



SUMMARY REPORT FOR INCOMPAS

# THE IMPACT OF TECH COMPANIES' NETWORK INVESTMENT ON THE ECONOMICS OF BROADBAND ISPs

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## Abstract

This report is intended to bring a clear and evidence-based perspective to the global debate regarding whether network usage fees should be introduced. It explains the interdependence of various stakeholders in the internet ecosystem and the mutually beneficial arrangements that they currently enter into for internet interconnection. In particular, we consider the relationship between content and application providers (CAPs) which provide online services and content that end users and other stakeholders demand, and the internet service providers (ISPs) which provide residential and business end users with the means to connect to the internet from their homes, offices, and mobile devices. We examine the implications of mandating that CAPs pay ISPs network usage fees linked to traffic flows between their networks in order to reach ISPs' end users, and we conclude that such a mandate would be harmful to end users and the global internet ecosystem.

We first highlight the significant investments that CAPs make in global internet infrastructure (over and above their investments in content, innovation, research, and development). Contrary to the assertions that CAPs are not investing in internet network infrastructure, we find that in the last decade, CAPs invested USD883 billion in digital infrastructure. This builds upon analysis conducted since 2014, and we find that between 2018 and 2021, CAPs increased their annual spend by over 50% compared to the 2014 to 2017 period, investing over USD120 billion in digital infrastructure, including hosting, transport, and delivery networks. These investments not only support the delivery of CAPs' own services, but also support the ISPs' business.

The combination of investments by CAPs and ISPs as well as freely negotiated interconnection on the internet has evolved over time to support increased traffic demand from end users. Investments made by CAPs to bring traffic closer to end users improve quality of experience for broadband users and save ISPs over USD5 billion each year in network and transit fees. The voluntary agreements between CAPs and ISPs ensure that growing demand from end users can be handled sustainably without increasing network costs over time. This framework ensures that ISPs do not shoulder all the cost of digital infrastructure, while enabling end users to gain access to diverse and high-quality online services.

We find that the imposition of network usage fees would risk creating barriers to entry and growth for smaller and new CAPs. In broadband markets, mandated network usage fees also risk increasing costs for many ISPs, by reducing CAPs' incentives to invest in infrastructure and processes that help optimize traffic delivery for ISPs, such as caching content closer to end users. Higher cost of traffic delivery for CAPs and higher network costs for ISPs may translate into lower quality of experience for end users. Higher costs for ISPs would heighten barriers to entry and growth for smaller and new ISPs, reducing long-term ISP competition and investment in broadband. Consequently, end users are likely to face higher ISP prices, less ISP choice, and reduced quality of broadband services, while also receiving diminished quality of experience for online services and less innovation and choice online.

Current proposals for mandating network usage fees rely on arguments that falter under scrutiny. Proponents of these fees tend to mischaracterize the relationship between traffic delivery and cost, while understating ongoing investments by CAPs in internet infrastructure, as well as private- and public-sector investments in ISP networks. Some arguments made in favor of network usage fees also appear to be based on an inadequate understanding of internet interconnection. If introduced, network usage fees would result in a shift away from the voluntary interconnection regime that continues to drive the rapid growth and impact of the internet. Policy makers should therefore scrutinize any network usage fee proposals carefully, while taking a holistic perspective on the potential harmful impact of those fees on the wider internet ecosystem.

## Executive summary

The internet is now more accessible than ever to more people around the world. The growth of the internet – and internet-enabled services and goods – has resulted in consumers, businesses, and governments conducting more daily activities online. The internet thus serves as the backbone for work, education, entertainment, and communication, and has proven to be essential, particularly during the Covid-19 lockdowns. The internet is a network of networks, which must all be connected (directly or indirectly) to one another to enable traffic delivery from any source to any destination around the globe. Its evolution has been driven by a combination of competition, collaboration, and innovation by all the stakeholders in the value chain. These players include:

- Internet service providers (ISPs), which provide residential and business end users the means to connect to the internet from their homes, offices, and mobile devices.
- 'Tier 1' global carriers, which invest and operate large-scale transmission networks that move content around the world and connect together the many networks that make up the internet.
- A wide variety of other companies that provide technology, services, and content to end users and other stakeholders through internet access and are referred to as content and application providers (CAPs). This includes cloud providers which invest in and operate data centers, peering and caching infrastructure, and increasingly their own backbone networks around the world.

Some stakeholders, including large, vertically integrated ISPs, have argued that growing internet traffic creates a cost burden on ISPs, which they argue is unsustainable. A central part of the argument put forward by these stakeholders is the notion that CAPs are benefiting from the network without investing in network infrastructure. As such, they call for policy makers to mandate that CAPs pay ISPs network usage fees that would be based on the amount of traffic delivered to end users.

This report demonstrates that:

1. CAPs are investing significant amounts in internet infrastructure (above and beyond their investments in content and applications for end users), and these infrastructure investments increase over time, reaching nearly USD900 billion in total over the period 2011–21.
2. Network-related costs for ISPs have remained stable over time even while traffic volumes have grown significantly. Data traffic only drives a small share of ISP costs, which are further mitigated by the investments that CAPs make in internet infrastructure.
3. The arguments put forth by proponents of network usage fees disregard ongoing trends in access network investment, and demonstrate an inadequate understanding of internet interconnection.
4. If introduced, network usage fees would disrupt existing interconnection arrangements, as well as incentives for stakeholders in the ecosystem to continue investing to deliver a high quality of experience for end users.

Policy makers should consider the potential impact of network usage fees holistically when evaluating regulatory proposals that would mandate the introduction of such fees.

## CAPs invest over USD120 billion annually in internet infrastructure

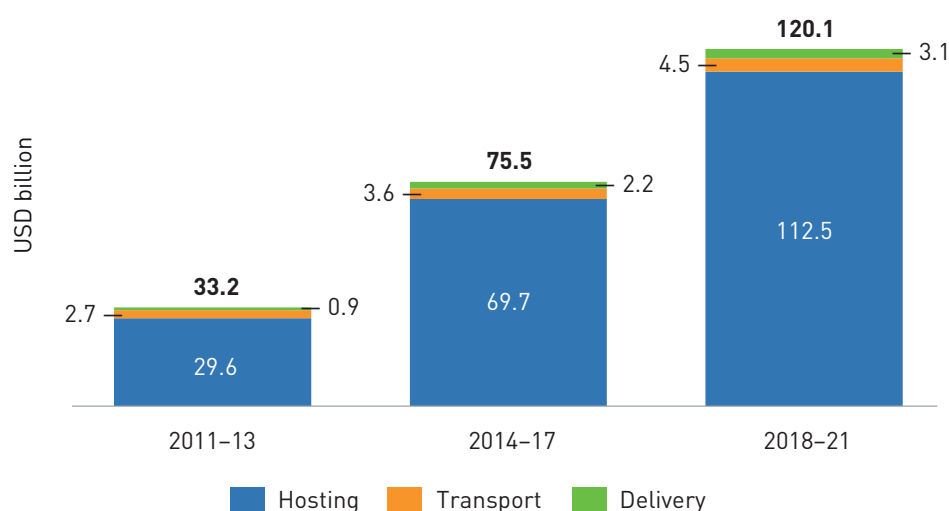
Over the period 2011–21, CAPs spent USD883 billion on digital infrastructure including hosting, transport, and delivery networks, leading to positive impacts on end users, and broader economic benefits.

CAPs focus their internet infrastructure investments on three main clusters – hosting (i.e. data centers), transport (i.e. submarine and terrestrial cables), and delivery (i.e. peering and caching). This infrastructure spans tens of thousands of miles around the globe and is critical to deliver online content and services close to ISPs for the benefit of end users' online experience.

CAPs are investing heavily in hosting, transport, and delivery networks. In 2018–21, CAPs increased their annual investment by 50% over the previous period (2014–17) and spent on average USD120 billion each year on this infrastructure. As a result of the annual investment amounts shown in the chart below over various periods, CAPs have spent a total of USD883 billion on infrastructure in these three main clusters from 2011 to 2021.

**FIGURE 0.1: AVERAGE ANNUAL INVESTMENT MADE BY CAPs**

[SOURCE: ANALYSYS MASON BASED ON VARIOUS SOURCES, 2014,<sup>1</sup> 2018,<sup>2</sup> 2022]



CAPs' investment in internet infrastructure increases reliability and quality of experience for end users. More broadly, we highlight the many studies that have shown how these investments drive overall internet penetration and usage and, as a result, generate macroeconomic benefits through digitalization. These include increased GDP, job creation, and environmental benefits, as well as better societal outcomes (e.g. education, health, access to remote work) from the consumption of online services.<sup>3</sup> Policy makers have also recognized the important role that the internet can play in unlocking these benefits.<sup>4</sup>

<sup>1</sup> Analysys Mason (2014), *Investment in networks, facilities and equipment by content and application providers*. Available at <https://www.analysismason.com/consulting-redirect/reports/content-application-provider-investment/>

<sup>2</sup> Analysys Mason (2018), *Infrastructure investment by online service providers*. Available at <https://www.analysismason.com/consulting-redirect/reports/online-service-providers-internet-infrastructure-dec2018/>

<sup>3</sup> Deloitte (2014), *Economic and social benefits of expanding internet access*. Available at <https://www2.deloitte.com/content/dam/Deloitte/uk/Documents/technology-media-telecommunications/deloitte-uk-tmt-value-of-connectivity-tmt.pdf>

<sup>4</sup> For example, see the digital targets for 2030 as set out by the European Commission, available at [https://ec.europa.eu/info/strategy/priorities-2019-2024/europe-fit-digital-age/europes-digital-decade-digital-targets-2030\\_en](https://ec.europa.eu/info/strategy/priorities-2019-2024/europe-fit-digital-age/europes-digital-decade-digital-targets-2030_en)

## Investments by CAPs in transport and delivery networks have a positive impact on the economics of ISPs

Beyond the lack of justification for network usage fees, policy makers should also consider the impact of network usage fees on the whole internet ecosystem. Network usage fees would effectively slow or reverse some of the advances in interconnection, peering, and caching that have evolved through voluntary, mutually beneficial arrangements that have aided ISPs and end users by lowering their costs and improving their service experience, respectively.

CAP investments to bring content closer to ISPs and end users generate benefits for end users in terms of better quality of experience, but also benefit ISPs in terms of cost avoidance or cost savings. For example, CAPs invest in large infrastructure projects like submarine cables, thus reducing the need for ISPs to invest in these systems. CAPs also use their global scale to deliver traffic broadly in internet exchange points (IXPs) and other peering locations across the world, reducing the need for ISPs to purchase transit or connect internationally to CAP 'home bases'. CAPs also invest in on-net caches that are embedded inside ISP networks, which reduces the backbone and backhaul capacity that ISPs require to deliver content to end users.

We quantify CAP investments that contribute to ISP savings in two areas: CAP investments in embedded caching in ISP networks (at core/metro/aggregation nodes), and long-distance transport and peering locations (both public and private), which contribute to the widespread availability of 'on-shore' peering in ISP home markets. We estimate that this enables ISPs to reduce capacity-related costs by between USD5.0 billion and USD6.4 billion each year, globally.

The central argument for network usage fees relies on two premises: that CAPs are responsible for large and growing traffic volumes, and that large growth in traffic drives much higher network costs.

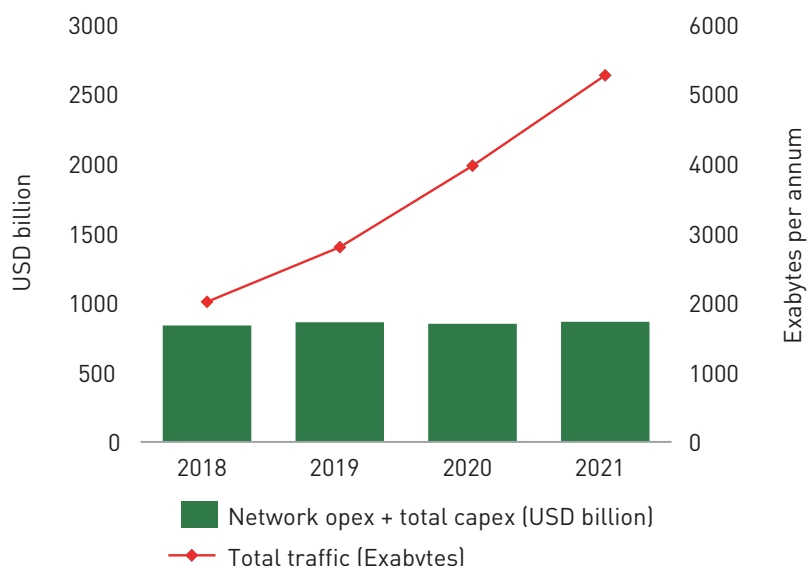
CAPs deliver traffic to ISPs when end users demand such content, and as demand for online services grows so does the demand for faster and generally more expensive broadband services that ISPs sell. A small number of large CAPs and content delivery networks (CDNs) deliver a large share of traffic demanded by end users, in part because they are very successful with end users, and in part because of the cost and quality benefits for all CAPs, large and small, to use their services due to their widely distributed CDNs that bring traffic either close to or directly into ISPs' networks.

Importantly, our analysis shows that the rapid increase in global traffic<sup>5</sup> delivered over fixed and mobile access networks is correlated with a stable annual spend by telecom operators on their networks, as shown in the figure overleaf.

<sup>5</sup>Traffic refers to the flow of data through networks over time, and bandwidth determines the amount of traffic that can flow through at a given time. Networks are provisioned to provide a given bandwidth rather than a given level of traffic, and in many modern networks, capacity significantly exceeds bandwidth demand.



**FIGURE 0.2:** GROWTH IN TRAFFIC DELIVERED OVER FIXED AND MOBILE ACCESS NETWORKS, AND EVOLUTION OF NETWORK-RELATED TELECOM OPERATOR COSTS FROM 2018 TO 2021  
[SOURCE: ANALYSYS MASON RESEARCH, ANALYSYS MASON, 2022]



Moreover, we find that traffic volumes drive a relatively small share of ISPs' costs. ISPs are in the middle of a once-in-a-generation transition to fiber – investments are being made by the public and private sectors, which affect the topology/architecture of their networks, and therefore the magnitude of network costs and their sensitivity to traffic. As ISPs increasingly transition to fiber and achieve more efficient architectures through more advanced technology and equipment, their costs are expected to become even less sensitive to traffic in future.

Thus, network costs are expected to continue to remain relatively stable in the future while traffic volumes grow, as fixed networks move toward fiber-based architectures, and as mobile technologies evolve to enable operators to add network capacity more efficiently, further demonstrating the unreasonableness of any permanent transfer of mandated payments from CAPs to ISPs.

### Policy makers should consider regulatory objectives holistically and scrutinize arguments in favor of network usage fees

Network usage fees would lead to regulatory and competition issues that policy makers already understand well: they have rejected network usage fees for the internet in the past, and have worked to mitigate similar issues in telephony markets for the last 20 years.

Proposals largely call for fees to be transferred from CAPs to ISPs on the basis of traffic for internet interconnection, one argument being that this mirrors voice termination rates in the telephony market. These mechanisms have worked for voice services as it is easy to identify the party that originated the call.

For internet traffic, however, it is usually difficult to identify the originator of a stream of traffic, not least because CAPs send traffic in response to an end-user request. There also would be the challenge of deciding what the rate should be, where it is imposed, which entities are charged, how to reconcile these charges with non-discrimination and net-neutrality policies, and how to limit ISPs' ability to exercise their termination monopoly. These challenges could result in excessive rates, leading to further regulation of quality of service, in addition to higher costs for end users. Some of these concerns have been raised in the past, for instance, when European regulators rejected similar proposals to regulate interconnection that emerged a decade ago.<sup>6</sup>

Proponents of network usage fees suggest that ISPs would invest more in connectivity and accelerate broadband deployment if they were able to charge CAPs for traffic. However, these arguments appear to disregard the large ongoing commitments made by ISPs themselves and by policy makers and other investors to roll out full-fiber networks throughout Europe, achieve 'Internet for All' in the US, and via other initiatives that are already underway for deploying broadband networks around the globe to unserved and underserved areas. Moreover, current proposals have not elaborated on mechanisms for ensuring ISPs use such fees on network investments that help to improve connectivity and end-user experience.

In this context, it seems unlikely that network usage fees would result in ISPs investing any more in networks. Instead, already large and vertically integrated ISPs would likely enjoy higher profits and shareholder returns at the expense of end users, who would face higher prices and a lower quality of experience.

#### **Implementing network usage fees could disrupt existing interconnection arrangements and investment dynamics, and reverse gains made in connectivity to date**

Beyond the lack of justification for network usage fees, policy makers should also consider the impact of network usage fees on the whole internet ecosystem. Network usage fees would effectively slow or reverse some of the advances in interconnection, peering, and caching that have evolved through voluntary, mutually beneficial arrangements that have aided ISPs and end users by lowering their costs and improving their service experience, respectively.

The introduction of network usage fees would disrupt existing interconnection arrangements. This is likely to affect incentives for both CAPs and ISPs to continue making investments that deliver ongoing improvements in quality of experience for end users. Network usage fees would raise costs for all CAPs, not just larger ones, resulting in barriers to entry and expansion for online content and service providers. Reduced incentives for CAPs to continue investing in infrastructure and processes that optimize traffic delivery will result in higher costs for ISPs as well, constraining resources for organic investment in ISP networks. Moreover, fees proportional to traffic paid directly to ISPs would favor larger ISPs, which may distort competition in the ISP market. As a result of these effects, end users are likely to face higher prices, reduced quality, and less choice in the ISP market, while also receiving a lower quality of experience for online services.

<sup>6</sup>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%2812%29120rev.1\\_BEREC\\_Statement\\_on\\_ITR\\_2012.11.14.pdf](https://www.berec.europa.eu/sites/default/files/files/document_register_store/2012/11/BoR%2812%29120rev.1_BEREC_Statement_on_ITR_2012.11.14.pdf)

South Korea is currently the only country where the regulator has mandated payments from domestic CAPs and ISPs. The added costs imposed by network usage fees have led to higher transit costs, diverging from other countries in the region. As a result, Korean CAPs have found it challenging to host content domestically due to higher costs and have either moved overseas or have become less competitive.<sup>7</sup> Likewise, service quality is affected as the overall average latency experienced by users in South Korea is the highest among Organization for Economic Co-operation and Development countries.<sup>8</sup> Importantly, the introduction of network usage fees elsewhere could disincentivize CAPs or CDNs from deploying caches domestically in those other countries as well, leading to similar negative effects as those seen in South Korea.

Demand for online services and demand for broadband access are inherently linked. The impact of introducing network usage fees, and the resulting impact on end users, could be long lasting and harmful for both markets. Lower consumption of online services by individuals and businesses could also result in further negative effects in terms of slower digitalization and economic growth.

## Conclusion

Based on current proposals, network usage fees are unlikely to be beneficial to end users. These proposals are supported by arguments that mischaracterize the relationship between traffic delivery and cost, and that appear to be based on an inadequate understanding of internet interconnection. If implemented, network usage fees would result in a fundamental shift away from the voluntary collaboration that has sustained the rapid growth of the internet thus far, and negatively affect a wide range of stakeholders. Policy makers and regulators should scrutinize any proposal on network usage fees and take a holistic perspective on the potential harmful impact of those fees on the internet ecosystem.

<sup>7</sup> See <https://carnegieendowment.org/2021/08/17/afterword-korea-s-challenge-to-standard-internet-interconnection-model-pub-85166>

<sup>8</sup> OECD (2022), *Broadband networks of the future*. Available at <https://www.oecd-ilibrary.org/docserver/755e2d0c-en.pdf?expires=1659966485&id=id&accname=guest&checksum=85B0F3FB66FF03752FF4111E10BF8E51>

# Mandated network usage fees could degrade network quality, decrease competition, and harm consumers

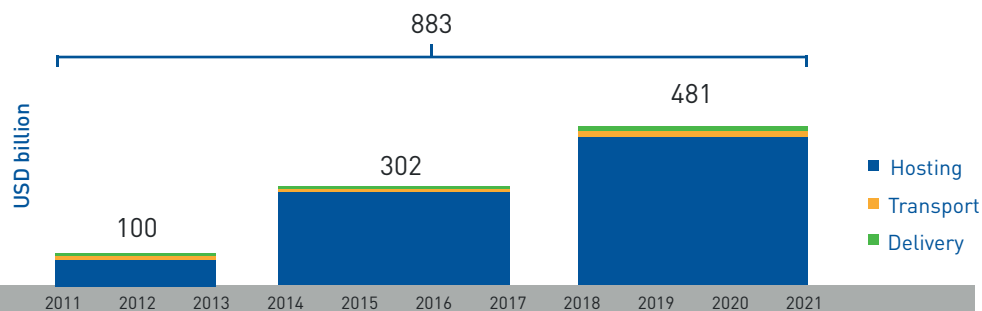
## Content and application providers (CAPs) invest extensively in global internet network infrastructure

Infrastructure investments in hosting, transport, and delivery are made in addition to other CAP investments in content, applications, and services for end users; the availability of these online services also drives demand for broadband access services from internet service providers (ISPs).

### Total spend by CAPs on internet infrastructure over various periods since 2011

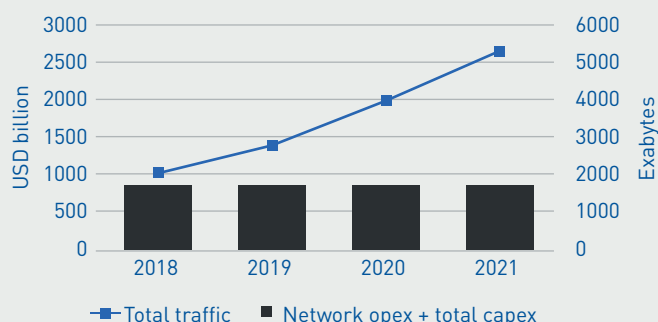
CAP investment in 2011–21 was USD883 billion. In the past four years (2018–21), CAPs invested USD120 billion per annum.

These investments help to reduce ISPs' costs, while optimizing performance for end users.



## The current voluntary interconnection regime incentivizes CAPs and ISPs to invest in efficient, cost-effective traffic delivery to provide quality experiences for end users

### Growth in traffic delivered over fixed and mobile access networks, and evolution of network-related telecom operator costs from 2018 to 2021



In 2018–21, network-related ISP costs increased by 3% in total over three years, whilst network traffic increased by over 160% in that same period, showing that ISP networks can handle significant traffic growth at modest incremental cost.

CAP network investments that bring content closer to end users also help ISPs to manage costs, saving ISPs USD5.0–6.4 billion per annum.

## Network usage fees would impose high interconnection costs for a non-existent problem, and they would disrupt incentives, investment, and competition

If introduced, network usage fees could have detrimental effects on multiple stakeholder types

### Impacts on CAPs include:

Fewer resources to invest in content and infrastructure

Higher barrier to entry for smaller/local CAPs

### Impacts on ISPs include:

Reduced ability to offer high-quality online experiences

Reduced long-term ISP competition and investment

### Impacts on end users (consumers and businesses) include:

Higher ISP prices, less ISP choice, and reduced quality of broadband services (e.g. latency)

Reduced quality of service from CAPs and fewer new CAPs to choose from in the future



**For more details please see:**

<https://www.analysismason.com/internet-content-application-providers-infrastructure-investment-2022>



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