

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.

[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 (delaying), 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.

[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

Type of Company/Business

If more categories apply to your business, please select the one with more revenues

- Electronic Communications Network (ECN) provider
- Internet content provider
- Cloud/Hosting provider
- Broadcaster
- OEM / vendor
- Other

* Please, specify "Other"

100 character(s) maximum

* **First name**

* **Surname**

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

* **Scope**

- International
- European
- National
- Regional
- Local

* **Level of governance**

- Local Authority
- Local Agency

* **Level of governance**

- Parliament
- Ministry/Government
- Authority
- Agency

* **Organisation name**

255 character(s) maximum

* **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.

- AF - Afghanistan
- AL - Albania
- DZ - Algeria
- AD - Andorra
- AO - Angola
- AG - Antigua and Barbuda
- AR - Argentina
- AM - Armenia
- AU - Australia
- AT - Austria
- AZ - Azerbaijan
- BS - Bahamas
- BH - Bahrain
- BD - Bangladesh
- BB - Barbados
- BY - Belarus
- BE - Belgium
- BZ - Belize
- BJ - Benin
- BT - Bhutan
- BO - Bolivia
- BA - Bosnia and Herzegovina
- BW - Botswana

- Ⓒ BR - Brazil
- Ⓒ BN - Brunei Darussalam
- Ⓒ BG - Bulgaria
- Ⓒ BF - Burkina Faso
- Ⓒ BI - Burundi
- Ⓒ CV - Cabo Verde
- Ⓒ KH - Cambodia
- Ⓒ CM - Cameroon
- Ⓒ CA - Canada
- Ⓒ CF - Central African Republic
- Ⓒ TD - Chad
- Ⓒ CL - Chile
- Ⓒ CN - China
- Ⓒ CO - Colombia
- Ⓒ KM - Comoros
- Ⓒ CG - Congo
- Ⓒ CR - Costa Rica
- Ⓒ CI - Côte D'Ivoire
- Ⓒ HR - Croatia
- Ⓒ CU - Cuba
- Ⓒ CY - Cyprus
- Ⓒ CZ - Czechia
- Ⓒ CD - Democratic Republic of the Congo
- Ⓒ DK - Denmark
- Ⓒ DJ - Djibouti
- Ⓒ DM - Dominica
- Ⓒ DO - Dominican Republic
- Ⓒ EC - Ecuador
- Ⓒ EG - Egypt
- Ⓒ SV - El Salvador
- Ⓒ GQ - Equatorial Guinea
- Ⓒ ER - Eritrea
- Ⓒ EE - Estonia
- Ⓒ SZ - Eswatini

- ET - Ethiopia
- FJ - Fiji
- FI - Finland
- FR - France
- GA - Gabon
- GM - Gambia
- GE - Georgia
- DE - Germany
- GH - Ghana
- GR - Greece
- GD - Grenada
- GT - Guatemala
- GN - Guinea
- GW - Guinea Bissau
- GY - Guyana
- HT - Haiti
- 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
- MR - Mauritania
- 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
- Ⓒ NO - Norway
- Ⓓ 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

Your name, the type of respondent that you responded to this consultation as, your country of origin and your contribution will be published.

Anonymous

The type of respondent that you responded to this consultation as, your 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.

* **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.

[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

[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 specify "Other"**

100 character(s) maximum

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 specify "Other"**

100 character(s) maximum

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

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

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

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 ongoing 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

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

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

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

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

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

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

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.

[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

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

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 the possible shortcomings of the universal service regime.

1000 character(s) maximum

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

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]

- Public general budget (as currently)
- 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 specify "Other ways of financing"

100 character(s) maximum

Please explain your answer

1000 character(s) maximum

27. If you answered in the previous question that the range of providers should be widened, how should contributions to financing from private entities (i.e. providers of electronic communications, digital online players and/or data generators) to the universal service regime be structured? [Only one option can be selected]

- All should contribute equally
- Contribution should be in proportion to certain criteria
- Other

* Please specify "Other"

100 character(s) maximum

Please explain your answer; if you consider that contribution should depend on certain criteria, please indicate the relevant criteria.

1000 character(s) maximum

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

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

30. If you answered that a fund would be useful, who should contribute to the dedicated EU-wide fund? [multiple answers are possible]

- Public general budget
- Providers of electronic communications networks and services
- Online players or data generators that benefit from connectivity
- Other ways of financing or other possible contributors

* Please specify “Other ways of financing or other possible contributors”

100 character(s) maximum

Please explain your answer

1000 character(s) maximum

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

Please explain your answer

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

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

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

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

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

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

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

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.

[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

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

55. In case you answered yes to Q54, who should be the:

a) Main contributors, and why? [Only one option can be selected]

- Digital online players/traffic generators in general (e.g. Online content providers)
- Certain digital online players (e.g. Largest traffic generators)
- Others

Please specify "Others"

100 character(s) maximum

Please explain your answer

1000 character(s) maximum

55. b) Beneficiaries, and why? [Only one option can be selected]

- All providers of internet access services
- All ECN providers (including wholesale-only undertakings for example)
- Others

* Please specify "Others"

100 character(s) maximum

Please explain your answer

1000 character(s) maximum

56. In case you answered yes to Q54, what would be the expected benefits/advantages and for whom? (quantify, timing)

Please explain your answer

1000 character(s) maximum

57. In case you answered yes to Q54, how should a contribution mechanism be structured to ensure that it effectively contributes to a swift and broader deployment of very high capacity networks?

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 specify "Other"

100 character(s) maximum

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

61. In case you answered yes to Q60, who should finance such EU/national digital contribution or contribute to such fund?

Please explain your answer

1000 character(s) maximum

62. In case you answered yes to Q60, what should this EU/national digital contribution or fund finance?

Use drag&drop or the up/down buttons to change the order or [accept the initial order](#).

| | |
|---|--|
| ⋮ | Future network deployments |
| ⋮ | Protect most vulnerable consumers |
| ⋮ | Increased costs related to increased traffic |
| ⋮ | Other |

Please specify "Other"

100 character(s) maximum

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.

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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- None

