IP interconnection on the Internet: a European perspective for 2022

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Contents

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Executive summary

A number of large telecoms operators in Europe, under the umbrella of the European Telecommunications Network Operators (ETNO) organisation, have recently re-introduced the idea that as Internet service providers (ISPs), they should receive payments from large Internet companies for terminating traffic to their end users,[1] to contribute to the cost of rolling out gigabit-capable network infrastructure to meet European Commission policy targets. This idea has not been clearly justified, and its proponents have not addressed the implications of this intervention, including not just for end-users using broadband but also for businesses and public services using public cloud services over the Internet.

Under ETNO's proposals, regulated 'network usage fees' would replace commercially negotiated Internet interconnection. These fees would involve mandated, traffic-related payments from Internet companies who deliver traffic to ISPs. This is not a new idea: ETNO raised it over a decade ago, in 2012, but regulators,[2] including the Body of European Regulators for Electronic Communications (BEREC) took the view that the commercially negotiated interconnection regime on the Internet worked well.[3] In 2017, BEREC reiterated this view in conclusion of a thorough review of trends in the marketplace.[4]

ETNO's position links the volume of Internet traffic delivered, and its perceived concentration from a small number of large Internet companies, as indicative of an issue with how ISPs are being compensated for carrying this traffic to end users who subscribe to their broadband services. These ISPs argue that they are unable to negotiate appropriate payments from Internet companies to cover their costs.

These arguments fail to recognise both established and emerging facts. First, there is evidence that the costs in fixed networks,[5] including full fibre networks, do not increase much with traffic, over time.[6] Second, current Internet interconnection arrangements have been examined at length by regulators,

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1 European Telecommunications Network Operators' Association (2022), *Europe's Internet ecosystem: A 72bn boost to GDP and 840k new jobs are within reach if gaps in network costs are tackled.* Available at https://etno.eu/news/all-news/735:eu-internet-ecosystem.html

2 Policy-makers also examined this issues – for example, the French National Assembly published a detailed report in 2012, in N° 3336 - Rapport d'information de Mmes Laure de La Raudière et Corinne Erhel déposé en application de l'article 145 du règlement, par la commission des affaires économiques sur la neutralité de l'internet et des réseaux (assemblee-nationale.fr)

3 BEREC (2012), *An assessment of IP interconnection in the context of Net Neutrality*, available at https://www.berec.europa.eu/en/document-categories/berec/reports/an-assessment-of-ip-interconnection-in-the-context-of-net-neutrality

4 BEREC (2017), *Report on IP-Interconnection practices in the Context of Net Neutrality*, available at https://www.berec.europa.eu/en/document-categories/berec/reports/berec-report-on-ip-interconnection-practices-in-the-context-of-net-neutrality

5 Fixed networks that handle over 90% of European Internet traffic, while mobile operators are able to charge end users in function of the traffic they generate; see Footnote 22

6 We address this in part in a recent paper for Netflix. Analysys Mason (2022), *Netflix's Open Connect program and codec optimisation helped ISPs save over USD1 billion globally in 2021*. Available at https://www.analysysmason.com/netflix-open-connect

including BEREC in 2017 and more recently through a report for BNetzA by WIK-Consult.[7] Based on a review of available evidence and literature, we see no substantial changes to the trends observed by BEREC in 2017 that would justify a significant change to the regulatory regime. Furthermore, data from ARCEP and findings by WIK-Consult show that ISPs are able to impose restrictive peering conditions and derive revenue for interconnection, through transit or 'paid peering' with Internet companies, which are described further below.

A note on definitions:

ETNO and other proponents of network usage fees tend to refer to corporate entities they believe should be paying ISPs for the delivery of traffic to end users as "tech giants" or "over the top providers". This conflates multiple concepts. The companies targeted in ETNO's proposals deliver their content and services directly to end users, through their own 'content delivery network' or CDN. Others do so primarily through third-party CDNs. Finally, commercial CDNs and cloud providers deliver content on behalf of their customers, including content providers (e.g. Spotify[8] or broadcasters such as ProSiebenSat-1,[9] as well SMEs, non-profits and public sector organisations.

By conflating these concepts, the proponents do not address how the network usage fees are imposed, and who ultimately pays them. As a result, as we describe in this paper, network usage fees being imposed on companies that deliver traffic to ISPs may end up being passed on to many other third parties, including public cloud users who are an important part of the European Commission's Digital Decade targets.

In terms of style, we address the ambiguity of the proposals by referencing Internet companies as a general term that could cover the types of companies who would be the apparent targets of an imposed network usage fee, and talking specifically about content providers, CDNs, and cloud providers when talking about the actual impacts of network usage fees on these companies and their customers.

Freely-negotiated Internet interconnection has enabled sustained growth in demand for Internet access and online services, supported by infrastructure investments by ISPs and Internet companies

Today, interconnection on the Internet is negotiated freely between networks. This has long been the norm nearly everywhere. Negotiated interconnection agreements have successfully supported the sustained growth and efficient functioning of the Internet, and have proven beneficial to all stakeholders on the Internet. Interconnection takes the form of peering or transit. In a peering arrangement, two providers exchange their own traffic directly with one another, almost always without any settlements or even any contractual relationship. Very occasionally, paid peering is negotiated to

7 WIK-Consult (2022), *Competitive conditions on transit and peering markets*. Available at https://www.bundesnetzagentur.de/EN/Areas/Telecommunications/Companies/Digitisation/Peering/download.pdf?__blob=publicationFile&v=1

8 https://cloud.google.com/customers/spotify

9 https://aws.amazon.com/solutions/case-studies/prosiebensat1-media-se-case-study/

address perceived differences in traffic exchange. In a transit arrangement, one provider pays the other for access to the entire Internet.[10]

As new uses of the Internet have reached commercial maturity, including rich content such as video and games, Internet companies have made significant investments and innovations to improve the delivery of content on the Internet. This includes the development of content delivery networks (CDNs) and public clouds to deliver content and services to the whole range of customers including end-users and businesses of all sizes. These Internet companies, be they content providers, public cloud providers, or intermediaries such as CDNs, invest billions in data centres, terrestrial and submarine fibre networks, and 'edge' infrastructure including routers and caches to bring traffic close to, or inside, ISPs' networks.[11] The result has been improved quality for Internet users to the benefit of all stakeholders, at a lower the cost for ISPs.

These dynamics have enabled sustained growth in traffic and new business models, including the temporary drastic traffic increase under the Covid pandemic in 2020. Internet companies and ISPs have always had shared interests: more attractive content and services for end users, enabled by ISPs' networks, drive demand for better connectivity over time; and, all stakeholders have an interest to operate efficiently, to minimise their costs and prices for their customers. Proposals such as those put forward by ETNO would threaten these shared interests and outcomes.

Evidence and data on disputes and existing arrangements do not support the view that ISPs suffer from an imbalanced bargaining position vis-à-vis large Internet companies

Looking specifically at the claim that ISPs are unable to get a fair contribution to their own network costs from Internet companies, we reviewed disputes that have occurred from time to time between interconnecting parties, and evidence available on who pays whom for Internet interconnection.

First of all, the very few public disputes that have occurred have typically stemmed from ISPs' imposing conditions and fees on traffic delivery, sometimes curtailing the capacity used for interconnection, at the ultimate expense of both content providers and their own end users. Today, some large European ISPs continue to operate selective or restrictive peering policies, which force Internet companies to pay for peering or transit to reach end users connected to these ISPs and deliver a good quality of experience to them.

From publicly available evidence, we understand that no major content provider has sought payment from ISPs for interconnection, despite the large investments they have made in infrastructure, services and content. Internet companies continue to have mostly open interconnection policies and invest in

10 In this way, parties can rely on indirect interconnection through transit providers as at least a partial substitute if they cannot agree a direct peering arrangement.

11 This is acknowledged by ETNO (2022), *8 common questions on the "fair contribution" debate*, under question 6: "In the period 2014-2017, the yearly investment in infrastructure elements by tech giants was $17.9bn (Europe). In the same period, figures show that European telecom investment ranged from €42.5bn to €53.2bn per year". These investments are increasing every year, and it is important to remember that ETNO members, telecoms operators, are selling access to the infrastructure they invest in, whereas Internet companies are making these investments to support the delivery of content and services including public cloud services.

infrastructure to support the delivery of content and services demanded by users in the most efficient way possible, reducing costs for operators and improving performance for end users.

This suggests at the very least a balance of bargaining power between Internet companies and ISPs. ETNO's proposal for mandated network usage fees would further strengthen the bargaining position of ISPs seen in historical disputes and current selective peering practices. ISPs would be able to exercise a 'termination monopoly' for delivering traffic to end users and charge 'termination rates' similar to those regulators have spent decades lowering for traditional telephony. From the perspective of regulators, regulating Internet interconnection would require significant sustained efforts to set rates and conditions for traffic termination. Evidence from the one country, South Korea, which has imposed network usage fees shows unintended consequences leading to new regulations, a series of legal cases, and higher costs for ISPs and Internet companies.[12]

Proposals for network usage fees fail to recognise the impact they would have beyond large Internet companies on a wide range of Internet users, including public cloud users

European digital players including broadcasters, games companies and music streaming services all use cloud and CDNs extensively to serve customers in Europe and globally. ETNO's proposal does not account for the implications for these European businesses, the customers these businesses serve, and indeed the millions of people and companies who use cloud services on a daily basis.[13]

Currently, all these users of the Internet benefit from a market that has led Internet companies, including content providers, public cloud providers and CDNs, to deploy infrastructure that reduces the overall investment that ISPs have to bear, and allows Internet companies to have a degree of control on the quality of experience they deliver to their customers. The current approach to interconnection on the Internet, through negotiation rather than regulation, has supported Internet growth and evolution for years, and unfettered IP interconnection remains fundamental to the health and growth of the Internet.

The effects of network usage fees remain uncertain, but it seems clear that they would ultimately impact the millions of consumers, businesses and public sector organisations in Europe who use the Internet for public cloud and CDN services. Even if ETNO targets network usage fees at large Internet companies, they would ultimately be borne by their European customers, including the millions of SMEs across Europe who now rely on software as a service running on public cloud. Lastly, although this goes beyond the scope of this paper, the possible introduction of network usage fees would by no means guarantee enhanced investment in connectivity infrastructure.[14]

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12 As mentioned in the 'note on definitions', some content providers deliver content through their own CDNs, and others use third-party CDNs. We understand that both mechanisms are impacted by the regulations in force in South Korea.

13 Public cloud adoption is an important cornerstone of the European Commission's Digital Decade agenda; see European Commission (2022), *Europe's Digital Decade: digital targets for 2030*. Available at https://ec.europa.eu/info/strategy/priorities-2019-2024/europe-fit-digital-age/europes-digital-decade-digital-targets-2030_en

14 See Communications Chambers (2022), *An internet traffic tax would harm Europe's digital transformation*

With this in mind, two things are essential to consider before imposing any regulatory intervention: whether there is actually a clear market failure, and how the regulatory intervention should be targeted to address such market failure. Unfortunately, proposals for mandated network usage fees fail to make a compelling case on either point.

1 Introduction and context

1.1 Proposals are emerging to regulate Internet interconnection and impose regulated network usage fee payments from Internet companies to ISPs

A debate is now ongoing in Europe on whether and how large Internet companies should contribute to the cost of rolling out gigabit-capable network infrastructure to meet European Commission policy targets.[15] This debate mirrors ongoing policy discussions in the USA and South Korea on the contribution of Internet companies to the connectivity environment.

As part of this debate, a number of large telecoms operators in Europe, under the banner of European Telecommunications Networks Operators (ETNO) have re-introduced the idea that as Internet service providers (ISPs), they should receive payments from large Internet companies, in the form of network usage fees for terminating traffic to their end users.[16] These proposals further argue that regulation is needed, mirroring developments in South Korea.[17]

Such regulated network usage fees would replace commercially negotiated interconnection agreements that have long been the norm on the Internet. These negotiated arguments, typically settlement-free and non-contractual, have successfully supported the growth and efficient functioning of the Internet, and have proven beneficial to all stakeholders on the Internet.

Such proposals have been brought up by large ISPs in the past. In 2012, ETNO pushed for a proposal to establish the 'sending party network pays' (SPNP) principle for Internet traffic instead of commercially negotiated interconnection agreements.[18] BEREC, together with several European governments, rejected the idea on the basis that the proposal risked artificially shifting the balance of power towards ISPs.[19] BEREC further published a report in 2012 that assessed IP interconnection

15 European Commission (EC) (2022), *Europe's Digital Decade: digital targets for 2030*. Available at https://ec.europa.eu/info/strategy/priorities-2019-2024/europe-fit-digital-age/europes-digital-decade-digital-targets-2030_en

16 European Telecommunications Network Operators' Association (2022), *Europe's Internet ecosystem: A 72bn boost to GDP and 840k new jobs are within reach if gaps in network costs are tackled.* Available at https://etno.eu/news/all-news/735:eu-internet-ecosystem.html

17 Internet Society (2022), *Internet Impact Brief: South Korea's Interconnection Rules* and *Old Rules in New Regulations – Why "Sender Pays" Is a Direct Threat to the Internet*. Available at https://www.internetsociety.org/resources/doc/2022/internet-impact-brief-south-koreas-interconnection-rules/ and https://www.internetsociety.org/blog/2022/05/old-rules-in-new-regulations-why-sender-pays-is-a-direct-threat-to-the-internet/

18 ETNO (2012), *ITRs Proposal to Address New Internet Ecosystem*. Available at https://etno.eu/datas/itu-matters/etno-ip-interconnection.pdf

19 BEREC (2012), *BEREC's comments on the ETNO proposal for ITU/WCIT or similar initiatives along these lines*. Available at https://www.berec.europa.eu/sites/default/files/files/document_register_store/2012/11/BoR(12)120rev.1_BEREC_Statement_on_ITR_2012.11.14.pdf

in the context of net neutrality[20], which was updated in 2017.[21] BEREC's conclusions in both reports highlighted that the interconnection ecosystem was able to successfully cope with increasing traffic levels without the need for regulation. It also stated that interconnection disputes included complex relationships and strategic decisions, and were usually solved without regulatory intervention. We understand that BEREC may update its analysis in 2022.

1.2 Internet interconnection is supported by investments by ISPs and Internet companies alike, and support a wide range of services including public cloud

A core part of the current argument brought forward by ETNO is that the recent and continued growth in traffic, particularly video, drives significant network costs. The evidence available is unconvincing however, particularly on fixed networks that handle over 90% of European Internet traffic.[22] Internet companies have invested in their own infrastructure and innovations to improve the delivery of services, including video, and lower the cost for ISPs.[23] Furthermore, technological advancements and improved engineering practices have drastically increased the capacities of networks while simultaneously reducing unit costs of carrying and exchanging traffic.[24]

In addition, by singling out video traffic provided by a handful of Internet companies to end users, ETNO and its members fail to account for the important role that large content delivery networks (CDNs) in general play in delivering traffic for a multitude of smaller content providers and indeed for companies as diverse as retailers and financial services providers, which use public cloud and need to access their data and workload through the Internet. Indeed, AWS, Google Cloud and Microsoft all serve a wide range of European companies who rely on public cloud to manage their own IT, but also to serve their customers. European digital players including broadcasters, games companies and music streaming services all use cloud and CDNs extensively to serve customers in Europe and globally. Even if ETNO targets the fee at a small number of Internet companies that deliver traffic to ISPs, the fees would be borne by their European customers, including the millions of SMEs across Europe who now rely on software as a service (SaaS) running on public cloud.

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20 BEREC (2012), *An assessment of IP interconnection in the context of Net Neutrality*, available at https://www.berec.europa.eu/en/document-categories/berec/reports/an-assessment-of-ip-interconnection-in-the-context-of-net-neutrality

21 BEREC (2017), *Report on IP-Interconnection practices in the Context of Net Neutrality*, available at https://www.berec.europa.eu/en/document-categories/berec/reports/berec-report-on-ip-interconnection-practices-in-the-context-of-net-neutrality

22 Including from the Frontier Economics report commissioned by some ETNO members and published concurrently with its calls to regulate network usage fees, which shows that the vast amount of traffic carried on fixed network only drives a relatively small share of costs; see Frontier Economics (2022), *Estimating OTT traffic-related costs on European telecommunications networks*, https://www.telekom.com/en/blog/group/article/why-Internet-companies-should-pay-for-their-data-traffic-1003714

23 See for example Analysys Mason (2018), *Infrastructure investment by online service providers*; this will be updated in Q4 2022 and is available at https://www.analysysmason.com/consulting-redirect/reports/online-service-providers-internet-infrastructure-dec2018/

24 Including variable cost of traffic exchanged through IP transit

Interconnection between networks on the Internet, including between Internet companies and ISPs, is based on commercially negotiated arrangements, and has been very successful in the development of the Internet to support rapid increases in traffic, entirely new content and applications and a plurality of digital businesses through public cloud. It has also provided effective incentives to all parties to invest independently but in a complementary fashion to ensure capacity remains ahead of demand.[25] This is a market that has worked well because there is a balance of interests and a mutual dependence between all the parties involved in bringing content to consumers. Network usage fees would upset the functioning of the market in a fundamental way, and their downsides have not been convincingly addressed by their proponents; indeed, concerns that such fees could break or 'splinter' the Internet were laid out over a decade ago, as also supported by previous BEREC findings, and remain valid.

1.3 This paper contributes a historical perspective, with a focus on recent trends and the impact of regulated fees on European stakeholders including public cloud users

ETNO's proposal for 'fair contributions' has sparked a debate once again, which comes at a time when BEREC is also consulting on the Internet ecosystems and value chain[26], and when the European Commission ('the EC' or 'the Commission') has indicated that it is working on related topics. Furthermore, BEREC may also review its 2012 and 2017 findings on interconnection issues in the context of the Open Internet. Whilst some stakeholders have mentioned publicly that plans were in the making to associate 'large platforms' to the funding of networks,[27] several member states are on the record supporting in-depth, careful assessment by the Commission.[28]

It is therefore essential that all parties involved share a clear understanding of the concepts, practices and trends related to the Internet interconnection landscape. As a contribution to these efforts, this paper discusses how the current model for unregulated interconnection has evolved since the earliest days of the commercial Internet, and how it continues to support successful growth of the Internet's scope and scale. We build on previous publications by Analysys Mason in 2020[29] and more recent findings by other stakeholders, including WIK-Consult for BNetzA.[30]

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25 On one level demand cannot exceed capacity by definition, but it is also useful to highlight the fact that even highly utilised networks only support 2-5Mbit/s of concurrent demand per user at present at peak times; see for example BT Group's reported peak bandwidth demand in December 2021 at https://newsroom.bt.com/another-fixed-network-traffic-peak-underlines-need-to-review-net-neutrality-rules/

26 Body of European Regulators for Electronic Communications (BEREC), (2022), *Public Consultation on the Draft BEREC Report on the Internet Ecosystem*. Available at https://www.berec.europa.eu/en/public-consultations/ongoing-public-consultations-and-calls-for-inputs/public-consultation-on-the-draft-berec-report-on-the-internet-ecosystem

27 Politico (2022), *Brussels' next lobbying dogfight: Big Tech vs. Big Telecoms*. Available at https://www.politico.eu/article/brussels-next-lobbying-dogfight-big-tech-vs-big-telecoms/

28 Seven EU countries warn the Commission against hasty decisions on 'fair share' – EURACTIV.com

29 Analysys Mason (2020), *IP interconnection on the Internet: a white paper*. Available at https://www.analysysmason.com/consulting-redirect/reports/ip-interconnection-korea-white-paper/

30 WIK-Consult (2022), *Competitive conditions on transit and peering markets*. Available at https://www.bundesnetzagentur.de/EN/Areas/Telecommunications/Companies/Digitisation/Peering/download.pdf?__blob=publicationFile&v=1

The importance of public cloud services to European businesses, public sector organisations and consumers, and to the European Digital Decade targets, has been of particular interest to us in preparing this paper. ETNO's proposal to target a subset of Internet companies that deliver traffic to ISPs would likely encompass major CDNs and public cloud providers, and the data they exchange with ISPs is not just theirs, but could also be their customers', depending on their business model.

This paper is structured as follows:

- In Section 2, we describe how Internet interconnection arrangements have developed, and why they have not been regulated to date.
- In Section 3, we explore recent developments in the interconnection market to assess whether there is evidence of any shift in the balance of power toward Internet companies at the expense of ISPs that would warrant changes to the status quo.
- In Section 4, we describe potential implications for Europe if interconnection arrangements are nonetheless regulated as proposed by ETNO.

2 A brief overview of Internet interconnection

The Internet interconnection arrangements necessary to create the Internet's 'network of networks' are based on voluntary negotiations between interconnecting networks. The resulting arrangements are known as peering or transit, and have continued to evolve with the growth of the Internet.

These arrangements have supported growth in existing services (e.g., streaming video) and the emergence of new applications and business models, including public cloud services available to every company and consumer in Europe.

Negotiating interconnection agreements works because there is a balance of bargaining power and mutual dependence between the parties involved in bringing content to consumers, which threatens to be upset by the imposition of regulated fees.

In this section, we provide a brief summary of the historical background to current practices for Internet interconnection:

- Section 2.1 examines the basis for unregulated interconnection arrangements, which have been a constant feature of the Internet globally.
- Section 2.2 shows how interconnection arrangements evolved in response to the evolution of demand for online content and services, as Internet companies (including content providers and CDNs) deliver content to ISPs closer to end users, in a way that reduces the costs of ISPs.
- Section 2.3 explains how the balance of bargaining power between Internet companies, ISPs and intermediaries in the Internet value chain has shaped current interconnection practice.

2.1 Interconnection on the Internet has been unregulated since its creation

Internet interconnection has been voluntarily negotiated between providers since the earliest days of the commercial Internet. Periodically, there are calls from one set of providers to share revenues or compensate another set of providers. In the earliest days of the Internet, content providers had no means of monetising their services, and instead sought compensation from ISPs, due to the value that content brought to ISP subscribers.[31]

These arrangements did not go forward, with ISPs effectively refusing to pay Internet companies for their content and services. Ultimately, monetisation mechanisms matured and content providers were able to invest in popular content and services that led to revenue from advertising or subscriptions. This content increased Internet adoption and usage, raising demand for higher bandwidth offerings to accommodate video and other multimedia services. As a result of the success of online content offerings, the calls for compensation have reversed, with ISPs seeking payment

31 RIPE Labs (2022), *Content vs Carriage – Who Pays?* Available at: https://labs.ripe.net/author/gih/content-vs-carriage-who-pays/

from content providers. These calls often put forward the cost of terminating traffic to end users and the cost of upgrading ISP networks as a justification for payments from content providers to ISPs.

The Internet is built through interconnection agreements between providers to exchange traffic. Even though many of the earliest ISPs were telecoms companies subject to economic regulation, including for voice interconnection, they were not regulated at the IP interconnection level. Instead, the ISPs voluntarily negotiated interconnection arrangements among themselves. These were known generally as **peering** or **transit** arrangements, and have adapted to all of the changes to the Internet over the years.

Internet providers addressed the need to interconnect with the collaborative approach that marked the Internet from its earliest development through today. In the beginning, ISPs with similar customer bases and traffic loads agreed to exchange their own customer's traffic with those of another ISP. As these ISPs were peers, this type of exchange became known as peering. Settlements for delivering traffic were generally not imposed, as the amount of traffic in both directions was roughly similar and payments would have cancelled out. This is sometimes referred to as **settlement-free** peering, or **bill and keep**, in which each provider charges its own customers for traffic delivery or termination, and not the other providers.

Even though settlements were included in some peering agreements (paid peering), the vast majority are based on 'handshake' agreements without formal contracts or written documents. According to a recent survey in 2021,[32] Packet Clearing House found out that the percentage of 'handshake' peering agreements increased from 99.51% in 2011 to 99.998% in 2021.[33] This implies that the vast majority of peering agreements did not involve written contracts. The survey also found that 99.9996% of agreements had symmetric peering terms in 2021, and that the remaining agreements had separate terms for the two parties, such as settlements. However, these figures can vary according to market conditions, as is the case in France as reported by ARCEP and described in Section 3.1 ('*Peering and transit remain partial substitutes*').

Peering is a bilateral relationship, exchanging traffic from the customers of each peering partner, and one peering partner will not accept traffic that the other partner received from another peer. As a result, each provider needs many bilateral peering agreements to reach the entire Internet. One change that facilitated peering was the rise of Internet exchange points (IXPs), where members could join and peer with other members through common switches to lower the cost of peering. Nevertheless, only a few so-called Tier 1 providers, also known as backbones, have been able to access the entire Internet through peering. These larger backbones in turn sell this access to the Internet to smaller ISPs, a service known as 'transit'.

32 Packet Clearing House (2021), 2021 Survey of Internet Carrier Interconnection Agreements. Available at https://www.pch.net/resources/Papers/peering-survey/PCH-Peering-Survey-2021/PCH-Peering-Survey-2021.pdf

33 The survey analysed 6.5 million peering agreements (including pairs of agreements); it should be noted that the percentages mentioned above reflect the number of agreements rather than the volume of traffic carried.

The result of these commercially negotiated peering and transit agreements is the 'network of networks' that is the Internet. These agreements highlight several important principles of the Internet. First, that the Internet is **decentralised** – there is no gatekeeper deciding which networks can join the Internet and how they should do so. As a result, the Internet is open to any network to arrange interconnection with other networks and become a part of the Internet. This principle of **openness** also makes the Internet **flexible** to networks using any technology – including fixed or mobile – that have adopted the Internet protocols that allow traffic exchange.[34]

As the usage of the Internet shifted over the years, some peering providers started to develop peering criteria as part of their agreements. One aspect of peering was to share the cost of delivering traffic between the partners. This involved interconnecting in multiple locations across a country or region in order to share the distance that traffic is carried, and setting a ratio on the incoming traffic accepted versus the outgoing, in order to share the volume of traffic that is carried. Together, these can be referred to as equalising the (*distance x volume*) of the traffic exchange. Many providers developed peering policies outlining the conditions under which they peered, some of which are publicly available.[35]

2.2 The fabric of interconnection on the Internet evolved to support new services, including public cloud and video streaming, without the need for regulation

Over time the Internet changed in countless ways, including in the breadth of usage within and across countries, and in the depth of usage, impacting communications, commerce, and entertainment. One significant shift with an impact on interconnection was the move from largely text-based, serial interaction, such as emails, to multimedia, immediate interactions such as video and music streaming or online gaming. This was driven by new online business models typified by Spotify, YouTube and Fortnite, but also the transition of traditional content businesses including broadcasters to be able to deliver their services online. Another more recent shift was the explosion in online collaboration and remote working enabled by cloud services.

Many (but not all) of these applications rely on asymmetric traffic and bandwidth[36] flows: end users are primarily consuming content by requesting and receiving data from the Internet. ISPs have long designed their networks asymmetrically, thanks to technology such as ADSL,[37] cable broadband

34 Analysys Mason (2021), *Study on the Internet's technical success factors*. Available at https://www.analysysmason.com/consulting-redirect/reports/study-the-internets-technical-success-factors/

35 Please see details of Swisscom's peering policies, available at https://www.swisscom.ch/en/business/wholesale/angebot/interkonnektion/ip-peering-transit.html and details of Orange's peering policies, available at https://internationalcarriers.orange.com/en/peering-policy.html#:~:text=Orange%20accepts%20a%20certain%20level,set%20at%202.5%20to%201

36 Bandwidth refers to the amount of traffic that can be delivered within a set time interval, and is the main determinant of network dimensioning and costs; data available from ETNO and regulators such as Ofcom show that data traffic has been growing much more rapidly than the bandwidth sold by ISPs to end users in their Internet access products

37 Asymmetric digital subscriber line, a technology used to carry IP packets through a broadband connection over a copper telephone line

systems using the DOCSIS standard,[38] and even state-of-the-art technology such as GPON[39] and 5G.

In the interconnection space, this asymmetry led to a change in the (*distance x volume*) exchanges between peering partners. Some transit providers took video providers as customers and began to deliver more traffic than they received, which began to exceed the ratios in some ISPs' peering policies, with resulting peering disputes. At the same time, the increased reliance on the Internet for quality-sensitive services, including streaming but also video calling and online applications, led to concerns that 'best effort' routing of traffic across networks did not give enough guarantees that end users would get a good, consistent quality of experience.

Content providers responded to concerns about the increased (*distance x volume*) metric for their traffic by lowering the distance the traffic travelled, in compensation for the increased volume. This was done initially through transit providers, but then through dedicated content delivery networks operated by commercial operators (e.g. Akamai, Fastly, Cloudflare and public cloud providers' own commercial CDNs) or by content providers themselves (e.g. Google Global Cache, Netflix Open Connect). In all these scenarios, the traffic is delivered to the receiving ISP in a location where its interconnection capacity can be deployed or upgraded at low cost.

In addition to lowering the costs for the receiving ISPs, this shift in the location of traffic delivery helped improve quality of experience for users, by ensuring traffic is delivered directly to the network to which a given end user is connected. Now, while traffic flows may overall have remained asymmetrical, the interconnection relationship provided mutual value for both parties. In addition, in a few cases, interconnection partners negotiated paid peering, where the content provider would pay the ISP for delivering the increased ratio of downstream traffic to their subscribers; these arrangements are rare, and remain entirely voluntary (outside of South Korea).

CDNs developed to enable any content provider to bring traffic closer to ISPs and end users, reducing the cost of delivering traffic and improving quality. CDNs rely on technology to optimise the delivery of online content that is **static and asynchronous**, including many videos, music, podcasts and pictures. This type of content does not change with each viewing and do not need to be consumed at a specific time. As a result, CDNs can distribute content through a network of caches that store and serve content at points of presence where CDNs interconnect with ISPs, and in some cases directly inside ISP networks through 'embedded' or 'on-net' caches. The result is that data-intensive content like video only needs to be sent once to each cache, and from there can be served to users, reducing the traffic in the core network. This leads to significant savings for ISPs as they

38 Data Over Cable Service Interface Specifications, a technology enabling part of the capacity of cable TV networks to be used for broadband connectivity

39 Gigabit passive optical network, a technology that enables IP packets to be carried through a broadband connection over a full fibre-optic link all the way to the end-user location

do not have to use transit to access the content further away and can receive content close to or directly in their networks.[40]

As Internet companies grew, providing content, online applications, and/or public cloud services, they began to invest in their own data centres for hosting and processing content and data, and to transport and deliver content closer to the ISPs, through submarine and terrestrial fibre network and caches.[41]

Today, there are three primary content delivery mechanisms, which progressively lower the cost to the ISP and improve the quality of service, either directly or through third-party CDNs. The option selected depends on the amount of traffic delivered and the preferences of the ISP. Any of the options listed below may be supplemented with paid peering, resulting from voluntary negotiations between the parties:

- Internet companies (which could be content and application providers themselves, CDN operators, or public cloud providers), like transit providers, may exchange traffic with an ISP in multiple locations, typically in IXPs, and can arrange to deliver the traffic to the ISP at an exchange point closest to the ISP's customers. At relatively low levels of traffic this would typically be done with **public peering**, through the shared IXP switch.

- As the amount of traffic grows, public peering can become congested or unwieldy, and Internet companies and ISPs can agree to expand **private peering**, involving direct connections between themselves. Private connections between the two providers can more easily be upgraded to avoid congestion as traffic and bandwidth requirements grow.

- Finally, Internet companies can embed caches directly in the network of an ISP in one or multiple locations, referred to as **on-net caching**. This on-net caching can be done directly by a content provider through their own CDN, or indirectly by commercial CDN operators including public cloud providers, on behalf of many other content providers. Caches allow content to be delivered once, stored within the network of the ISP, and served on demand to end users without going back to peering points. This further reduces the cost for the ISP in whose network the cache is embedded, and also improves user quality of experience as the ISP can fully manage the connection from the cache to the end user.

In all these scenarios, Internet companies including content, cloud and CDN providers, invest in infrastructure to lower the cost of the traffic for the ISP, and together the providers can manage the quality of experience on behalf of their customers. Increasingly, as cloud providers begin offering their own CDN services to third-party customers, efficient delivery is opened to a wider variety of

40 Analysys Mason recently released a report showing that the use of the Netflix Open Connect CDN alone reduced the transport costs for ISPs by USD1 billion in 2021. Analysys Mason (2022), *Netflix's Open Connect program and codec optimisation helped ISPs save over USD1 billion globally in 2021*. Available at https://www.analysysmason.com/netflix-open-connect

41 Please note that we published a report on this topic in 2018 and are currently in the process of updating it and issuing an updated report. Analysys Mason (2018), *Infrastructure investment by online service providers*. Available at https://www.analysysmason.com/consulting-redirect/reports/online-service-providers-internet-infrastructure-dec2018/

content and services. In turn, ISPs are able to interconnect efficiently with CDNs to get access to an ever-wider range of content and services from various providers, at lower costs and higher quality than would be possible otherwise. End users respond to lower price and higher quality through increased demand for higher-bandwidth access services, which stimulates further demand for content, in a virtuous circle.

Public cloud services are used by a rapidly increasing number of companies and public service organisations, large and small, as part of their efforts to digitise their operations and their offerings. In order to get access to those public cloud services, and to deliver services hosted on the cloud to end users, companies rely on CDNs. Some early and heavy users of public cloud services are companies who are themselves offering online services and content, including audio and video. Some of them, such as Spotify and SoundCloud, are 'digital native' and were created as Internet-first companies. Others, including European TV and radio broadcasters, are now relying extensively on the Internet in order to reach audiences and provide them with the services they demand, and do so through public cloud services. For these companies, the ability to use cloud infrastructure and content delivery services is essential to reach existing and new audiences efficiently, in their home markets and globally.

2.3 Commercial interconnection between content providers and ISPs is based on a balance of bargaining power that benefits all stakeholders

The basis for voluntary negotiations of interconnection agreements is a balance in the bargaining power of content providers and ISPs that underpins a mutually beneficial relationship. Content providers such as Netflix and Disney, but also Spotify or the BBC, have desirable content, some of which is licensed from third parties, and some developed in-house. These providers attract users due to their unique content offering, and this in turn drives demand for Internet connections provided by ISPs. Richer content and applications further drive end users' appetite for higher-speed broadband services, such as those enabled by fibre and 5G.

In general, the bargaining power of the two sides should be countervailing, as the question of who provides more value is a chicken and egg problem – content attracts broadband subscribers, who subscribe to view content. Typically the two sides have co-operated, as seen in the efforts by CDNs to deliver the content closer to the ISP end users, to lower costs for the ISPs and improve quality of experience (e.g. video or music streaming) for their customers.

Internet companies have always been willing to interconnect and been flexible in how that should be done, particularly so in large, mature markets like those in which ETNO members operate. The nature of the Internet is that all content and services are available to all users in countries where they are made available – indeed, this is a principle of the Internet – and the basis of the network of networks – that any end user can reach any destination, either directly or indirectly.[42] This willingness results in content providers frequently peering with anyone at an IXP (also known as

42 Some services may not be available in some countries, for instance if they cannot license sufficient content for those countries, but in countries where services are available, they are available to all ISPs.

open peering) and to upgrade to direct peering or on-net caches depending on traffic volume. This willingness is apparent even in the case of content providers that have unique content that is in high demand, which demonstrates the balance of bargaining power.

On the other hand, ISPs have what is known as a 'termination monopoly', as the only way for content to reach their subscribers at any given point in time. This concept is familiar in telecoms markets, in which mobile operators charged a high price for terminating calls to their subscribers from other networks. These termination rates were paid by the subscribers of the other networks initiating the calls, artificially raising the cost of calls, until regulation intervened to impose cost-based termination rates. A similar termination monopoly has not led to much competitive abuse thus far in the Internet, aside from disputes we discuss in Section 3.2 below, but if regulators decided to grant ISPs' wish to impose regulated charges for interconnection and network usage, they would effectively enable the monetisation of this termination monopoly.

As noted above, peering began as a co-operative arrangement between ISPs that were peers, in terms of the traffic balance and size of the network. As the traffic balance changed, notably as a result of rich content including video, gaming and other online and cloud-hosted services, interconnection arrangements began to shift to deliver traffic closer to the ISPs and maintain the mutual benefits for both parties willingly entering the interconnection arrangement. These changes reflect a continued balance of power and interests between content providers and ISPs, in which each relies on the other in a mutually beneficial relationship. In the next section, we examine whether there are any developments that change the fundamental balance of power underlying commercial negotiation of interconnection arrangements.

3 Recent developments in the interconnection market

In both 2012 and 2017, BEREC concluded that interconnection did not need to be regulated; trends and interconnection disputes since that time confirm that the existing interconnection ecosystem still does not require regulatory intervention. Reviewing the evidence in the last five years shows that the changes are an evolution, not a revolution, and not ones that undermine the current unregulated and commercially negotiated practice for IP interconnection on the Internet.

Nonetheless, interconnection disputes and specific practices highlighted in recent reviews support the view that large ISPs are sometimes able to leverage a 'termination monopoly' over their broadband subscribers to improve their bargaining position in negotiations with Internet companies. This tends towards transit or paid peering, although settlement-free peering remains favoured by Internet companies and many ISPs, and is increasingly common.

A further development that is important for Europe's Digital Decade ambitions is the growing importance of public cloud services, which many businesses, public sector organisations and consumers are increasingly using on a daily basis for productivity, communication, and to interact and deliver content and services to their own customers. Public cloud users benefit from high quality, low cost, scalable Internet interconnection between public cloud platforms, CDN providers and ISPs. Regulated interconnection rates could increase the costs to these users, with an impact on the Digital Decade outcomes.

In this section, we review the evidence of changes in the last few years by looking at changing dynamics since BEREC's 2017 report on IP interconnection practices, and by reviewing disputes relating to IP interconnection agreements since that time:

- In Section 3.1, we analyse the major changes since 2017, such as steadily increasing traffic, the role of IXPs, the balance between peering and transit, as well as CDNs and new business models. The changes in each area show that the markets have evolved and mostly continue the trends observed in BEREC's 2017 report.
- In Section 3.2, we examine interconnection agreement disputes between players in the past five years. We note that regulators rarely needed to step into these disputes, with a notable exception being when the incumbent telco in Switzerland was found to have exploited its market power.
- In Section 3.3, we explain how the current flexibility in interconnection arrangements are key to the effectiveness and the economics of CDNs that underpin the delivery of traffic from public cloud, to the benefit of millions of businesses and consumers in Europe and globally, including European content providers who rely on public cloud for their online business.

3.1 The trends identified by BEREC in 2017 are progressing in a way that remains consistent with earlier findings

As noted above, in 2017 BEREC produced a report on IP interconnection practices.[43] The report analysed major developments around traffic, IXPs, peering and CDNs, while concluding that commercially negotiated interconnection arrangements worked well without intervention. In light of the recent debate around fair contributions by Internet companies, we understand that BEREC may review the interconnection market in the near future to assess, and if relevant address, changes since 2017.

In this section, we review the main areas of interest mentioned in BEREC's 2017 report, as well as other major changes since then. We come to the conclusion that these changes, whilst significant and persistent, do not appear to undermine BEREC's previous findings, and certainly would not warrant the intervention proposed by ETNO.

Flexibility and adaptability are core dimensions of the success of the Internet that did not require regulatory intervention, and indeed thrived without regulation.[44] This flexibility and adaptability are critical for scalability, and to satisfy increased levels of demand.[45] Indeed, peering is widely seen as the most efficient and scalable way to support traffic growth and consistent quality of service.[46] As peering can only be agreed if both parties (Internet company and ISP) agree to peer, there is an in-built degree of countervailing bargaining power for both ISPs and Internet companies; this is made clear by the interconnection policies of some large ISPs, which have translated to negotiated payments from Internet companies delivering traffic for themselves or on behalf of their own customers, including public cloud users.

In particular, the overall conclusion is that voluntary peering continues to grow in prominence, to meet the need to deliver increased traffic with better quality and at lower costs. Furthermore, content continues shifting to CDNs, and peering is shifting toward private connections, sometimes paid. However, IXPs still play an important role in traffic exchange.

Internet traffic continues to grow, accelerated by Covid-19

In its 2017 report, BEREC found that traffic was growing, fuelled in particular by video traffic. Growth remains high and there was a rapid increase in average traffic during the Covid-19 pandemic. Between 2018 and 2022 traffic grew by 27% annually, as an average across Europe, while it peaked

43 See Footnote 21

44 See Footnote 34

45 OECD (2022), *Broadband Networks of the future*. Available at https://www.oecd-ilibrary.org/science-and-technology/broadband-networks-of-the-future_755e2d0c-en

46 DRPeering (2022), *Access Power Peering*, Available at http://drpeering.net/HTML_IPP/chapters/ch10-6-Evolution-6-Access-Power-Peering/ch10-6-Evolution-6-Access-Power-Peering.html

at 32% growth during the pandemic between 2019-20. Since then, growth appears to have slowed somewhat, although it remains sustained.[47]

Video continues to drive traffic volumes: globally video represented 73% of total IP traffic in 2016 and 82% in 2021.[48] This reflects the transition of demand to entertainment online, supplied by Internet companies such as Netflix, Amazon or Google, traditional media players such as Disney and television broadcasters actively delivering live and on-demand content online, through public cloud and CDNs.

With the exception of a few disputes, content providers and ISPs have so far managed to deal with increased traffic growth. The evolution of interconnection to support this growth has occurred in the context of commercially negotiated agreements and mutual dependence, a context in which the Internet has been able to cope with increased demand. When there were perceived risks of congestion, agreements were found: for example, streaming companies reduced the resolution of their videos in the early days of Covid-19 lockdowns to address concerns that an increase in demand for in-home entertainment might overload networks.[49] The share of uploaded traffic also increased, due to videoconferencing and work-from-home arrangements. In France, ARCEP reported that upstream traffic increased by 36% between H2 2019 and H1 2020, whereas downstream traffic increased by 26%.[50]

In addition, despite the surge in demand due to the Covid-19 pandemic,[51] traffic growth rates appeared to decline in 2021. This suggests that the stable traffic growth observed as part of the 2017 BEREC report remains broadly relevant, hence supporting the fact that the changes represent an evolution rather than revolution, and that the IP interconnection market has evolved to support continuously increasing traffic levels, as also concluded as part of BEREC's 2017 analysis.

Interconnection happens in ever more locations, including IXPs, as Internet companies invest to deliver content efficiently, closer to ISPs and end users

BEREC's 2017 report suggested that multilateral peering (where more than two parties exchange traffic through a public switch) would gain prominence, and hence that IXPs (where public peering typically takes place) would also have a more prominent role.

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47 TeleGeography (2021), *Global Internet Geography*. Available at https://www.telegeography.com/products/global-Internet-geography/analysis/executive-summary/index.html

48 Cisco (2021), *Global – 2021 Forecast Highlights*. Available at https://www.cisco.com/c/dam/m/en_us/solutions/service-provider/vni-forecast-highlights/pdf/Global_2021_Forecast_Highlights.pdf

49 YouTube agreed to switch all traffic to standard definition by default temporarily, whereas Netflix announced to cut traffic by 25% at the beginning of Covid pandemic, following European Commissioner Thierry Breton's request to maintain smooth functioning of the networks during the pandemic

50 ARCEP (2022), *The state of the Internet in France*. Available at https://en.arcep.fr/uploads/tx_gspublication/report-state-Internet-2022-300622.pdf

51 See for example https://blog.telegeography.com/the-global-internet-post-pandemic

In line with general increase in traffic levels, IXPs have continued experiencing growing traffic since 2017. Both the number of IXPs and traffic at IXPs have seen an increase in Europe. The number of known operating IXPs in Europe reached 255 in 2020, from 198 in 2017, while the average aggregated peak traffic for IXPs in Europe (those with Euro-IX membership) has grown from 26 136Gbit/s to 45 325Gbit/s over the same period.[52]

In addition to this growth in traffic exchanged at IXPs, a broader trend that is now visible is the multiplication of private peering locations over and above IXPs themselves. According to a recent WIK report, private peering traffic has grown faster than public peering through IXPs. In Germany, for example, DE-CIX in Frankfurt used to handle 50% of IP traffic ten years ago, while it handles around 25% of traffic currently.[53] This implies that private peering is increasingly chosen as the preferred means to exchange traffic, subject to ISPs' peering policies allowing it.

It is worth noting that often the private peering takes place in the same facilities where IXPs are located, which highlights the importance of IXPs as central meeting places.[54] In addition, public peering at IXPs still plays an important role, especially for smaller players or to ensure back-up and resilience.

As a result, BEREC's expectation in 2017 that IXPs would gain in prominence has largely been validated, while private peering and other direct forms of interconnection (such as on-net CDNs) have grown in importance.

Peering and transit remain partial substitutes, with some ISPs restricting traffic delivery to their end users through a form of transit that is equivalent to paid peering

In 2017, the BEREC report suggested that there is partial substitutability between peering and transit. Peering involves a direct connection between networks, including end user networks, and is therefore usually perceived to be a good substitute for transit for such networks. Conversely, transit is generally an indirect interconnection relationship, with no guarantees on the routing of traffic to end users and the resulting quality of service. Nevertheless, the BEREC report stated that although the importance of transit has been declining over time, mainly due to CDNs, it still plays an important role as a partial substitute for peering and could provide a constraint on paid peering negotiations.

As traffic grows and the Internet is used for ever more applications, capacity and quality requirements increase, and peering becomes even more relevant. Furthermore, as peering relationships develop, the relative demand for transit reduces, putting downward pressure on transit prices. Conversely, in South Korea, where network usage fees payable by content providers to ISPs

52 Euro-IX (2020), *Internet Exchange Points 2020 Report*. Available at https://www.euro-ix.net/media/filer_public/cf/7c/cf7c8cb1-40c9-4e37-9d79-02b61ccc081e/ixp_report_2020_.pdf

53 See Footnote 30

54 LINX, the large IXP in London, offers a Private Interconnect service for private peering within one of the connected data centres, and also across a number of data centres for two connected members who are not in the same data centre. See https://www.linx.net/services/private-interconnect/

have been imposed by law, as shown in Section 4.2, transit prices are higher than in neighbouring countries.[55]

France is one of the rare countries for which comprehensive interconnection data is publicly available. ARCEP, the French communications regulator, began to gather data on IP interconnection in response to increased tensions between ISPs and content providers, in order to monitor the risks of anti-competitive discrimination.[56]

The data in France, and anecdotal evidence from our discussions with many Internet companies and ISPs in recent months, support the findings of BEREC's 2017 report: public and private peering has continued to gain usage in the past five years, and content from more and more sources are exchanged through peering as public cloud usage develops. ARCEP reports that the proportion of inbound traffic of the main ISPs in France shows that peering increased from 36% in 2012 to 52% in 2021; while transit dropped from 64% to 48% in the same period.

In some cases, peering relationships are subject to negotiated payments to individual ISPs. In France, ARCEP reports that paid peering applied to 48% of the inbound traffic of the main ISPs in 2021.[57] Paid peering is not commonly used in other markets, but in some cases, restrictive ISP peering policies force some parties to use transit offer instead of peering. In practice, this leads to a similar outcome as paid peering. For instance, WIK-Consult reports that Deutsche Telekom operates a strict peering policy that Internet companies who are not ISPs cannot meet; this requires these companies to purchase transit from Deutsche Telekom instead. To the extent that this transit relationship is only used to exchange traffic with Deutsche Telekom's retail customers, it is similar to a paid peering arrangement (see Section 3.2 for further discussion).[58]

These dynamics demonstrate that peering and transit continue to co-exist in the interconnection market with commercially negotiated agreements and a degree of substitutability, in keeping with BEREC's 2017 findings. Importantly, some of the evidence in the public domain shows that large ISPs have bargaining power in the market: they are able to restrict peering and impose transit charges instead.

CDNs, including on-net caches, are becoming ever more important and effective

In 2017, BEREC found that CDNs account for a growing share of total traffic. The development of CDNs, more recently using on-net caches, has continued, shifting IP interconnection traffic flows. CDNs are increasingly connecting directly to ISP networks and deploying 'deeper' caches (defined

55 See TeleGeography (2021), *Global Internet Geography*. Available at https://www.telegeography.com/products/global-internet-geography/analysis/executive-summary/index.html

56 ARCEP (2017), *The state of the Internet in France*. Available at Section 2.2 of https://www.arcep.fr/uploads/tx_gspublication/State-Of-Internet-in-France-2017_may2017.pdf

57 ARCEP (2022), *see* Footnote 50

58 See WIK-Consult (2022) pages 43-44. There also appears to be some evidence of pricing power by some large ISPs: for example, in Germany, Deutsche Telekom is positioning its transit product at a premium price, idem. page 41

as on-net), enabling better quality of service and the delivery of new services. This trend has started bringing the interconnection points closer to ISPs, while shortening or completely eliminating the distance of traffic carried within ISP core networks.

The data available for France does show a significant increase in the importance of on-net caching over time. According to ARCEP, the percentage of inbound traffic that is delivered through on-net CDNs for the main ISPs in France has increased from 11% in 2017 to 21% in 2020 (leaving 79% for peering and transit). This is likely to underestimate broader trends; as we understand from discussions with ISPs and Internet companies active in other European markets, France is an outlier and on-net CDNs deliver a greater share of total traffic in most countries.

The market continues to evolve in other ways not evident when BEREC wrote its 2017 report. Some content providers are developing their own CDNs; others[59] are using multiple CDNs to deliver traffic. There is no 'one-size-fits-all approach' to CDNs, but interesting innovations are being explored, including for example a new model using open caches.[60] Open caching is a specification that allows caches (in ISP networks) to receive and store content from different providers using a harmonised technical approach, as well as rendering management of caches easier and more visible. This could bring the benefits of online caching to more content providers and reduce the number of on-net caches that ISPs deploy. If adopted widely, open caching would mean that content providers, without their own CDNs or commercial CDNs, can deliver content to ISPs, while ISPs can charge for CDN services.

Open caching architecture has been developed by various companies as part of the Streaming Video Alliance (SVA). SVA tested open caching with a few companies such as Disney, Telefónica and BT which implemented the specifications. Recently Disney and Lumen Technologies partnered to develop open caching metadata and APIs, under the guidance of SVA. Notwithstanding the support from some companies, the concept is reasonably new, and CDNs and large content providers that have invested substantially in their own CDN networks are likely to need further convincing.

In summary, and similar to what was noted in BEREC's 2017 report, CDNs and on-net CDNs continue to improve the efficiency of interconnection, leading to improved performance and reduced costs for ISPs. This highlights how the market has evolved through voluntary commercial negotiations and the mutual dependence between content providers and ISPs.

Market trends continue to support the growth and development of the Internet as a vector for ever more applications in the digital economy, consistent with BEREC's 2017 findings

Since 2017, Internet traffic has continued to grow and the interconnection market has evolved with some changing dynamics, such as the increasing popularity of peering at the expense of transit. At the same time, content providers have continued to invest in networks to maintain quality of experience for their

59 For example Disney, see https://www.csimagazine.com/csi/Disney-eating-up-Euro-peering-traffic-with-multi-CDN-approach.php

60 See for example https://www.qwilt.com/company/disney-streaming-services-open-caching-video/

end users. Large content providers have continued to use CDNs and on-net caches (self-provided or from third-party CDN providers) to carry increasing amounts of video traffic, which then ensures quality delivery and lowers costs for the ISPs. In the case of the larger ISPs that are willing to negotiate, the content providers privately peer or embed caches in their networks, with the option of paid peering.

ETNO has acknowledged that their members have been able to handle the current traffic loads and this is confirmed by Netflix's ISP speed index, which shows that even high definition video streaming does not come close to using the bandwidth advertised by ISPs selling broadband Internet access.[61] Indeed, Netflix shows that the average bandwidth used to deliver their content to European end users is around 3.4Mbit/s, thanks in part to effective encoding.[62]

In combination with these developments, commercial negotiations have evolved to accommodate new trends and bargaining relationships between players, including cases where large ISPs are able to extract negotiated payments from Internet companies by restricting peering and forcing them to use transit, as discussed further in the next section. For smaller ISPs, conversely, the trends towards more peering, through many Internet companies' open peering policies, and embedded caching, all help mitigate the cost of operating competitively at smaller scale than large incumbent operators. This helps support competition and investment in the ISP market, beyond those large incumbents (see also Section 4 for further discussion).

Together, these trends show the potential of negotiated interconnection agreements to respond to increasing levels of demand and changing market dynamics. The absence of regulation does not appear to have hampered the growth and responsiveness of the Internet to significant challenges including Covid-19. BEREC's 2017 position therefore appears to still be valid today: regulatory intervention in the interconnection market remains unnecessary and potentially harmful.

3.2 Interconnection disputes provide evidence of ISPs' termination monopoly

The structure of the European broadband market ensures ISPs have a 'termination monopoly' on access to their subscribers, particularly on fixed networks that account for over 90% of traffic

Fixed broadband networks handle the vast majority of traffic in Europe. ETNO's State of Digital 2022[63] shows that, on average, individual fixed connections handled nearly 300GB per month in 2021, compared to 8.5GB for mobile connections. At an aggregate level, fixed connections handle over 90% of total Internet traffic to and from end users.[64]

61 Netflix (2022), *ISP Speed Index*. Available at https://ispspeedindex.netflix.net/global

62 See Footnote 40

63 ETNO (2022), *State of Digital 2022*, https://etno.eu/library/reports/104-state-of-digi-2022.html (data for this report is provided by Analysys Mason's Research practice)

64 ETNO reports around 200 million fixed connections including FWA in 2021, and 107% 4G + 5G mobile penetration in the same period, which is around 600 million connections.

The norm is for households to have a single fixed broadband subscription from a single ISP. Typically they sign up for a fixed-duration contract, and therefore at any given point in time they can only access the Internet through one fixed ISP. This is called 'single-homing'.

Although each European household typically also has access to multiple mobile broadband connections, outside of specific products marketed as substitutes to fixed broadband, these mobile connections are associated with individuals, not the household per se. Furthermore, a major difference between fixed and mobile broadband lies in the widespread availability of unlimited data packages for fixed broadband, and their rarity for mobile broadband. Again according to ETNO's State of Digital 2022, this results in average monthly spend per GB of EUR1.89 per mobile connection, compared to EUR0.07 on fixed connections.

An important consequence of single homing is that fixed ISPs operate a 'termination monopoly' on fixed broadband connection, which has implications for their bargaining position in negotiating interconnection agreements.[65]

Disputes in the USA and Europe illustrate how ISPs have been able to exercise their termination monopoly to influence bargaining in interconnection relationships

Two sets of disputes provide some evidence of ISPs foreclosing adequate access to their end users to some Internet traffic via interconnection, as a means to influence commercial negotiations.

In the USA, Netflix ran into separate disputes with Verizon and Comcast between 2012 and 2014.[66] In order to deliver content, Netflix used transit providers, whom it paid to carry and deliver traffic to its customers' ISP. One of these transit providers, Cogent, was initially able to peer settlement-free with to Comcast and Verizon. The dispute started when Comcast and Verizon argued that the traffic flowing from Netflix to their consumers was increasing rapidly, which violated the peering policy they had agreed with the transit providers upon which Netflix was relying. At the same time, Netflix argued that it paid transit fees and that the peering points should be maintained. Over time, the transit routes became congested and resulted in the viewing quality falling to then-SD level (significantly below today's standard definition). Cogent's CEO claimed that Comcast stopped investing in the Comcast–Cogent interconnection links after Cogent started to carry Netflix traffic.[67]

65 Technically there is also a termination monopoly on mobile broadband connections, but it is easier for consumers to 'multi-home' by using multiple broadband connections; for example in a typical household, there will be three or four concurrent mobile connections available, which could be shared through WiFi tethering relatively easily. As discussed here, this is not particularly relevant to the discussion of network usage fees, because the vast majority of traffic is carried on fixed networks and the prices consumers pay for mobile broadband does not allow them to substitute their fixed broadband consumption with mobile broadband.

66 TIME (2014), *Here's Why Your Netflix Is Slowing Down*. Available at https://time.com/8681/netflix-verizon-peering/

67 CNET (2014*), Cogent: Comcast forced Netflix with clever traffic clogging*. Available at https://www.cnet.com/tech/services-and-software/cogent-says-comcast-forced-netflix-interconnection-deal-with-clever-traffic-clogging/

Following the deterioration of streaming quality and complaints from consumers, Netflix and Comcast reached a paid agreement in February 2014 for a direct connection between Comcast and Netflix's CDN, Open Connect.[68] Similarly, Netflix also agreed on a paid agreement with Verizon in April 2014. Following the agreements, the viewing quality was then seen to increase from SD level back to HD-quality level for the end users.

The second example demonstrates how large ISPs can leverage their termination monopoly as a competitive tool vis-à-vis smaller ISPs.

In Switzerland in 2011, small ISP Init7 satisfied Swisscom's advertised settlement-free peering conditions, in order to deliver traffic to and collect traffic from Swisscom's Internet access customers. In 2012, Swisscom asked for unusually high interconnection prices (CHF3 per Mbit/s for traffic beyond the 2:1 ratio) from the smaller ISP Init7, when their settlement-free peering agreement ended.[69] As a result, Init7 sued Swisscom for abusing its market power. While the dispute was in process, Swisscom throttled Init7's peering connection without any warning. This is understood to have caused Init7 to lose important transit customers such as the TV streaming provider, Zattoo, which stopped its transit agreement with Init7 and agreed on a paid-peering agreement with Swisscom instead.

Furthermore, at one point during the dispute, Swisscom struck a commercial agreement with Deutsche Telekom that meant any network that wanted to reach Swisscom through transit had to go through Deutsche Telkom's transit arm. This linked Swisscom's termination monopoly with the commercial product of Deutsche Telekom, in a way that forced any party excluded from peering directly to pay Swisscom to terminate traffic to its end users.

The Swiss Federal Administrative Court in 2020 accepted Init7's claim that market power was abused. While a court finding is rare, the dispute exemplifies discrimination by large ISPs against smaller players in the context of bargaining power for interconnection agreements. The trend towards more direct peering, a denser and more distributed 'fabric' of interconnection points, and open peering policies, are all beneficial to smaller ISPs, and conversely, as discussed further in Section 4, more restrictive interconnection policies, including mandated network usage fees, are likely to benefit larger ISPs at the expense of smaller ISPs.

In both sets of examples mentioned above, ISPs chose to exercise their termination monopoly. The disputes were eventually resolved either commercially with mutually beneficial agreements, or through a court, with fewer clear benefits given the time and cost associated with such processes. However overall, the infrequency of disputes, when considered in conjunction with the potential negative impacts of regulated usage fees, illustrate how commercially negotiated agreements have

68 The Wall Street Journal (2014), *Netflix to Pay Comcast for Smoother Streaming*. Available at https://www.wsj.com/articles/SB10001424052702304834704579401071892041790

69 DENOG (2020), *Peering with the Incumbent.* Available at https://www.denog.de/media/DENOG12/Day1_1415_peering_with_the_incumbent_init7_fredy_kuenzler.pdf

worked well so far and how they have helped provide a flexible environment for new developments in IP interconnection.

Large ISPs have been able to gain bargaining power from their termination monopoly, by imposing transit or paid peering charges that Internet companies cannot readily circumvent

In Europe, some ISPs appear to be able to impose selective peering policies or simply refuse to peer with content providers and CDNs, or to limit the number of interconnection locations, without causing a dispute per se. Although this is rare globally, we understand this approach is used by some large European ISPs.[70] According to a study by WIK, Deutsche Telekom (DT) in Germany only peers with Tier 1 transit providers, restricting other interconnection partners including content and cloud providers to buying transit. As a result, DT does not allow on-net CDNs (embedded caches from content providers). The operator is also reported to be the only player of all the large ISPs and content providers in Germany that enforces a traffic ratio limit.

This forces parties who wish to interconnect with these ISPs to either negotiate paid peering arrangements directly with the ISP in question, or go through a transit provider. However, transit does not provide any guarantees on the routing of traffic, and ISPs are able to restrict the capacity of their interconnection links with specific transit providers who carry traffic for specific content providers. As a result, content and CDN providers who are sensitive to quality of experience are incentivised to buy transit directly from the ISP (or from the transit provider arm of the ISP).[71] To some extent, the existence of negotiated paid peering (or 'forced transit') arrangements in countries such as France and Germany show that ISPs are able to exercise bargaining power and reach agreements without major disputes (see Section 3.1, '*Peering and transit remain partial substitutes*').

In addition to these examples, which arise in commercial negotiations but may be impacted indirectly by net neutrality and competition law constraints, some ISPs are starting to put pressure on regulators to regulate interconnection relationships and impose regulated traffic-related fees. Most such proposals, including by ETNO in Europe, refer to the South Korean precedent, which we discuss further in Section 4.2. This would entrench the practice of imposing paid peering charges, increasing costs across the Internet ecosystem, and could reduce or eliminate the competitive dynamics that are currently effective in preventing unjustified degradation of interconnection links.

In this context, we note that the European Commission has previously identified ISPs' termination monopoly as a potential risk for consumers' ability to access content and services of their choice. In the merger of Ziggo and Vodafone in the Netherlands, examined by the European Commission, a condition of the merger was that the combined entity would be required to maintain three uncongested transit routes to the Internet, to reduce the risk of asymmetric bargaining power in

70 See ARCEP (2022), Footnote 50; and WIK (2022), Footnote 30

71 Autorité de la concurrence, (2012), *20 September 2012 : Internet Traffic – Peering Agreements*. Available at https://www.autoritedelaconcurrence.fr/en/communiques-de-presse/20-september-2012-Internet-traffic-peering-agreements

favour of the combined entity, which would have reduced consumers' ability to access online services.

3.3 Many European businesses access and use public cloud services, with traffic exchanges through negotiated interconnection arrangements

A distinguishing feature of some of ETNO's proposals for Europe is the focus on a small number of Internet companies, designated by ETNO as "the top six tech giants".[72] This mirrors the importance of scale as a determinant of applicability of the new rules under the Digital Market and Digital Services Acts, enacted earlier this year in the European Union.

As far as interconnection and traffic delivery is concerned, it is important to note that three of these companies are major providers of public cloud services (AWS, Google Cloud and Microsoft Azure). These public cloud services are used extensively by businesses, public sector organisations, and by citizens and consumers across Europe. Many companies, including many very small businesses and SMEs, now rely on software-as-a-service running on public cloud for their productivity needs, and for business support services such as data storage, accounting and taxes, or human resources. The widespread availability of public cloud services supports the digitisation of small and large organisations and help to satisfy European digital economy goals.[73]

A core requirement for being able to use public cloud services is the ability to exchange traffic seamlessly with the public cloud providers. For larger and more sophisticated users, this can be done through a dedicated private network connectivity product called a 'cloud on-ramp', offered by an ISP and a cloud provider in partnership. For most users, however, including employees of larger companies working from home, the exchange of traffic happens over the Internet, and therefore relies on efficient, high quality interconnection arrangements.

In addition to using public cloud services for their internal operations, European online content and application providers, from broadcasters (ProSiebenSat 1 on AWS) to music streaming providers (Spotify on Google Cloud) to games companies (Ubisoft on Microsoft Azure), use public cloud infrastructure at the core of their products, and rely on cloud infrastructure being fully interconnected with the rest of the Internet and accessible to end users.

As part of their suite of public cloud services, public cloud providers including AWS, Google and Microsoft, have invested in extensive CDN networks.[74] These CDN services can be bundled or taken

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72 Alphabet, Amazon, Apple, Meta, Microsoft and Netflix

73 OECD identifies integration of cloud as one of four main trends: "integration of cloud services into networks". See Footnote 45. In addition Europe's Digital Decade targets for 2030 include reaching 75% of EU companies using cloud/AI/big data. Please see European Commission (2021), *Europe's Digital Decade: digital targets for 2030*. Available at https://ec.europa.eu/info/strategy/priorities-2019-2024/europe-fit-digital-age/europes-digital-decade-digital-targets-2030_en

74 Amazon CloudFront has 310 CDN points of presence (PoPs), Microsoft Azure CDN has 118 PoPs across 100 metro locations, and Google Cloud CDN has 146 PoPs. Commercial 'pure-play' CDN providers such as Limelight and Fastly have 140 and 72 PoPs respectively. Google Cloud is also launching Media CDN to leverage its embedded caches for streaming media.

up separately by their public cloud customers. Some public cloud providers built their CDNs for internal use and started to offer them to third parties, while others built them specifically to support public cloud services to deliver third-party content.

The availability of competitive CDN services from cloud providers and specialised third-party suppliers enables public cloud users to access the interconnection arrangements made by Internet companies who deliver traffic to ISPs. As discussed further in Section 4.2 below, a large disruption of the interconnection market such as the approach advocated by ETNO would have an impact not only on large content providers and CDNs, but also on businesses of all sizes, public sector organisations, and consumers, who rely on public cloud services provided by these Internet companies for everyday activities. Such developments could adversely impact European businesses who rely on the Internet to deliver their own content and applications, and hinder steps towards hitting digital economy targets and improving the competitiveness of European businesses.

4 Possible implications of network usage fees on European stakeholders

The evidence in favour of allowing negotiated, rather than regulated, interconnection is broad and deep. Negotiations supported the development of the commercial Internet, spread to every country, and evolved to reflect access- and content-related changes. Regulators considering a change in the status quo should look at the impact in the one country that has already made such a change, South Korea, where regulation has led to complexity and unintended consequences, and may yet prove detrimental to consumers and to investment; they should also consider the necessity for, and implications of such changes for Europe.

In this section, we discuss the potential impact of network usage fees as proposed in ETNO's recent publications on European stakeholders:

- Section 4.1 discusses the relevance of network usage fees in Europe, in the absence of clear evidence of a significant imbalance in bargaining position between large ISPs and Internet companies.
- Section 4.2 describes the situation in South Korea, where regulation appears to have discouraged peering and investment in the country, leading to higher costs for ISPs, initially lower quality for end users, and need for more regulation to correct unintended consequences.
- In Section 4.3, we conclude with a look at the likely impact of regulated network usage fees on the quality of service and costs, competition, and the broader digitalisation agenda of Europe, highlighting in particular the impact on public cloud users and on smaller ISPs.

4.1 Proponents of network usage fees have so far failed to provide convincing justification for regulatory intervention in Europe

ETNO has linked its most recent call for network usage fees to the pressure faced by telecoms operators to build out fibre to the home (FTTH) and 5G networks to meet Europe's Digital Decade targets. The argument in support of a network usage fee is that Internet companies should make a 'fair contribution' payment towards the building of the networks from which they would benefit; the argument for regulatory intervention to impose the network usage fee is that there is otherwise a bargaining imbalance in favour of Internet companies.

The arguments for a fair contribution put forward so far by ETNO and the large ISPs it represents seem to disregard the significant investments that Internet companies are already making, not only in content and R&D,[75] but also in Internet infrastructure, including undersea cable transport, data

[75] Internet companies are very large spenders on Research and Development (R&D); Amazon, Microsoft and Google collectively reported around USD100 billion in R&D expenditure in their respective 2021 fiscal year,

centres for hosting the traffic closer to the end users, and infrastructure to deliver the content to ISPs, including on-net caches.[76]

They also seem to underplay the fact that some ISPs have been able to negotiate paid peering agreements with content providers, as shown in ARCEP's State of the Internet reports and WIK-Consult's recent report for BNetzA.[77] As a result of these trends, Internet companies are already contributing to Internet infrastructure without a need for regulatory intervention, based on a negotiated position that reflects the incentives and bargaining power of each party.

With respect to the need for regulatory intervention, there is no clear market failure, no cost justification, and little evidence that the bargaining imbalance today favours the content providers. Instead, as discussed above, all evidence of disputes between content providers and ISPs stems from the actions of large ISPs. Otherwise, some large ISPs impose restrictive peering policies, or as in the case of Deutsche Telekom, refuse to peer with content providers; other ISPs have deliberately slowed down capacity upgrades for connections in order to improve their bargaining position, as shown in the examples of disputes involving Comcast and Swisscom in Section 3.2.

Where ISPs have imposed restrictive peering policies, Internet companies have continued to operate open peering policies while at the same time adapting to ISPs' demands in order to maintain the quality of their services to end users. Most large Internet companies have chosen to build their networks out to many European countries to deliver content directly where ISPs are present, and sometime inside ISPs' networks through on-net caches, in order to improve quality of service and reduce the overall costs of delivering traffic to end users, to their benefits but also to the benefit of ISPs.

Overall, the mechanisms suggested by ETNO members for Internet companies to contribute directly to ISPs' revenues through regulated traffic-related charges have not been convincingly or rigorously justified. Internet companies do not originate traffic in a vacuum, they respond to requests from ISP subscribers. The content they deliver, including through a combination of in-house and third-party CDNs, is the result of billions of dollars of investment, and content in general is the reason that users subscribe to broadband. While broadband subscribers request the content, ETNO explicitly argues that end users pay enough for broadband, and that prices cannot go up, instead placing the burden on the companies fulfilling the requests.

Finally, the policy objectives enshrined in the Digital Decade plan by the European Commission explicitly recognise the benefit of the Internet as a building block for digitisation of enterprises and public services, including through public cloud. Placing a regulated burden on Internet companies to directly increase ISPs' revenue will be a significant disruption, with no evidence that it will do

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or around 11% of their total combined revenue. For comparison, Light Reading reports total R&D spend by AT&T, BT, DT, Orange, Telefonica, TIM, and vendors Huawei, Ericsson and Nokia, of around USD35 billion, or around 6% of combined revenue. See annual reports, Light Reading, https://www.lightreading.com/service-provider-cloud/telcos-spend-pathetically-little-on-randd-and-its-often-shrinking/d/d-id/779532

76 See Footnote 41

77 See Footnotes 30 and 50

anything to further the Digital Decade's policy objectives. If the objective is to increase take-up of 5G and FTTH services that require high bandwidth content and services in order to drive demand for these infrastructures, charging content and application providers for delivering the content and services that would drive this demand is counter-intuitive.

4.2 Regulation of Internet interconnection in South Korea has led to worse outcomes in terms of South Korea's connectedness to the global Internet

Despite calls from ETNO and ISPs in 2012 for the regulation of Internet interconnection in Europe, BEREC, the European Commission and individual Member States all refrained from implementing any regulation. In effect, there has been only one market where IP interconnection arrangements are regulated, namely South Korea. In the South Korean case, regulators began by imposing network usage fees only on interconnection between ISPs. Following disputes, regulated fees were subsequently extended to CAPs wishing to interconnect with ISPs in South Korea. This has yet to be fully implemented, and is subject to litigation.

These regulations were first imposed on ISPs in 2016 when the 'sending party network pays' principle was introduced. This required ISPs (especially the three largest ISPs who have concentrated market share)[78] to pay network usage fees to each other for the traffic sent, as opposed to previous settlement-free negotiated peering agreements (using the bill-and-keep principle).

Following such developments, ISPs tried to pass on the increased costs of interconnection to content providers whose traffic they were carrying and exchanging with other ISPs, resulting in negative impacts on the market. Facebook disconnected its caches in response to KT Corp's requests for network usage fees. This is understood to have slowed other ISPs' consumer access to Facebook services. Facebook was fined by the regulator, but won a court case against the fine.[79] In the meantime, SK Broadband also sought to make Netflix pay network usage fees in 2019, resulting in a string of court cases that are ongoing today, fuelled by the runaway popularity of the South Korean Netflix show *Squid Game*, which further increased Netflix traffic.

As a likely result of these disputes, more regulations were added to try to address the perceived unintended consequences of the first set of regulations, by directly regulating companies delivering content. In May 2020, the interconnection regulations introduced in 2016 were extended directly to providers such as Netflix, and others. These extensions included the requirement for content providers to pay regulated network usage fees, as well as to satisfy quality-of-service requirements while delivering traffic to ISPs in South Korea, likely in response to Facebook disconnecting its caches.

Such regulations have unintended consequences that impact consumers, smaller ISPs and content providers, as well as the digital ecosystem. In South Korea, regulated interconnection fees are likely

78 Carnegie (2021), *The Korean Way With Data: How the World's Most Wired Country Is Forging a Third Way*. Available at https://carnegieendowment.org/2021/08/17/afterword-korea-s-challenge-to-standard-Internet-interconnection-model-pub-85166

79 See http://world.kbs.co.kr/service/news_view.htm?lang=e&Seq_Code=147588

to lead to increased costs for ISPs, either directly or indirectly as some content providers delivering their own traffic choose to only interconnect outside of Korea as a result of the regulations.[80] This process started when interconnection fees were only imposed between ISPs, as they were passed on to these Internet companies, and incentives remain for Internet companies to interconnect away from Korea where possible now that fees are imposed directly onto Internet companies. The result is that this content must be accessed abroad, at relatively high transit prices for smaller ISPs and at the cost of international capacity for larger ISPs.

Regulated network usage fees in South Korea also reduce competitive pressure on transit prices, because peering is not as direct a substitute for transit as in other markets, due to the regulated network usage fees. As a result, South Korea has experienced slower IP transit price decline than most other Asian and European benchmarks. In Seoul, the capital of South Korea, transit prices declined by 13% between 2018 and 2021, whereas Asian and European benchmarks experienced declines of between 19–30%. The price per Mbit/s was also higher at USD2.33 in 2021 as opposed to USD0.93 in Hong Kong, USD0.73 in Singapore and USD1.05 in Tokyo, and much lower prices for other European benchmarks.[81]

Such costs are likely to weaken competition. Smaller ISPs and content providers that are faced with higher costs may experience weakened market positions compared to larger players or may exit the South Korean market altogether. Increased ISP costs may also be passed on to consumers (hence increasing consumer prices), in addition to potentially lowering the quality of the content consumption experience and resulting in less diverse content (due to both increased latency and weakened competition). Moreover, content providers who have been building networks closer to ISPs (either in the form of PoPs at IXPs, CDNs or on-net CDNs) are disincentivised to do so. In general, such regulations are likely to lower investment in digital infrastructure, especially by international players, and impact national digital transformation targets, such as South Korea's Digital New Deal.[82]

Regulatory intervention in Europe could have similar implications for stakeholders: it would impose additional costs and barriers to access for content providers and CDNs of all sizes, and could leave smaller ISPs unable to compete effectively with larger ISPs who could exploit their scale to generate much higher payments from content providers, without a clear basis in costs.

80 Analysys Mason (2020), please see Footnote 29; also WIK-Consult (2022), op. cit., paragraph 14 and Section 2.2.1 page 37

81 TeleGeography (2021), *Global Internet Geography*. Available at https://www.telegeography.com/products/global-internet-geography/analysis/executive-summary/index.html

82 Ministry of Science and ICT, South Korea (2022), *Korean Digital New Deal*. Available at https://digital.go.kr/front/main/eng.do

4.3 Network usage fees would disrupt the entire Internet, including European companies who rely on seamless, efficient interconnection to access and use cloud services

The introduction of mandated network usage fees would be disruptive, imposing costs and burden for regulators, content providers, ISPs, and business cloud customers and end users.

First, the imposition of mandated network usage fees would upset the current balance of bargaining power in the market decisively in favour of ISPs, who will effectively be allowed by regulators to monetise their termination monopoly. ISPs would have an incentive to set a high network usage fee, deriving additional revenue from content providers rather than their own retail customers. In addition, raising the costs of interconnection for third-party content providers may result in an imbalance in the cost of traffic delivery between those third-party services, and services offered by ISPs themselves (e.g. pay TV, but also hosting and cloud services).[83]

This situation is similar to the one that impacted mobile termination rates, which were set high to increase revenue and favour on-net calls, leading to costly, complex economic regulation which started in the late 1990s and remains in force today throughout the EU. Over the past 25 years, European telecoms regulators have expanded significant efforts and costs towards mitigating the effects of 'calling party pays' in the telephony market; moving towards a similar model for Internet interconnection would be complex and costly, without any clear benefits.

On the other side, Internet companies may react to the imposition of network usage fees by reducing investment in content delivery, with fewer on-net caches and fewer private peering locations, as they may be forced to pay for traffic delivery irrespective of their own efforts to reduce the cost of traffic delivery. This will affect the content they deliver through CDNs, which for cloud providers is third-party content handled on behalf of cloud customers. As a result, ISPs may have to spend more to access the content, which could offset the revenue from the network usage fees. This is particularly true for smaller ISPs, for whom public peering may be the only option, possibly even in another country. This would impact the level of competition in broadband markets.

As a result, there may be a significant regulatory cost to the imposition of network usage fees. First, as was the case with mobile termination rates, regulators may need to set maximum rates for the network usage fees, using detailed cost models that would need continuous updating as markets evolve. Second, if quality of experience declines as a result of changes in interconnection points, there may be a call for additional regulations on content providers, as was the case in South Korea. And finally, impacts on competition resulting from additional costs for smaller ISPs may require yet more regulatory interventions.

Finally, there could be a broader impact on users – not just the end users whose costs of accessing content may rise, but also organisations using cloud services. While ETNO has argued that the network usage fee should be focused on the larger content providers, the impacts are likely to be

83 See, for example, paragraph C.2.b, in N° 3336 - Rapport d'information de Mmes Laure de La Raudière et Corinne Erhel déposé en application de l'article 145 du règlement, par la commission des affaires économiques sur la neutralité de l'internet et des réseaux (assemblee-nationale.fr)

broader. As mentioned in Section 3.3, this could affect public cloud users. Indeed, much of the traffic that public cloud providers' CDNs collect and deliver to ISPs is effectively third-party traffic carried on behalf of their customers. For companies that offer online services, including broadcasters, music streaming providers or games publishers, this traffic directly supports the delivery of their own services to end users.

For many other businesses, public cloud is a mechanism through which they store their business data, and benefit from the wide range of applications available as a service and running on cloud, including productivity, communications, and other business applications such as accounting, tax and HR. Consumers and public sector organisations also use cloud services extensively.

Network usage fees payable by public cloud providers and CDNs to ISPs would fall indiscriminately on even the smallest customers, raising their costs and lowering their competitiveness. This is true even if the network usage fees are only imposed on large tech companies – as noted, they have many smaller customers. This would in turn impact the digitalisation of the European economy and its global competitiveness. Lastly, although this goes beyond the scope of this paper, the possible introduction of network usage fees would by no means guarantee enhanced investment in connectivity infrastructure.[84]

Bearing all of these potential risks in mind, and in the absence of convincing justification thus far, calls for network usage fees in Europe risk undermining the policy objectives of the Digital Decade. Network usage fees in Europe would increase costs for content and service providers (directly or indirectly via cloud providers), to the benefit of ISPs and their investors, but bring no clear benefits to the public.

84 See Communications Chambers (2022), *An internet traffic tax would harm Europe's digital transformation*