned) | 2026 (planned) | 2027 (planned) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Decrease by more than 10 % | | | | | | | | | | | |
| Decrease 1 - 10 % | | | | | | | | | | | |
| No change | | | | | | | | | | | |
| Increase by 1 - 10 % | | | | | | | | | | | |
| Increase by more than 10 % | | | | | | | | | | | |

Please explain your answer

*1000 character(s) maximum*

**49. Specify the threshold above which you would consider a company to constitute a so-called large traffic generator ("LTG") based on the percentage level of traffic loaded on your network during peak time traffic (or any other classification that you may use). You should refer to this categorization method in all questions referring to LTGs.**

Please explain your answer

*1000 character(s) maximum*

**50. In your view, over the last 5 years how have LTGs' investments in digital infrastructure and other innovations (e.g. evolution of compression algorithms) impacted the costs of network deployment investments of the network operators related to the increase of data traffic?**

- They increased by 20% or more
- They increased up to 20%
- They did not change
- They decreased by up to 20%
- They decreased by 20% or more

Please explain your answer

*1000 character(s) maximum*

**51. What is today the share of your network investment incremental costs caused by the increases of data traffic coming from LTGs, you defined in Q49? What was this share 10 years ago and how is it expected to evolve in the next 10 years? Please provide a separate assessment for fixed and mobile networks.**

For fixed network investment costs:

| | In 2012 | In 2022 | In 2032 |
|---|---|---|---|
| 0 - 20% | | | |
| 21 - 40% | | | |
| 41 – 60% | | | |
| 61 - 80% | | | |
| 81 - 100% | | | |

For mobile network investment costs:

| | In 2012 | In 2022 | In 2032 |
|---|---|---|---|
| 0 - 20% | | | |
| 21 - 40% | | | |
| 41 – 60% | | | |
| 61 - 80% | | | |
| 81 - 100% | | | |

Please explain your answer, providing a separate assessment for fixed and mobile networks

*1000 character(s) maximum*

**52. Are there any obstacles preventing providers of ECNs from charging digital players for increased data traffic through their networks?** [Only one option can be selected]

- No
- Yes
- I do not know

Please explain your answer. In particular, if you reply is yes, please explain the reasons (e.g. legal, regulatory, other)

*1000 character(s) maximum*

**53. What could be the effect on the environmental footprint of the services provided over electronic communications networks of a potential mechanism whereby the largest generators of traffic would contribute to network deployment, and/or would be subject to obligations regarding data delivery mode?**

Please explain your answer

*1000 character(s) maximum*

A robust environmental impact assessment cannot be conducted without having a clear understanding of proposed financial mechanism. BEREC did not find clear evidence of positive effects on environmental sustainability of a financial contribution of CAPs for the deployment of networks.

**54. The European Declaration on Digital Rights and Principles states that all digital players benefiting from the digital transformation should contribute in a fair and proportionate manner to the costs of public goods, services and infrastructures to the benefit of all people living in the EU. Some stakeholders have suggested a mandatory mechanism of direct payments from CAPs/LTGs to contribute to finance network deployment. Do you support such suggestion and if so why? If no, why not?** [Only one option can be selected]

- No
- Yes
- I do not know

Please explain your answer

*1000 character(s) maximum*

**58. Do you see any possible risks of a contribution to finance network deployment in the form of direct payments and if so, which? Please substantiate your answer, including with data.**

*Use drag&drop or the up/down buttons to change the order or accept the initial order.*

- Negative effects on the incentives for innovation
- Sustainability within the internet ecosystem
- Negative consequences for consumers
- Negative consequences on medium/small traffic generators
- Negative consequences on the competition between large and small providers of ECNs
- Other
- I do not know

Please specify “Other”

*100 character(s) maximum*

Please explain your answer

*1000 character(s) maximum*

**59. What mitigating measures could be put in place to avoid the risks indicated in Q58?**

[Multiple answers are possible]

- ☐ Excluding medium/small traffic generators
- ☐ Mandatory ratio into green (lower energy consumption) investment
- ☐ Other
- ☐ I do not know

Please explain your answer

*1000 character(s) maximum*

**60. The European Declaration on Digital Rights and Principles states that all digital players benefiting from the digital transformation should contribute in a fair and proportionate manner to the costs of public goods, services and infrastructures to the benefit of all people living in the EU. To achieve this, some stakeholders have suggested to introduce a mechanism consisting of a EU/national digital contribution or fund. Do you support such suggestion and if so why? If not, why not?** [Only one option can be selected]

- No
- Yes
- I do not know

Please explain your answer

*1000 character(s) maximum*

**You may upload a written contribution that you think is relevant to better explain your views (max. 10 pages). Please, mark those contribution as "Confidential", which you do not wish to be published.**

**Please upload your file.**

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**/20230517_BoR__23__131b_Overview_of_BEREC_Response_to_Exploratory_Consultation_10p.pdf**

## Confidentiality

* The Commission will publish all contributions to this exploratory consultation. Your contribution will be published as submitted. If you consider that your replies to certain questions of the questionnaire are confidential, please mark those questions as confidential here. Responses to questions marked as confidential will not be published.

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- Question 3
- Question 4
- Question 5
- Question 6

- Question 7
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- [ ] Question 62
- [x] None

### Background Documents

Protection of your personal data

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Contact Form