Belgian Institute for Postal Services and Telecommunications

Draft communication by the BIPT Council:

Analysis regarding the request to impose mandatory contributions by Internet platforms to operators for the use of their networks (fair share)

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1. Executive summary

With this draft communication the BIPT wishes to contribute to the debate on the possible introduction of mandatory payments by companies conveying content through the Internet, to the telecom operators. The European Telecommunications Network Operators' Association (ETNO) has pleaded several times in the past for this, calling it a fair share contribution. Although no actual propositions have been launched so far, a questionnaire by the European Commission on 'The future of the electronic communications sector and its infrastructure' alludes to two types of contributions: a direct contribution between CAPs and ISPs or a contribution into a European or national fund.

In this paper the BIPT compiles data and studies, in order to assess the necessicity and desirability of a contribution obligation. This research could be adjusted in the future if new studies or more concrete payment mechanisms are presented.

Is there a need for additional contributions?

The main arguments for mandatory contributions, proposed principally by ETNO, can be summarised as follows: large Internet platforms use network infrastructure free of charge while generating considerable costs depriving the operators of sufficient means to invest in VHC networks.

In terms of financing no disquieting issues can be found on the Belgian market: commercial fibre roll-out plans already exist for the majority of the territory. The more scarcely populated areas shall be or are addressed through a combination of state aid, the existing cable networks able to deliver gigabit connectivity and/or Fixed Wireless Access. Furthermore, the European telecom sector's profitability remained stable over the past decade. Although the currently high inflation and high interest rates could cause investors to exercise more restraint, the availability of financial capital for network roll-out in Belgium appears to be unaffected so far. Indeed, current bottlenecks are rather related to the availability of staff, licensing procedures, etc.

Data traffic has been increasing since the early days of the internet and this will continue in the near future: streaming platforms are for example aiming more towards UHD content[1] but VR/AR, video games and other new visual applications will contribute to the increase in data consumption as well. However, it would an oversimplification to attribute the cause of these data streams to Big Tech. It is true, however, that these companies develop products to fuel the end-users' demand for their applications. This undoubtedly contributes to end-users' demand to be online and thus use their Internet subscription more intensively. Ultimately, however, it is the end-user who purchases an Internet Access Service from his Internet provider, which allows him to request certain content on the Internet within the capabilities of his subscription in terms of bandwidth and download volume. Consequently, it is the end-user who pays for the increasing data intensity: fixed subscriptions with higher speeds or mobile subscriptions with more data, cost more.

Regardless, the network operators' marginal costs linked to additional data traffic in the backbone network are low compared to the total of network costs of for instance the roll-out of a fibre access network (which in turn, can be used for 40 up to even 80 years)[2].

The main Internet platforms are moreover investing in, among other things, data centres and content delivery networks (CDNs) in Europe to facilitate the handling of their data traffic.[3] Of course, it is

[1] Ultra High Definition Content.

[2] 40 years is the minimal assumption, Proximus for instance mentioned 80 years in Trends on 20 April 2023. "An investment of around 10 billion euros spread over 10 years and covering the company's next 80 years obviously has an impact on free cash flows at some point. […] We have to invest now for the coming 80 years and that will pay off." (free translation)

[3] ETNO hereby acknowledges that each year the big tech companies invest approximately $ 17.9 billion in their network and delivery infrastructure, compared to about $ 55 billion in the case of network operators.

also to the streaming platforms' own benefit that they implement, among other things, compression techniques to promote video quality for the end-user. Because of net neutrality CAPs indeed cannot obtain "priority transmission".

In other words, CAPs and ISPs have a mutual economic dependency due to the importance of both powerful networks and the availability of interesting content. It is in the interest of both an ISP and an Internet service to deliver content as reliably as possible to the end-customer, which entails significant investments for both parties.

Impact on the Open Internet architecture

These arguments mainly rely on the model in which the contribution is paid directly to network operators and which is based on the bandwidth used or the data traffic conveyed.

A mandatory fee depending on the volume of data traffic radically reverses the Open Internet architecture by allowing to monetize the Internet Service Provider's (ISP) termination monopoly.

This can undermine net neutrality: if the CAP does not (or insufficiently) pay the mandatory contribution, an ISP has to have the possibility to adjust the former's connectivity quality; or will be tempted to do so in order to improve his negotiation position towards the CAP. If net neutrality is completely maintained, CAPs can, in principle, refuse to pay as their content can also reach the consumer indirectly. The CAP could then stop the direct interconnection (peering) or even in theory move its servers outside of the EU. This would increase the risk of higher latency for the end-user as the traffic has to travel through longer interconnection routes. Moreover this could cause more congestion on the transit and backbone networks as investments in CDNs are discouraged.

In addition, this intervention creates hard-to-predict distortions in the competitive dynamics in various other layers of the Internet ecosystem. Major ISPs for instance will have better negotiation positions then smaller ISPs have towards the CAPs in question. Small CAPs experience a greatly reduced incentive to grow beyond the contribution limit. If a direct interconnection contribution is skirted, international CAPs can obtain a competitive advantage compared to local platforms. In addition many Internet providers offer cable or IPTV services. It could therefore be in their interest to inflate the costs for online streaming platforms. It is unclear whether passive network operators rolling out fibre will be entitled to the contribution if the ISP negotiates on this.

Despite the European Commission's goals, this could actually discourage European companies to invest in data-intensive Internet applications such as big data and cloud computing. In any case the introduction of transaction costs in the negotiations amplifies the economies of scale of the major players on both sides.

Cost-benefit relation

The possible benefits for ISPs are most likely not in proportion to the downsides. Today parties decide to uphold a direct mutual interconnection from a win-win point of view: the content arrives quicker and the shortcut they create, restricts the need for transit services. The IP interconnection market risks to be reduced to a zero-sum game following the introduction of a mandatory payment, increasing transaction costs to add insult to injury. Because abuse of the termination monopoly and the circumvention of net neutrality is becoming a real possibility, regulators need to devote resources to this. In addition, a payment can shift the focus to rent seeking in stead of productive innovation.

Although the temporary investment peak in fibre and 5G undoubtedly presents challenges, a permanent intervention on the market does not seem to be the appropriate way to go in light of the corresponding transaction costs and the potentially market-distorting effects. The telecom sector inherently requires long-term investments that will need to be renewed at a given moment. On the

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ETNO (Palovirta, Maarit), 8 June 2022. *8 Common Questions on the "fair contribution" debate.* https://etno.eu/news/8-news/742-8-questions-fair-contribution.html

other hand, there is the economic interest to have an excellent broadband infrastructure in place as soon as possible, but here the scarcity in terms of human resources also constitutes a bottleneck.

If the contributions to be paid are passed on to the CAPs' end-customers or if investments in proprietary infrastructure as CDNs are at risk of being reduced, the payment of the fair share ultimately risks falling at least partially on consumers.

Finally, there is no guarantee that contributions will effectively trickle down to the public good such as investing in additional coverage or price reductions for consumers.

The indirect contribution

The majority of the arguments above focus on a Sending Party Network Pays model. An indirect contribution that is not immediately based on the big CAPs' Internet traffic and is deposited into a central fund, has a less radical impact on the IP interconnection market and the Open Internet. The funds could then be used to encourage the roll-out of certain networks (white spots) for instance. In that sense they could contribute to a geographically universal fund based on their turnover.

Although the necessity for the Belgian market is not established either, it can be said that it leaves the existing Internet architecture largely intact and is therefore less likely to impact the net neutrality.

The criteria or thresholds based on which OTT players have to contribute, risk causing additional regulatory costs (creating funds, project calls, assessments, disputes). The content platforms passing on these contributions to the end-user, would indirectly come down to having the Internet user subsidise the networks.

Moreover, this creates the risk that investments are actually postponed in the hope that at a given moment there will be subsidies - especially when a fund is replenished each year. This can also make Member States less inclined to set up private-public partnerships where needed and in due time. Such strategic behaviour would, on the contrary, slow down the accomplishment of the European Commission's connectivity goals.

Collaboration for a more solid broadband ecosystem

Whether or not direct or indirect payments are introduced does not preclude that CAPs can be incentivised to work together with operators to establish a robust broadband ecosystem. It is in the interest of both mobile operators and CAPs to reduce and prevent the congestion on the mobile network etc. Take for instance HD video, screen side, Wi-Fi offload, compression, CDNs, automatic software upload, automatic occupation of broadband capacity etc. Experiences gained during the pandemic can be used as an inspiration here.

Conclusion

On the basis of this first study, the BIPT believes that the need for mandatory payments from Internet platforms to network operators is not sufficiently demonstrated. Firstly, end-customers choose which content to watch within the possibilities of their premium Internet subscription. Secondly, Internet platforms and Internet providers are characterised by a mutual dependency resulting in a sustainable symbiosis in terms of interconnection, CDN investments and efficiency gains such as video compression. For they have similar interests in providing the end-customer with a qualitative connectivity, something both parties strive after.

Allowing for the possibility to monetize the ISPs' termination monopoly by means of mandatory, **direct payments** by CAPs reverses the existing, free IP interconnection market and brings about hard-to-assess shifts in the competitive dynamics on related markets.

Setting up a fund for **indirect contributions**, on the contrary, leaves the interconnection market intact. However, this does not exclude the possibility of a market-distorting effect due to the choice of criteria based on which the OTT players have to contribute. It is also unclear whether a permanent and separate fund to help finance a temporary investment peak, is the appropriate means as there

are already a lot of commercial fibre roll-out plans and as state aid is sometimes already provided in rural areas.

In both cases it remains unclear to what extent it will be possible to pass on the payments from CAPs to their end-customers and whether this will discourage their investments, for instance in CDNs.

2. Context

The European Telecommunications Network Operators' Association (ETNO) has been a long-standing advocate of a mechanism for contributions by large consumers on the Internet. For instance in 2012 at the World Conference on International Telecommunications (WCIT 2012), ETNO suggested to implement a 'sending party network pays' mechanism (SPNP). In May 2022 a new offensive was launched by means of a study by Axon (hereinafter: Axon/ETNO study[4]). This study supports a direct contribution by the main OTT players to telecom operators. They are less in favour of an indirect mechanism contributing to a special fund or a digital tax.[5]

In the proposal for a European Declaration on Digital Rights and Principles early 2022, the European Commission was already hinting at a form of contributions:

> *"Developing adequate frameworks so that all market actors benefiting from the digital transformation assume their social responsibilities and* ***make a fair and proportionate contribution*** *to the costs of public goods, services and infrastructures, for the benefit of all Europeans."* [6]

From the European Parliament, 54 MEPs called on the Commission to exercise caution with regard to this, in their words, "radical proposal". They fear an erosion of net neutrality and point out that monetizing a termination monopoly could seriously damage the Internet economy. They also have questions regarding the need to finance the roll-out: licences and capacity are a bigger bottleneck and there is little proof that mandatory fees will indeed result in higher investments. In addition they ask to consult BEREC, experts as well as the public on this matter.[7]

At the beginning of 2023 the European Commission launched a questionnaire, The future of the electronic communications sector and its infrastructure, sounding out which form such contributions should take on:

> *"Some stakeholders have suggested a mandatory mechanism of direct payments from CAPs/LTGs[8] to contribute to finance network deployment. Do you support such suggestion and if so why?*
>
> *In case you answered yes […], who should be the main contributors:*
>
> - *Digital online players/traffic generators in general (e.g. Online content providers)*
> - *Certain digital online players (e.g. LTGs)*[9]
>
> *In case you answered yes […], who should be the main beneficiaries:*

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[4] ETNO/Axon, May 2022. Europe's internet ecosystem: socio-economic benefits of a fairer balance between tech giants and telecom operators Reports (etno.eu)

[5] Ibidem, p. 2. : "By contrast, indirect compensation solutions would probably be more complex to set up and could risk being misdirected or abused, thus missing the intended benefits."

[6] European Commission, 26 January 2022. Draft Proposal: European Declaration on Digital Rights and Principles for the Digital Decade. COM(2022) 18 https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:52022DC0028&from=EN. BIPT marking.

[7] Open letter to the European Commission, M. Vestager and T. Breton, 12 July 2022.

[8] Largest traffic generators.

[9] European Commission, 23 February 2023. The future of the electronic communications sector and its infrastructure, p. 62.

https://digital-strategy.ec.europa.eu/en/consultations/future-electronic-communications-sector-and-its-infrastructure

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

In this note, the BIPT collects the available data and studies and the validity of the most common arguments is examined. Firstly, it is examined whether there is a need to intervene in the current market operation. In addition, the mechanism of the direct contribution is assessed in depth based on the benefits and disadvantages to be expected. Finally, a number of reflections are formulated regarding the concept of an indirect contribution - a system that is currently still too superficially developed for it to be assessed thoroughly. The BIPT will continue to keep a finger on the pulse as regards this theme and these studies.

3. Does the current system pose a problem?

These last couple of decades the Internet continued to grow exponentially in all its aspects without such a contribution from Internet companies. BEREC[10] confirms this:

> *"BEREC's experience shows that the internet has proven its ability to cope with increasing traffic volumes, changes in demand patterns, technology, business models, as well as in the (relative) market power between market players."* [11]

Objections brought against this are (i) that the big Internet companies, the Big Tech, thanks to their low (interconnection) costs, live off of the network upgrades that the European network operators carry out to meet the increasing network traffic; and (ii) that there would be insufficient financial resources to finance these investments. In this chapter, the BIPT examines the validity of these arguments.

The European Commission estimated that each year in the EU, € 65 billion is underinvested in digital infrastructure and networks to meet the digital goals.[12] Although it will undoubtedly be a challenge to close that gap, the relevant question remains whether the current Internet architecture, and more specifically the interaction between ISPs and CAPs, is at the root of that problem.

3.1. Unilateral use of network or beneficial interaction?

As was the case for the earlier launch of an SPNP mechanism in 2012, one of the underlying assumptions of ISPs arguing for payments from large CAPs is that the latter do not account for the incremental cost they cause for ISP infrastructures which would not cover the ISPs' costs:

> *"Most of the data traffic growth over the last decade has been driven by a small number of leading Over-The-Top (OTT) providers, with little or no economic contribution to the development of national telecom networks, who now account for over 55% of all network traffic. A recent study by Frontier has estimated that – just looking at the picture today - traffic driven by OTTs could generate costs of up to €36-40 billion per year for EU telcos".*[13]

This argument is based on three assumptions discussed below, namely that (i) CAPs are the cause of the increased traffic, (ii) that they generate considerable costs for which (iii) CAPs do not chip in.

3.1.1. Who generates Internet traffic?

By way of *preliminary assessment* in 2022 BEREC already gave its opinion regarding the assumptions based on which this debate is held or framed by the sector.[14] BEREC criticised the assumption that CAPs cause Internet traffic, for it is the end-user who asks for Internet content and pays for this.

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[10] Body of European Regulators for Electronic Communications; of which the BIPT is a member.

[11] BEREC, 7 October 2022. *Preliminary Assessment of the Underlying Assumptions of Payments from Large CAPs to ISPs*, p. 3.

[12] European Commission, 19 February 2020. Shaping Europe's Digital Future.

[13] ETNO/Axon, May 2022. Europe's internet ecosystem: socio-economic benefits of a fairer balance between tech giants and telecom operators, p. 1

[14] BEREC, 7 October 2022, Preliminary Assessment of the Underlying Assumptions of Payments from Large CAPs to ISPs.

The relationship between the private user and his ISP can be described as follows. End-customers pay for an Internet Access Service: this is a service providing them with access to the Internet at a given download and upload speed and with a given data volume. They mainly use this service by requesting content available on the Internet through their browsers and applications, and less so by sending information themselves.[15] The data traffic is consequently initiated when they want to interact with the Internet, which is so to speak situated behind the ISP, through the Internet Access Service.

Today, the interaction of the private Internet users is more focused on certain companies than in the past: in France 51% of the data stream is said to come from Netflix, Google, Akami, Facebook and Amazon.[16] The fact that these companies develop products to boost the end-users' demand for their applications, undoubtedly contributes to the end-users' demand to surf more and thus to use their Internet subscription more intensively (see also 2.1.3: mutual dependency). Neither the popularity, nor the market concentration of those platforms, however, alters the nature of the matter: in the end it is still the end-customer who decides to consult certain websites. Shortcomings in the competitive dynamics among online platforms themselves seem to demand more of a *sui generis* approach but have no impact on the causality of the network traffic.[17] Furthermore, Internet traffic has always increased at a rapid pace - a fact that already preceded this market dominance. In the end, which brand delivers a certain amount of data to the end-consumer, is irrelevant with regard to its origin. ISPs arrange their networks according to the peak consumption of their end-customers, regardless of to which extent their customers wish to use the same websites or apps.[18] WIK arrives at this conclusion as well:

> *"Furthermore, it is* ***questionable why the concentration of data traffic*** *on different CAPs and not the absolute level of data traffic […]* ***changes anything*** *about the economic assessment and the demands of the ISPs concerned. The investments in network expansion are thereby based on the utilisation of the networks at peak times and not on whether this traffic volume originates from a few large CAPs or an atomistic number of small CAPs."*[19]

Furthermore the same study shows that the growth rate of Internet traffic remained stable. The data traffic continued to grow by 22% each year, but there is no indication that this growth is accelerated compared to its trend in the past.[20]

The European definition of an Information Society Service, including the Internet platforms in question, interprets this causal relation moreover in the same manner: "any service normally provided for remuneration, at a distance, by electronic means and at the individual request of a recipient of services".[21]

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[15] As private persons on average download much more Internet content than they upload, the speeds for standard Internet subscriptions are asymmetrical: the download speed is generally a multiple of the upload speed.

WIK-Consult (2022) estimates that the increase in video calls during homeworking, shifted the download versus upload volume ratio from 10:1 to 9:1 in Germany.

[16] ARCEP, 30 June 2022. Barometer of Data Interconnection in France

https://www.arcep.fr/fileadmin/user_upload/grands_dossiers/interconnexion/Barometer_of_Data_interconnection_in_France_2022.pdf

[17] For instance, the Digital Markets Act, among other things, aims to render certain online markets more contestable.

[18] The market concentration of the main online platforms could work to their advantage: for they have room to invest in CDNs (see chapter 3.1.3.2.) that can be cost-saving for network operators. Even if the origin of the data traffic mattered, it would be at the advantage of ISPs at the most.

[19] WIK-Consult 28 February 2022. *Competitive conditions on transit and peering markets: Implications for European digital sovereignty.* Commissioned by the regulator BNetzA. p. 53

[20] Cisco VNI 2018 (2019), Cisco Predicts More IP Traffic in the Next Five Years Than in the History of the Internet. * .

[21] EU Directive 2015/1535 of 9 September 2015.

The argument of free riding can hardly be considered to be conclusive in a context that only occurs in the relationship between ISPs and end-customers using their premium subscription to consult Internet content of their choice at a certain bandwidth and with a certain download volume.

3.1.2. The costs of additional network traffic

Internet traffic has been increasing year by year. With regard to the stress on networks the distinction between data traffic (volume or traffic) and bandwidth has to be taken into account, however. Traffic refers to the volume during a given period, while bandwidth specifically refers to the volume of the data stream at a given time.[22] Increases in data traffic do not automatically imply that the bandwidth increases proportionally.

A study by Communication Chambers (2016) commissioned by Liberty Global discusses the complex relationship between traffic and bandwidth with regard to online video:

> *"If the number of users and their time online are approaching saturation, bandwidth requirements can still be driven upwards by a shift of usage to higher bandwidth applications. One such transition has been the rise of streaming video, which already represents approximately 45% of European fixed traffic in peak periods. That said,* ***while video is important for traffic, it is less important for bandwidth.*** *In 2015 67% of video streams had a bandwidth of less than 2 Mbps, and 97% of less than 5 Mbps."*[23]

In theory a network only has to be upgraded structurally if the bandwidth at peak times no longer suffices and congestion sets in.[24] A report by Sandvine also states that the increase in traffic due to the pandemic rather shifted the peak consumption:

> *"In addition to significant volume increases during 2020 and 2021, operators also saw a shift of when "peak usage" and "congestion" took place, with* ***usage more evenly spread out during weekdays*** *– resembling what had traditionally been "weekday" or "holiday" patterns."*[25]

In addition CAPs invest in Content Delivery Networks that are directly interconnected in Internet Exchange Points (IXPs), or even more directly at a lower level of the ISP's network architecture (on-net CDN). An on-net cache more specifically is a sort of (temporarily) stored file located in the ISP network. To put it simply: a popular series requested by tens of thousands of users in Belgium does not have to travel through Europe tens of thousands of times to be collected at a data centre elsewhere on the continent. This does not require the end-users increasing Internet traffic to move up until the highest and most central network element - see graph below. These caches are generally 'completed' outside of peak hours and can contain various versions of the same content, in multiple formats and can be subject to different compression techniques.[26] An increase of the Internet traffic

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[22] For private persons the bandwidth is limited by the end-user's Internet subscription (the number of Mbps) and the total volume is either restricted (e.g. 150 GB/month) or sold as unlimited. Abuse regarding unlimited download volume is curtailed by the Fair Use Policy, in Belgium generally 3 TB per month.

[23] Kenny, Robert en Williamson, Brian (Communications Chambers commissioned by Liberty Global), November 2016. *Connectivity for the Gigabit Society: A framework for meeting fixed connectivity needs in Europe*. p. 22-23

[24] See also: "Doing more does not necessarily involve doing more at the same time. For example, additional usage of video outside peak hours adds to traffic but makes no difference to peak bandwidth requirements".

Source: Kenny, Robert en Williamson, Brian (Communications Chambers commissioned by Liberty Global), November 2016. *Connectivity for the Gigabit Society: A framework for meeting fixed connectivity needs in Europe*. p. 9.

[25] Sandvine, January 2023. *The Global Internet Phenomena Report.* p. 8.

[26] Source: Analysys Mason, 14 July 2022. *Netflix's Open Connect program and codec optimisation helped ISPs save USD1 billion globally in 2021. p. 9.*

consequently does not automatically imply that all layers of the network are submitted to an equal load. This way the ISP can for instance save on international transit services.[27] This phenomenon is also called Regionalisation of Transport.[28] If the CDN is able, allowed and willing to place caches deeper in the network, the ISP's core network is also relieved from traffic.

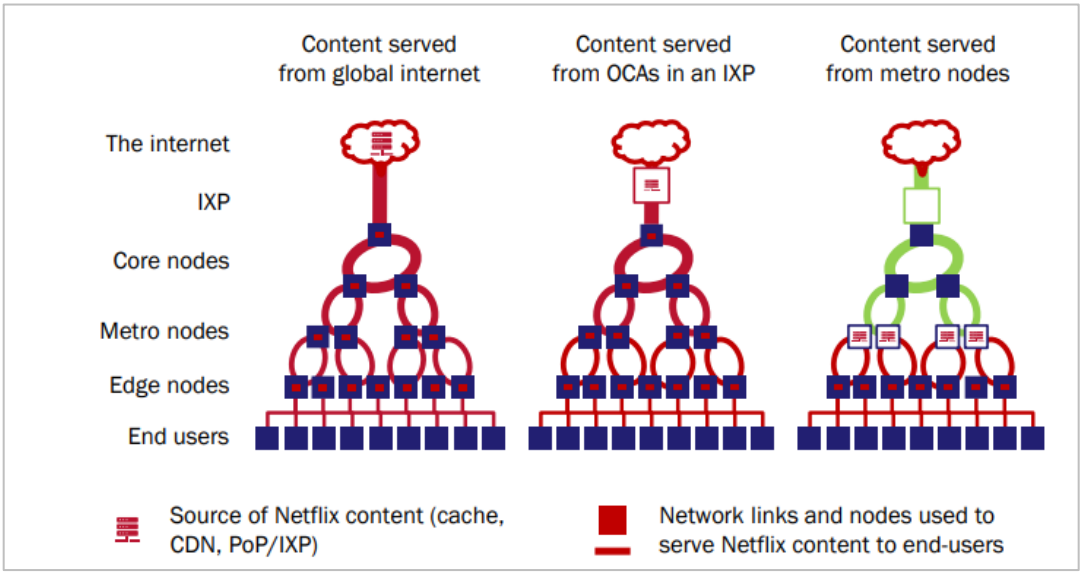

Figure 1. Content delivery possible in multiple layers of the network (source: Analysys Mason)

Even though the data traffic is growing exponentially, that does not mean that the impact on the necessary bandwidth needs to be proportionate. Of course the bandwidth capacity does not remain the same: this does require upgrades in the backbone network from time to time. The question rises however as to which incremental costs are linked to an increase in bandwidth.

A proportionate increase in the network operators' backbone costs does not seem to be in the offing - especially since technologies evolve along as well. BEREC for instance notes:

> *"[T]he cost of increasing backbone capacity can be considered very low […] Backbone networks exhibit significant economies of scale. In its reports on net neutrality and IP interconnection, BEREC has shown that competition and technological progress have led to* ***declining per unit costs for data traffic, thereby allowing the Internet to cope with increasing traffic volumes."*** [29]

The exponential growth in data is accompanied by an exponential decrease of the costs per unit. As regards transit services ARCEP notes:

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[27] Among other things because of these interventions, a study conducted by Analysys Mason and commissioned by Netflix states that for a modelled cost structure of a fibre ISP, the marginal costs to deliver Netflix content, amount to 0.5% of the total network costs, even though this type of content represents 15% of the total traffic at peak moments. The BIPT does not posses the data to verify this. Source: Analysys Mason, 14 July 2022. *Netflix's Open Connect program and codec optimisation helped ISPs save USD1 billion globally in 2021. p. 9.*

[28] WIK-Consult 28 February 2022. *Competitive conditions on transit and peering markets: Implications for European digital sovereignty.* Commissioned by the regulator BNetzA. p. 26

[29] BEREC, 7 October 2022, Preliminary Assessment of the Underlying Assumptions of Payments from Large CAPs to ISPs, p. 11. BIPT marking.

"The observed transit services prices have decreased steadily over time due to the combination of increased traffic volumes, lower equipment costs and competitive pressure."[30]

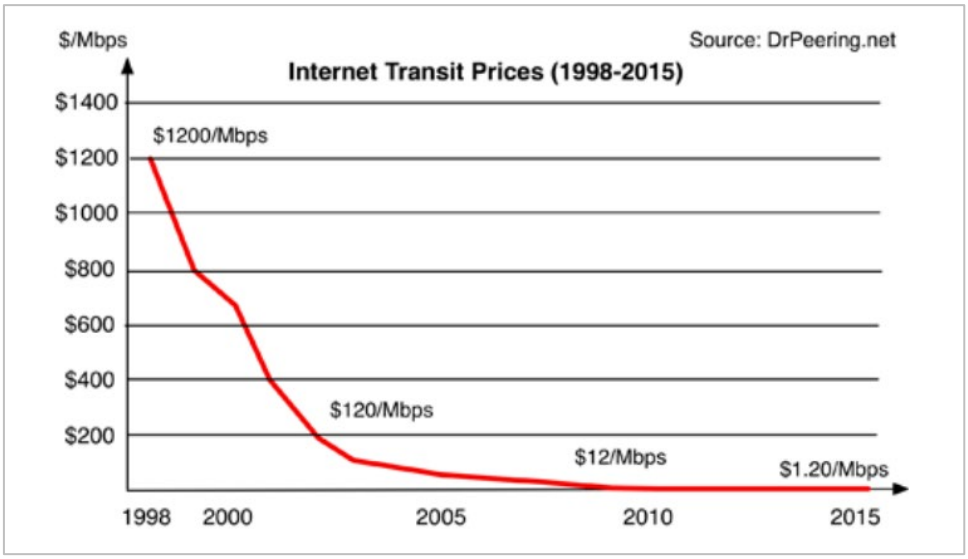

Figure 2. Transit prices in $/Mbps (source: Arcep - drpeering.net)

In addition fixed costs in the backbone network such as the purchase and installation of the routers used to have two parties interconnect are by definition not correlated with increasing data traffic. From time to time new investments will of course have to be made but this is a gradual and inevitable process as long as the required Internet peak bandwidth generally continues to increase. Peering is also characterised by strong economies of scale:

"If the [peering] capacity requirement is more than 1 Gbps, the use of one 10 Gbps port is typically more cost-effective than the use of two 1 Gbps ports. Similarly, one 100 Gbps port is more cost-effective than two 10 Gbps ports. […] The cost of a 10 Gbps port is on the order of a few thousand euros (~ 3,000 EUR). A 100 Gbps port does not cost ten times as much as a 10 Gbps port, but only about twice as much (as of 2020)." [31]

The fixed access network lends itself less to incremental upgrades, even though Docsis 3.1 on cable networks and G.Fast at short distances on copper networks allow gigabit speeds. A complete conversion of technology, as in the case of the roll-out of a fibre network, is very capital-intensive on the contrary. Such networks however last for at least forty years, following which extremely low variable costs remain in the case of an increased use of bandwidth. As the Internet traffic and the required bandwidth continues to increase year by year, a fact preceding dominance by certain online companies, the roll-out of a new access network cannot be ascribed to platforms that have become popular over the last couple of years. An access network does not constitute an incremental cost but rather a long-term project as Proximus CEO Guillaume Boutin recently explained:

[30] ARCEP, 30 June 2022. Barometer of Data Interconnection in France, p. 7.

[31] WIK-Consult 28 February 2022. *Competitive conditions on transit and peering markets: Implications for European digital sovereignty.* Commissioned by the regulator BNetzA. p. 29

"We have to invest now for the coming 80 years and that will pay off. […] We have to get across an investment wall, which will indeed produce considerable yields but only in the long run."[32] *(free translation)*

In addition the qualitative advantages these networks offer in terms of latency and reliability are less to the benefit of similar services focused on private users, such as streaming services and social media.

Finally, BEREC expressed a similar vision regarding the argument that the traffic of big CAPs generates considerable costs for the ISPs: it does not take into account the type of network (fixed or mobile), nor the elements thereof (access part and backbone part). In a fixed network however i) only the backbone part is actually sensitive to traffic and ii) an increase in traffic (notably an increase of the traffic at peak moments exceeding the available capacity) mainly entails additional hardware costs (that are in each case low compared to the total network costs).[33]

3.1.3. Mutual dependency and investments

This section examines to what extent the relation between Internet Service Providers and Content Application Platforms attests to a mutual dependency and to what extent their goals correspond. In addition the investments are looked at as well.

3.1.3.1. Economic dependency

Firstly, BEREC's analysis establishes a mutual interdependence: a content provider requires an Internet provider to reach the end-users but an Internet provider who cannot offer such content would not be capable of charming a lot of end-customers either. So they need each other for their own business model to work and are at the same time bound to each other's faith: both wish to provide the end-customer with an optimal quality.

In the field of mobile Internet it is precisely the popular apps that have led to the end-customers to be willing to pay more for their mobile phone subscription. The number of text messages and calling minutes was rendered unlimited for most subscriptions while today the main focus is on the quantity of mobile data. The bigger the number of gigabytes, the more expensive the subscription. In Belgium the average mobile data consumption between 2015 and 2022 increased from 0.5 GB to 6 GB.[34] So the effect of this increase is already priced into the behaviour of end-customers. A similar reasoning applies to fixed Internet: customers can choose among subscriptions with a limited or unlimited data volume on the one hand and various download speeds on the other hand. As these quality characteristics increase, the price goes up as well. Due to the growing Internet needs - among other things because of the popularity of said platforms - more customers chose these increased characteristics, for which they also paid more. This means that the popularity of such services actually contributes to the end-customers' willingness to pay for the more expensive premium services, that are more profitable to the Internet providers than when the consumer is only looking for basic connectivity. BEREC already expressed a similar opinion in 2012: *"Ultimately, it is the success of the CAPs […] which lies at the heart of the recent increases in demand for broadband access."*[35]

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[32] Trends, 20 April 2023.

[33] BoR (22) 137, p.9.

[34] Data coming from the BIPT.

[35] BEREC, 2012. *BEREC's comments on the ETNO proposal for ITU/WCIT or similar initiatives along these lines* (BoR (12) 120 rev.1), https://www.berec.europa.eu/en/document-categories/berec/others/berecs-comments-onthe-etno-proposal-for-ituwcit-or-similar-initiatives-along-these-lines

In other words, consumers who wish to use the services of said Internet platforms intensively, already partly pay for this via their Internet subscription.

3.1.3.2. Investments

CAPs can undoubtedly only flourish when networks are sufficiently robust and therefore benefit from the ISPs' network investments. However, the quality of the connectivity is also fostered by the CAPs who invest in both infrastructure (fibre and data centres) and software (compression technology and streaming protocols). These avoid Internet traffic on the ISPs' networks and ensure a faster and more reliable connection for the end-customers.

Big CAPs invest in network infrastructure, among which submarine and terrestrial fibre and elements bringing the content closer to the end-user.[36] These private fibre lines are often a combination of proprietary installation and long-term leases. In this context, Analysys Mason points out that network operators profit from this as well through leasing:

> *"While OSPs' investments in submarine cables are more widely publicised, terrestrial fibre accounts for a larger share of transport investment. […] OSPs' investments in terrestrial fibre do not typically extend to deploying their own fibre cables, as these deployments require complex processes to gain 'rights of way' permissions. The favoured model, where available, is to lease access to dark fibre based on 10- to 20-year agreements."*[37]

In addition to the network elements such as fibre, CAPs mainly invest in their own networks of hosting and delivery infrastructure, avoiding large data streams on the 'public' Internet (especially in transit and IXPs) and thus lowering the risk of congestion.[38] More specifically CAPs invest in submarine fibre connections, own hyperscale data centres and Content Delivery Networks that bring the content closer to the end-user or that are cached on the ISP's network. The figure below gives a schematic representation of the investments by CAPs in CDNs and private fibre connections. Firstly, there are the many servers of the Content Delivery Network. These can reach the ISP in different ways but ideally this is done as closely to the ISP's network as possible through direct peering. Secondly, investments are made in private fibre connections used to connect clusters of data centres and CDNs of the CAP among each other (as illustrated by the grey arrow in the figure below).

[36] BoR (22) 87, p. 58

[37] Analysys Mason, December 2018. *Infrastructure Investment by Online Service Providers.* Commissioned by Google. P. 28

[38] Ibidem.

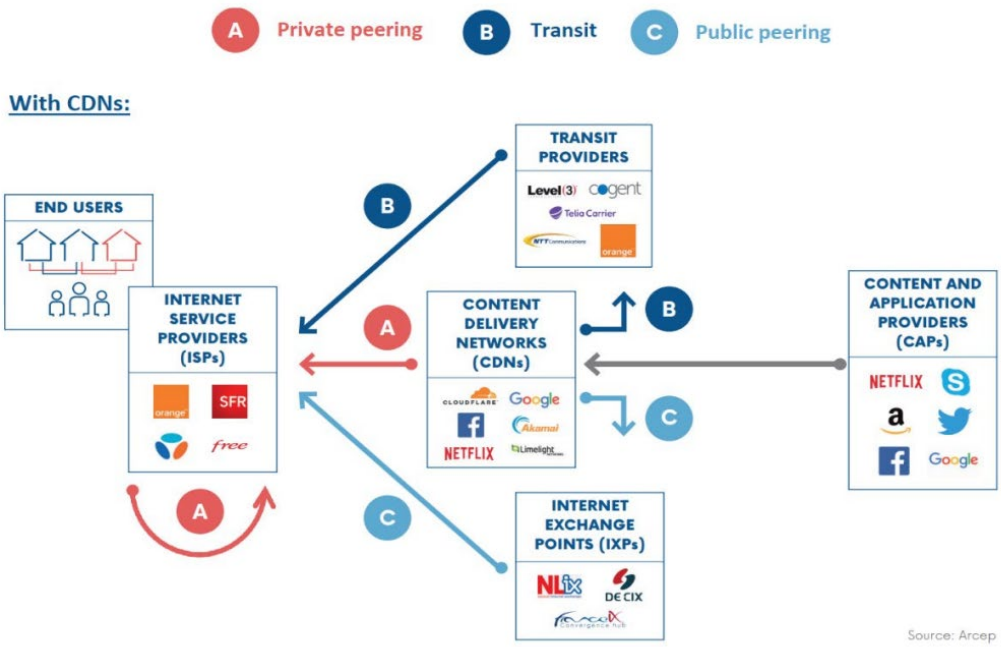

Figure 3. The role of CDNs in interconnections (source: ARCEP)

These investments are recognised and welcomed by ETNO, which still believes that there is an imbalance:

> "[In] *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 was in average $55bn per year, reflecting the uncomparable effort of bringing superfast broadband to hundred millions Europeans*." [39]

Investments from CAPs are significant and contradict ETNO's other statements, namely: *"with little or no economic contribution to the development of national telecom networks",* as these investments avoid congestion on networks that would otherwise be borne by network operators. Indeed, CAPs do not contribute directly to the development of the ISP network but they provide beneficial side effects such as a decrease in data traffic and latency. This will also benefit the reliability of the ISP network. The rather complementary nature of CAP investments has also been recognised by BEREC:

> *"Many CAPs are deploying their own physical infrastructure, such as CDNs or cloud computing servers, as well as network infrastructure, such as submarine cables, as alternatives or in addition to the infrastructure provided by ECN [Electronic Communication Network] operators. While in some cases it can also be provided to third parties, the infrastructure deployed by CAPs is often aimed at carrying their own traffic. In this way, they are currently not directly competing, but rather complementing the infrastructure of ECN operators."*[40]

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[39] ETNO (Palovirta, Maarit), 8 June 2022. *8 Common Questions on the "fair contribution" debate.* https://etno.eu/news/8-news/742-8-questions-fair-contribution.html. BIPT marking.

[40] BEREC, 2022. *Report on the Internet Ecosystem.* BoR (22) 167 https://www.berec.europa.eu/en/document-categories/berec/reports/berec-report-on-the-internet-ecosystem

As the core activity of such Internet platforms exists in providing all sorts of OTT applications, there is a priori no reason why investments in physical infrastructure should adopt the same proportions. For OTT players will foremost invest in the provision of their own services. In addition to the physical infrastructure streaming platforms for instance also invest billions in the licences and production of media content.[41] As argued above, this content turns fast premium Internet connections more attractive to the consumer.

The market dynamics of the Open Internet architecture and free interconnection are discussed in further details in Chapter 3; at the moment it suffices to emphasize that, precisely because of that free interconnection market, it would not be possible nor would it be desirable for the BIPT to determine what relation between the investments of both parties would be optimal. No normative conclusions can be drawn based on the relative size of the investment amounts.

In a study conducted by Analysys Mason, commissioned by Netflix, it is estimated that the presence of Netflix's CDNs alone at the lower levels of the ISPs' Internet architecture as a side effect entails significant saving for the ISPs:

> *"Extrapolating these savings globally, based on the bandwidth served from embedded [Open Content Appliances] around the world, results in estimated cost savings between USD800 million and USD1 billion globally in 2021, assuming a distribution of OCAs at various levels of ISP networks."*[42]

According to a report by WIK Consult for BNetzA, 60 to 70% of the traffic delivered comes from Content Delivery Networks in Germany meanwhile. In France traffic from on-net CDNs increased by 82% in 2020, presumably because of the increase in streaming services focussing on just that.[43] As discussed above, Internet traffic would have to traverse the entire network hierarchy in the absence of such infrastructure. Consequently, it goes without saying that investments in these clusters of data centres and servers are indeed beneficial to the ISP networks in terms of the correct routing of data; on top of the fact that the latency for end-users is lower, which benefits both parties. In short, CAPs invest in both network and delivery infrastructure entailing benefits for the CAPs, the ISPs and the end-users.

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[41] In the case of Netflix this came down to about $ 17 billion, $ 7 billion of which in its own productions. Amazon is said to spend $ 4.5 on its own productions. In this discussion, the BIPT does not wish to draw normative conclusions regarding the relative size of these amounts; they are only mentioned for context.

Source: Statista. https://www.statista.com/statistics/964789/netflix-content-spend-worldwide/

Source: https://www.fiercevideo.com/online-video/amazon-will-increase-original-content-spending-despite-imploding-video-team

[42] Analysys Mason, 14 July 2022. *Netflix's Open Connect program and codec optimisation helped ISPs save USD1 billion globally in 2021. p. 10*

[43] WIK-Consult 28 February 2022. *Competitive conditions on transit and peering markets: Implications for European digital sovereignty.* Commissioned by the regulator BNetzA. p. 15-17

3.1.3.3. Compression techniques and streaming protocols

In addition to investing in physical infrastructure Internet platforms use different sorts of techniques to limit their required bandwidth for the data traffic to arrive at the end-customers as quickly and as reliably as possible. The ISP in question also reaps the benefits from this as there are less data to handle, which reduces the risk of congestion.

The two main methods that content providers use to optimise the data traffic are codec[44], which reduces the amount of data by means of compression, and streaming protocols that align the bandwidth to the device and the connection of the end-user. These two aspects are summarised separately below, and expanded on further in Annex 1.

As early as 2016, a study by Communication Chambers, commissioned by the network operator Liberty Global, expressed hope for the swift development of video compression technologies:

> *"The bandwidth required to deliver a given video quality has halved every seven years. […] Even 8K – the generation beyond UHD TV – only requires 50 Mbps, and will likely require much less before it is widely available to consumers."* [45]

There are different generations of codecs, each with a greater compression power and thus reducing the data traffic and the required bandwidth. The use of these codecs is patented however, giving rise to royalties having to be paid. The business models supporting these licences are complex and not transparent, even if can be stated simply that the manufacturers of chips and the OTT providers, whom the customers purchase access to content from (such as Netflix) pay for these licences as well.[46] In reaction to this, the Open Media Alliance (OMA) was set up by a number of tech companies such as Amazon, AMD, Apple, ARM, Cisco, Google, Intel, Microsoft, Mozilla, Netflix and Nvidia, which developed the patent-free codec AV1 in 2018.

Does this mean that the development of new compression techniques can immediately be put to use on a large scale by CAPs to stimulate data reduction? There is more to it than that. For, compression by the sending party requires a decompression at the end-user's. This can either be done through hardware support by means of a dedicated chip or through built-in software in certain apps and browsers.[47] Indeed, not all hardware manufacturers and app developers support all codecs. In addition, stronger compression implies stronger decompression, requiring more computing power from the terminal equipment. That computing power also has to be quick enough to keep up in order to allow for a sufficient buffer to guarantee the continuity of the image in the case of a video stream. It therefore goes without saying that the older and/or more low-end terminal equipment is not compatible with the newest codecs. That is why CAPs provide for several compression variations of the same file in their CDNs.[48]

In the first place it is in the content provider's own interest to apply an appropriate codec maximising the user-friendliness for his end-customer: less data stabilises the connection and for streaming reliability is especially important. He will furthermore use less data, something that is still limited for

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[44] Codec is short for compression/decompression. It is an algorithm that compresses all frames of a video as optimally as possible to minimise data and bandwidth.

[45] Kenny, Robert and Williamson, Brian (Communications Chambers commissioned by Liberty Global), November 2016. *Connectivity for the Gigabit Society: A framework for meeting fixed connectivity needs in Europe*. p. 22-23. BIPT marking.

[46] https://jina-liu.medium.com/settle-your-questions-about-h-264-license-cost-once-and-for-all-hopefully-a058c2149256

[47] Hardware support is more efficient as the computing takes place directly in the computer's chip, instead of being mediated through the software in a browser or application.

[48] Source: Analysys Mason, 14 July 2022. *Netflix's Open Connect program and codec optimisation helped ISPs save USD1 billion globally in 2021. p. 9.*

most mobile subscriptions. The networks of course ride on this wave as well as there is less data to be processed: because of the data compression certain burdens shift from the network to the content provider (compression, codec licences, storages of multiple versions in CDNs) and the end-customer (increased computing and shorter battery autonomy).

Closely connected to the codecs are the streaming protocols[49] that, in combination with the use of a CDN[50], are crucial to deliver a live stream or video on demand in optimal quality to the end-user's terminal equipment. They ensure that the bandwidth used adapts in real time to the terminal equipment's capabilities and to the connection's strength. The video is divided into smaller fragments to allow for a flexible download of the smaller fragments loaded in order to avoid image drop-out and waiting times. The end-user can notice this.

In short, this software helps to ensure that no more data than required are transmitted to the end-user, as that would deteriorate the latter's experience (longer waiting times, unnecessary data consumption). A more detailed description for this technology is given in Bijlage 1.

3.1.3.4. Standard settings on Internet platforms

Above it was established how the end-user sets the Internet traffic in motion by consulting certain web pages or applications via his IAS. Nevertheless network operators point out the major impact certain settings and transmission methods used by CAPs have on the data traffic, and the responsibility that brings along. ETNO for instance claims that CAPs themselves are partially responsible for the exponential manner in which traffic increases. Example given through the video auto play setting which Facebook pioneered in 2013 and the prefetching of advertisements.[51] At the same time ETNO cites the state of emergency in the early days of the COVID lockdown to prove that a decrease in image quality did not result in additional complaints by the end-users.[52]

Although a setting modified in 2013 can still have an impact in 2023, the data traffic has been seen to continue to increase these past few years by 26% per year.[53] That means that the data traffic has increased tenfold since 2013 and a similar growth rate is expected for the years to come.

Prefetching does indeed result in more unnecessary traffic but advertisements' web pages represent relatively little traffic compared to video traffic as this often regards pages with a couple of pictures displaying the product.

In any case it is clear that the traffic caused by such settings is very limited compared to both the total traffic and its growth rate. That strong growth of the data traffic was caught by the networks. Although the efficiency of prefetching and autoplay can be questioned, their share in the total network traffic is very limited. A measure such as mandatory payments is very drastic in this light and precisely because of the small share in the total traffic it is unlikely that an incentive in the form of a price signal linked to data traffic or bandwidth will result in a change in course.

Further promoting efficiency, either through agreements among operators and CAPs or from a regulatory stance, is not excluded but can be discussed separately from a payment mechanism.

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[49] https://www.wowza.com/blog/streaming-protocols

[50] http://highscalability.com/blog/2016/6/27/how-facebook-live-streams-to-800000-simultaneous-viewers.html

[51] The web page to which the advertisement is linked, is already being downloaded by the end-user's device before the latter has even clicked on the advertisement. The goal is to quickly display the advertisement in case the end-user does click on it. If the advertisement is not clicked on, which is most often the case, the web page has been downloaded in vain.

[52] ETNO/Axon, May 2022. Europe's internet ecosystem: socio-economic benefits of a fairer balance between tech giants and telecom operators, p. 14

[53] P17, Cisco Annual Internet Report (2018–2023)

3.1.4. Conclusion mutual dependency

Based on the investments in physical infrastructure, software and media protocols, it can be stated that the interaction between the CAPs and network operators is indeed characterised by similar interests and mutual investments.

All this does not preclude further cooperation and the development and use of efficiency gains by CAPs (e.g. through video compression) from being encouraged in certain cases. Certain standard settings (e.g. not the highest image quality) for the biggest platforms can also prevent unnecessary data traffic, if the end-customers who wish to can easily adapt their settings to their preferences themselves. In addition to a limited data reduction positive side effects can emerge - on top of the own interest for the CAP in question - especially with regard to for instance the energy consumption and the charging times for mobile users. It is unclear however whether that collaboration should be promoted through a mandatory payment from one party to the other.

Considering the above, the BIPT believes that the necessity of a contribution from the Content Application Platforms in the incremental costs is insufficiently proven to be able to state that the current system, in which end-customers already pay for their Internet Access Service, would be untenable. The infrastructure, software and media protocols show that there is no free riding but rather a mutually beneficial interaction.

3.2. The financing of network investments

The network operators' investments can generally be subdivided into two categories: large one-off investments such as for the roll-out of a new access network or incremental upgrades such as the provision of more capacity in the backbone network. These investments are firstly financed with the revenue from private and business buyers of their connectivity products, possibly complemented with wholesale customers.

As regards the exponential growth of data traffic the Axon/ETNO study states:

> *"[T]he future development of the EU telecoms sector may be at risk, as a result of the ever-growing investments EU telcos will be forced to make to accommodate exponential traffic growth without being able to recover the specific costs generated from OTT services – and this with EU telcos' retail revenues steadily falling year over year."*[54]

Above it was already stated that the increasing data traffic does not translate into a proportionate increase in costs. Consequently, a priori there is no obvious reason as to why the investment capacity of network operators would have declined considerably.

In a report by the European Commission (2022) it was pointed out that the monetary policy and a worldwide savings surplus resulted in an abundant availability of financial means this past decade. At the same time financial investors realised that networks had become essential infrastructure following the lockdowns and fibre represented the most future-proof network technology. Furthermore the advantage of the telecom industry pushing back during a recession is emphasised[55] - for consumers do not cancel their Internet to save - raising the interest of investors seeking an attractive risk return.[56] All of this combined created a great boost to invest in networks.

An internal BIPT study on the profitability of quoted telecom operators also reveals that the profit margins and ROC have remained stable these past ten years in the European telecom sector.

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[54] ETNO/Axon, May 2022. Europe's internet ecosystem: socio-economic benefits of a fairer balance between tech giants and telecom operators, p. 25

[55] European Commission, 13 June 2022. *A study on investing in local and regional Gigabit broadband deployment: Opportunities and challenges for market investors in the EU*, p. 18

[56] Ibidem, p. 16.

Although, from an international perspective, they are "lagging behind", there is neither a gap nor a decrease to be seen in the past decade.

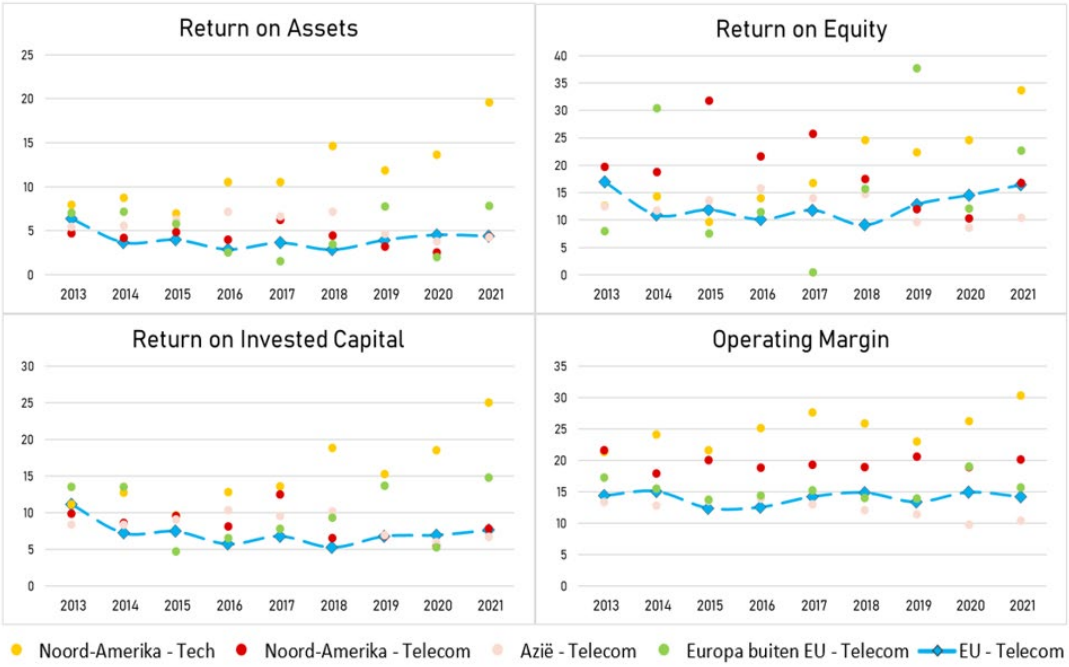

Figure 4. Profitability European telecom sector (source: BIPT study)

Because of the high inflation and interest rates it is possible that investors will exercise more restraint. Its effect is hard to determine beforehand, even more so as especially fibre is a project at very long term. It is unclear how long the inflation and related interest increases will last.

Finally, there is the factual observation that all throughout Europe many fibre networks are rolled out without any additional compensation. In Belgium Proximus for instance is rolling out fibre largely in line with the Digital Decade goals. A joint venture between Telenet and Fluvius (NetCo) wants to upgrade the existing cable network to an FTTH network by 2038 with the revenue of the existing network. The wholesale-only company is fully self funded by using the cash flows from day one.[57] For the rural areas that are less profitable, state aid is sometimes provided; in Belgium that is the case in the East Cantons for instance.

The first 5G spectrum auction - implying coverage obligations - also aroused sufficient interest, which shows that the profit forecasts for 5G without these compensations are already sufficient. The result of an auction is indeed a reflection of the estimated net value after deduction of possible costs. The fact that in the end more than 1.4 billion was bid for the total lot of spectrum, does not mean that the participants deem the roll-out to be unprofitable.[58] Thus, it does not seem to be primarily about purely the *availability* of financial means as they were abundant for over a decade, but rather about the distinction between first focussing on the more profitable projects and only later on the less profitable ones. Furthermore, even when the capital is available, it remains a great challenge to organise a large-scale roll-out of networks in the short run. All sorts of shortages in terms of staff, in the supply chain, difficulties regarding access to civil works and administrative delays are hampering or slowing down the roll-out that can be carried out as well. The Gigabit Infrastructure

[57] Telenet Earnings Call S1 2022. Transcript p. 3. https://nl.investors.telenet.be/static-files/fbe1f534-4c96-4e12-b959-e0f9578a0fa0

[58] BIPT, 20 July 2022. https://www.bipt.be/consumers/publication/radio-spectrum-auction-ultimately-yields-more-than-1.4-billion-euro

Act (GIA), the new proposal replacing the Broadband Cost Reduction Directive (BCRD), aims to address part of these challenges by proposing measures that should accelerate the roll-out but reduce its costs.

3.3. Conclusion

The BIPT feels that the necessity for the Belgian market to implement a compensation based on the volume of the Internet traffic is not established. Firstly, the traffic is generated by the free choice of end-customers paying for their Internet subscription. Secondly, Internet platforms and Internet providers have a mutual dependency resulting in a sustainable symbiosis in terms of interconnection, CDN investments and efficiency gains such as video compression. For they have similar interests in providing the end-customer with a qualitative connectivity, something both parties strive after.

This does not exclude however that it is possible to stimulate certain measures to achieve more efficiency (development of advanced compression, automatic software uploads during off-peak hours, agreements regarding automatic occupation of bandwidth etc.).

Although investors will possibly exercise more restraint because of the high inflation and interest rates, sufficient capital seems to be available for the financing of the roll-out of access networks; in rural areas the private investment is sometimes supplemented with state aid. Regarding the Internet backbone, where costs are only traffic sensitive to a certain degree, decreasing unit costs compensate a part of the possible costs linked to increasing network traffic.

4. Direct contributions: impact analysis

Actual proposals to devise a mandatory payment to ISPs, are lacking. The impact analysis suggested in this chapter, therefore remains rather conceptual by nature.

4.1. The current Internet architecture

The Internet exists of countless threads that are all directly or indirectly interconnected, like a spider's web. In this complex constellation Internet Service Providers (ISPs) are the only ones to provide the end-customer with Internet access. These, what we call 'Internet Access Services' (IAS) are subjected to net neutrality[59]: an ISP may, among other things, not discriminate between specific content on the basis of commercial considerations.[60]

One layer deeper we find a myriad of IP interconnections where the different players on the market are free to choose how they interconnect and whom with. Thus data centres, servers and ISPs are interconnected. There is public peering through Internet Exchange Points (IXP), a proverbial junction where connections of multiple ISPs and CAPs all gather at one place. Although that Internet content has always been accessible indirectly, different parties can provide an additional "shortcut" through an interconnection by linking their routers, i.e. private peering.[61] Peering is mainly characterised by the fixed costs of the routers and their gateways. WIK sees considerable economies of scale in this regards, which would lower the unit costs:

> *"The cost of a 10 Gbps port is on the order of a few thousand euros (~ 3,000 EUR). A 100 Gbps port does not cost ten times as much as a 10 Gbps port, but only about twice as much (as of 2020)."*[62]

Peering can allow savings on IXPs or transit services. The costs of transit services have a more obvious link with the required capacity. It is therefore logical that once two networks or a network and a CAP have exceeded a certain threshold of Internet traffic, covering the fixed costs of peering, they will turn to each other. This creates a decentralised model in which all players can interact in their mutual interest. In 2012 and 2017 BEREC came to the conclusion that the IP interconnection market showed competitive dynamics.

In any case the Internet traffic can only be delivered to the end-user once it has been delivered through the Internet provider's terminal network. In other words, the ISP has a termination monopoly to deliver data to his end-customers. Today, that monopoly cannot be used to demand revenue from content providers because of the net neutrality imposed. It is the end-customer who pays for access to the Internet.

The possible impact of a regulatory intervention has to be assessed against this background. There are two models of direct contributions, even though the analysis below shall not yet make a clear distinction between the two as they have the same structure for the most part and consequently

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[59] According to the Open Internet Regulation 2015/2120

[60] Unless for the provision of specialised services, in conformity with the stipulations in Art. 3 (5) of the Open Internet Regulation (EU) 2015/2120.

[61] "Technically, interconnection between two networks is realised by connecting two routers of the involved networks. Each party needs either a free network interface (port) at an existing router or else needs to set up a new router with free ports. The hardware costs for routers (and associated cables) can be considered very low compared to the total network costs, in particular given the pace of technological progress." BEREC Preliminary, 7 October 2022, Assessment of the Underlying Assumptions of Payments from Large CAPs to ISPs, p. 10.

[62] WIK-Consult in opdracht van BNetzA, 28 februari 2022. *Competitive conditions on transit and peering markets: Implications for European digital sovereignty.* p. 29.

produce the same effects. The considerations regarding the indirect contribution are discussed in the final chapter.

4.2. Sending Party Network Pays

There are two main models to implement a direct fair share contribution based on the heavy consumption. In the first model - the Sending Party Network Pays model - a party who transmits more traffic than it receives, is obliged to pay a fee to the other party based on that surplus traffic.

Even with an SPNP mechanism, the remaining price is still to be negotiated by both parties, among other things to take into account the economies of scale. Consequently the unit price is not imposed, even though a price cap is probably necessary to avoid extremes that are reasonably to be expected in the case of monopolistic pricing.

4.3. Direct contribution of big CAPs

Another model to arrive at fees from Internet companies, is to only oblige the major Content Application Platforms (CAPs) to do so. We then spontaneously think of companies like Google and Netflix, but a concrete proposal on how to implement this has not yet emerged, although it would probably be based on a proportionality with the amount of Internet traffic as well. In South Korea there is a type of Sending Party Network Pays system that applies to parties representing at least 1% of the Internet traffic.

In a study conducted by Oxera and commissioned by the Dutch government, that constriction to the major CAPs is considered to be the only realistic scenario because

(i) firstly, there are a huge number of small CAPs and it is unclear as of what point a regular Internet service becomes a content application platform;
(ii) the Internet is a worldwide platform while ISPs operate on a national or regional level, meaning that every CAP in the world would have to conclude a contract with every European ISP;
(iii) and finally the Internet is too dynamic for the permanent monitoring of all (for instance upcoming) CAPs to be considered feasible.[63]

The Axon/ETNO study also expresses its preference to subject a select group of big platforms to a contribution:

> The scope of such tools could also be limited to just a few, very large OTTs, in line with the EU approach taken for the regulation of "gatekeepers" under the Digital Markets Act, and "very large online platforms" under the Digital Services Act.[64]

At the moment, ISPs seem to prefer this model to the SPNP model (which ETNO aimed at in the past). As of a certain percentage of Internet traffic, the ISP would have to be able to negotiate with the CAP about additional fees. ISPs also recognise that in the case of such a system a regulator will be needed who can settle disputes and that it will not be obvious to verify to what degree these amounts flow back into investments. A body capable of monitoring this would be required as well.

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[63] Oxera, 30 January 2023. *Proposals for a levy on online content application providers to fund network operators*, p. 28. (paraphrased)

[64] Axon/ETNO, May 2022. Europe's Internet Ecosystem : socio-economic benefits of a fairer balance between tech giants and telecom operators, p. 2.

However, the arguments below are applicable to every mechanism that is based on direct contributions, i.e. contributions that are paid to the network operators or ISPs and are based on the amount of Internet traffic.

4.4. Analysis and evaluation

4.4.1. Possible benefits

European ISPs can use the CAPs' contributions to finance network investments. Above it was already called into question whether such fees represent a *conditio sine qua non* to roll-out networks.

Despite this, a higher revenue for telecom operators does mean that there are more fluid assets *available* to invest. The question is whether those funds will indeed be used to roll out networks beyond what is planned today (in absence of such contributions).

The areas in which investments in VHC networks are not profitable, are generally located in the sparsely populated rural country. As a sparsely populated region per definition will not connect a lot of new end-customers to the ISP's network, a possible reinforcement of the ISP's negotiating position compared to the CAP is negligible in any case. For the market for his termination monopoly will only grow to a very limited extent. Although the contribution does increase the general profitability of the Internet provider, there is no direct increase of the incentive to further boost investment in such regions.

Companies and their investors seek a return on capital that they use. An uneconomic project will remain uneconomic however - regardless of the general profitability of the mother company. Consequently, a direct contribution as is the case with the SPNP mechanism, does not seem to increase the likelihood of network investments.

Only if a contribution is paid into a central fund, for instance to subsidise private-public networks, there is a guarantee that the money will indeed be used to invest. This type of indirect contribution is discussed in Chapter 5.

4.4.2. Expected downside

4.4.2.1. Case Study: South Korea

The only country where a system of mandatory payments based on Internet traffic exists, is South Korea. An extensive case study can be found in Bijlage 2. Experience there shows that it is hard to avoid diversion mechanisms such as stopping direct peering or installing servers abroad if one also wishes to maintain net neutrality. Although the South Korean system has only been introduced recently and multiple corrections were needed to rectify unforeseen consequences, the question remains to what degree the conclusions of one country can be extrapolated to Europe, which, due to its population and size carries a different weight all together. Moreover South Korea is doing very well in other fields such as the take-up of FTTH and 5G.[65]

4.4.2.2. Impact on the Open Internet architecture

The introduction of a contributions mechanism based on data traffic entails a major turnover of the existing, free Internet architecture.

[65] *Broadband Portal - OECD*

At the moment, the interactions on the current IP interconnection market is characterised by a win-win approach. Both ISPs among each other and in interaction with CAPs, benefit from data being delivered to the end-customer fast and at a low latency. It is therefore to both parties' advantage to achieve an interconnection. The bigger CAPs invest among other things in Content Delivery Networks (CDNs) that interconnect with network operators or that are even located in the ISP network. Smaller CAPs use CDNs from international groups such as Amazon, Akamai, ... If a mandatory contributions mechanism based on the volume of Internet traffic is introduced, that win-win interaction turns into a win-lose. For, the mandatory payment to one party entails additional interconnection costs for the other party. The paying party, however, cannot purchase an additional quality improvement with this, as the former may not be given a preferential treatment by the ISP according to net neutrality.

Giving up this free search of each player for mutually beneficial interconnection by introducing a mandatory contribution, brings about all sorts of unintentional competitive distortions on the Internet eco system's submarkets. These will probably complicate the cooperation and the spontaneous, decentralised growth of the Internet. A non-exhaustive list of new thresholds and altered interactions among market players:

- **Big and small Internet providers**: small ISPs have a less favourable negotiation position as the value of the termination monopoly will depend on the number of end-customers connected. Small ISPs will probably get less favourable fees. Moreover this promotes market concentration among Internet providers, who are seeking as big a customer base as possible, for instance through mergers.
- **Big and small CAPs**: small CAPs do not have the means to negotiate with each ISP, which is presumably to their disadvantage. Should the contribution only apply to the big CAPs, small CAPs and CDNs would be less inclined to grow passed that threshold and to challenge the market, which would render the market less dynamic.
- **Local and international CAPs:** International CAPs can circumvent the mandatory contribution more easily by moving certain servers outside of the market, as the Korean example shows. This way, their content remains available thanks to net neutrality but has to travel a greater distance. It originates from a jurisdiction where no mandatory fee applies. In terms of input costs this constitutes a competitive advantage compared to local CAPs who have more difficulties skirting the fee.
- **Physical networks and wholesale Internet providers**: It is unclear who is entitled to the fee. If an Internet provider using wholesale access receives the contribution, this undermines the purpose of promoting the roll-out of new networks. However, network investors rolling out passive infrastructure do not partake in interconnection and do not deliver Internet access services to the end-customer. So strictly speaking, passive networks do not have a termination monopoly, but they do make the investments.
- **Television subscriptions and VOD:** Many ISPs offer a television subscription via their cable television network or IPTV. If they perceive video-on-demand platforms such as Netflix and Disney+ as a threat, they can use negotiations about the mandatory contribution as a means to drive up the costs for streaming services artificially. This can hurt the consumer in two ways: higher prices being passed on or a reduced offer if certain streaming services avoid Europe.
- **Innovative Internet products**: new and innovative applications on the Internet are often data-intensive, such as AI-based big data analyses and virtual reality. It could damage Europe's competitive position if the development of such innovative products is hampered by subjecting them to additional costs.

The Internet eco system forms one integrated whole with layers having a direct or indirect impact on each other. Allowing Internet Service Providers to monetize their termination monopoly, enables them to demand an access and/or consumption fee on their terminating network. This brings about all sorts of changes in the competitive dynamics on the underlying markets. It is *a priori* hard to tell at this stage how this impact will eventually unfold into new market balances. Intervening in the business model on "the edge" of the Internet, is therefore not without risks in terms of the Internet architecture.

4.4.2.3. Transaction and regulatory costs

As discussed above, a fair share mechanism comes down to a transfer sum, from which the CAPs do not derive benefits in terms of quality due to net neutrality. The advantage for one party is as big as the disadvantage for opposition. In the most optimal scenario revenue from one player is moved to another without benefits at the aggregated level, i.e. a zero-sum game.

Before that transaction is completed, however, the parties have to negotiate. This will generate transaction costs that will increase the costs for both parties. In Oxera's study the following conclusion was drawn:

> *"**Currently, transaction costs are low** in the market(s) between CAPs and ISPs. Most peering and transit agreements are voluntary and there have been few disputes or other regulatory interventions. […] However, a levy on CAPs would **likely increase disputes**."* [66]

The conflictual nature of a direct contribution and corresponding regulatory charges is even acknowledged in the Axon/ETNO study:

> *"[T]he most important condition for the instrument's success in practice will be an effective and compulsory **dispute resolution** mechanism, as the **two sides' interests are unlikely to be aligned** at the start of the overall process."* [67]

Depending on the volume of the contributions, Oxera expects there to be inefficiencies if the companies focus their strategy on winning the zero-sum game:

> *"Essentially, the time and effort of senior management at both telcos and CAPs would be diverted to **rent-seeking activities […] rather than productive activities** in terms of improving their products and business operations."* [68]

In addition, a risk would arise of abuse of the termination monopoly by ISPs and the interaction with the complex net neutrality regulation, which requires regulatory oversight and thus generates even more additional costs. A non-exhaustive list of new charges for the regulator(s), extracted from the above-mentioned Oxera study:

> *"Assessing costs and setting prices; traffic analysis and verification; dispute settlement and litigation; reassess SMP market reviews; deal with the effects of distortion of competition; monitoring; coordination and alignment."* [69]

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[66] Oxera, 30 January 2023. *Proposals for a levy on online content application providers to fund network operators*, p. 28. BIPT marking.

[67] Axon/ETNO, May 2022. Europe's Internet Ecosystem : socio-economic benefits of a fairer balance between tech giants and telecom operators, p. 44.

[68] Ibidem, p. 31. BIPT marking.

[69] Ibidem, p. 29.

In short, any direct contribution based on the data traffic volume seems to exhibit all characteristics of a zero-sum game in the most optimal scenario. Any additional transaction cost relegates this to a net negative market intervention.

Such transaction costs are likely to weigh more in relative terms in Belgium. The Internet providers who serve end-customers here, are small from a global perspective and consequently have a lesser negotiating position compared to the main Internet companies. For them, the bigger part of the benefits will go to the transaction and regulatory costs compared to the main players such as Telefonica or Orange. The advantage for the Belgian ISPs will therefore presumably be smaller, causing them to suffer a competitive disadvantage. This intervention is likely to reinforce the economies of scale of the largest operators.

4.4.2.4. Possible effects on the network quality

In South Korea a version of a Sending Party Network Pays mechanism with contributions based on the data traffic volume is imposed. This has pushed certain CAPs to choose to withdraw from local interconnection points and to use international capacity as a baseline.[70] This way they skirt the contributions but the traffic still arrives at the private user.

In this context, the European Centre for International Political Economy commented on the South Korean model as follows:

> *"By disincentivising data hosting, the SPNP regime has actually reduced network investment in Korea – a densely populated country with a number of inhabitants equivalent to a large Member State like Italy or Spain. Korean users have ended up paying more for* ***an inferior service that follows an elongated traffic route****."* [71]

The same argument applies to the network resilience: longer routes with more interconnection transfers are susceptible to congestion or other issues in different ways. Direct peering with transit or IXP services as a back-up option is a more robust solution; but this is actually likely to be discouraged.

In other words, connectivity quality goes beyond merely the last mile Internet providers are looking at. If a fee based on the data traffic indeed deters large Internet companies from providing direct interconnections with Internet providers within Europe, these data will have to travel longer distances. This causes the traffic in question to pass through more nodes and arrive at the end-user's with a higher latency.

4.4.2.5. Possible effects regarding sustainability

If the CAPs have less reasons to achieve a direct interconnection with the ISPs or are even encouraged to move (certain) servers outside of the jurisdiction in which contributions are mandatory, a lot more traffic will pass through international transit services. Although its marginal impact is probably low, a longer route with more transfers in interconnection nodes also requires more energy. When servers and data centres are moved outside of the European Union, there is even a real chance that they end up in countries with less ambitious goals in terms of renewable energy. This could increase not just the amount of energy needed but that energy's CO_2 intensity as well.

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[70] WIK-Consult commissioned by BNetzA, 28 February 2022. *Competitive conditions on transit and peering markets: Implications for European digital sovereignty*, p. 36 .

[71] ECIPE (Hosuk Lee-Makiyama) https://ecipe.org/blog/rethinking-incentives-infrastructure-investments/ BIPT marking.

This reasoning raises doubts as to the claim in the Axon/ETNO report stating that a contribution in investments from big CAPs can help avoid emissions. The study cites sustainability to address the increasing data traffic:

> *"Increased data traffic comes with important negative externalities for sustainability. In particular, some argue that the substantial growth envisaged for data traffic could drive higher energy use in telco networks, with important ramifications for greenhouse gas (GHG) emissions. […] it is also true that the increasing data traffic they [CAPs] are responsible for is the main driver for the increasing energy use; and yet the negative externalities of energy expenditure or CO2 emissions are not passed on OTTs."* [72]

As was already demonstrated above, the data traffic has been ever increasing and there is no indication of an acceleration of the historical growth rate. In addition, a study commissioned by the BIPT, revealed that the total energy consumption of the Belgian operators throughout the 2018-2021 period dropped by 11% despite the increase in data traffic.[73]

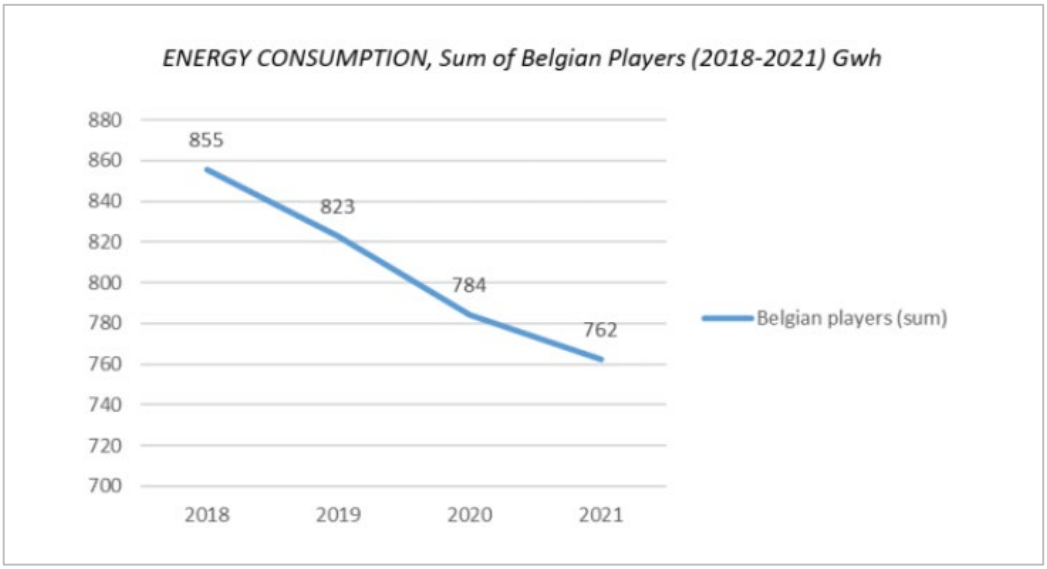


Figure 5. Total energy consumption Belgian operators (source: the BIPT)

Moreover a steep drop in CO_2 emissions can be noted in that same period.[74] This can be explained by the lower energy consumption but also by the operators' efforts to work with sustainable energy (such as wind or solar power) and the electrification of their fleet.

Over a 4-year time span, we can therefore see that the CO_2 emission per unit has decreased to only one fourth.

[72] Axon/ETNO, May 2022. P. 22.

[73] BIPT, 29 November 2022. https://www.bipt.be/consumers/publication/communication-of-29-november-2022-on-the-study-regarding-the-sustainability-of-the-telecom-networks-in-belgium

[74] Between 2018 and 2021 emissions dropped from 53 Kton CO_2 to 38 Kton CO_2.

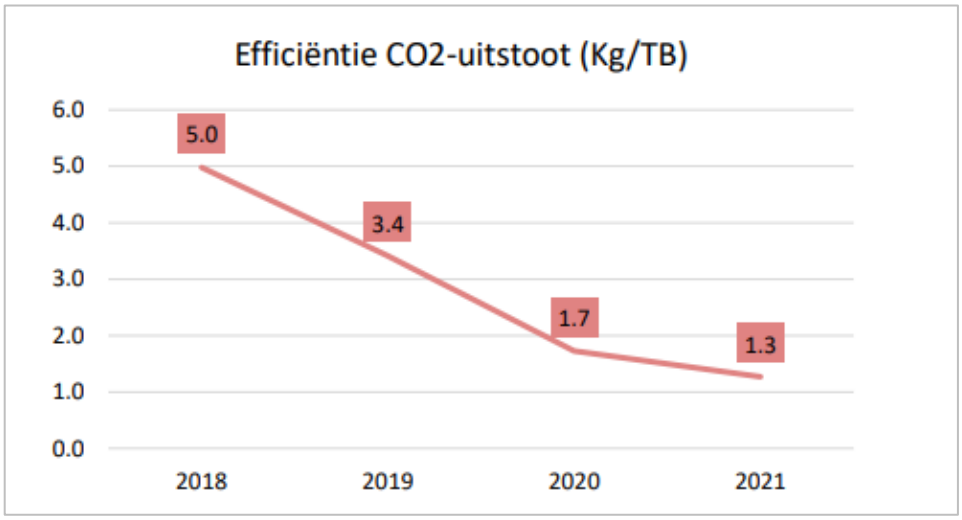


Figure 6. Emissions per data unit, Belgian operators (source: the BIPT)

Consequently, the growing data consumption does not translate into an increase of the energy consumption or into higher emissions.[75] Similar results can be found with other European operators such as KPN, Deutsche Telekom and Telefonica.

Alarming predictions of the exponentially increasing data consumption causing a significant increase in emissions, are therefore unfounded. Furthermore the BIPT study reveals that the bigger part of the Scope I emissions[76] of the Belgian Internet Service Providers comes from sources that are not correlated with the volume of data traffic, such as fuel for the fleet (74%) and for heating (21%). The impact of an increase in the data volume will therefore presumably be very small in this regard. In addition the already scheduled investments in 5G and fibre will actually enable the operators to switch off energy-inefficient networks (copper network, 3G and later 2G). Thus, further improvement is likely. The operators moreover already committed to improve their own energy-efficiency even further, to make optimal use of renewable energy and to reduce their CO_2 emissions to a minimum.[77]

Introducing inefficiencies by stimulating evasion on the IP interconnection market, actually brings about the risk of undoing part of this positive evolution in terms of sustainability.

4.4.2.6. Structural modification of a temporary problem

That a direct contribution seems disproportionately intrusive can be approached more generally in addition to the arguments based on Internet architecture and network quality. The basic assumption of the fair share discussion indeed implies that network operators have to finance major investments, in particular in fibre and 5G, thus requiring a compensation.

The EU adopted connectivity goals for 2030 stating that: "*all end users at a fixed location are covered by a gigabit network up to the network termination point, and all populated areas are covered by next-generation wireless high-speed networks with performance at least equivalent to that of 5G, in*

[75] Between 2018 and 2021 emissions dropped from 53 Kton CO_2 to 38 Kton CO_2.

[76] Scope I emissions are direct emissions for which the company is responsible and not the supply chains.

[77] "Net zero" refers to both the emissions produced (scope I) and the purchases of electricity (scope 2). CO_2 emissions are cut to a minimum level that causes a rise in temperature of 1.5 °C at the most, as laid down by the Paris Agreements. This is driven by science-based targets (SBTi – https://sciencebasedtargets.org/)

accordance with the principle of technological neutrality"[78] The Axon/ETNO study points out that if there is insufficient investment capital available, these goals may not be achieved in time:

> *"EU telcos are investing heavily in Very High-Capacity Networks ('VHCN') for the provision of fixed (FTTH) and mobile (5G) services. […] If, at the same time, EU telcos have to cope with increased OTT-driven traffic without fair and proportionate compensation,* ***these benefits*** *to the European economy* ***may be delayed****, which may represent an important opportunity cost."* [79]

Although the BIPT did not find significant financing issues (see above), a delay - even if such issues were to exist - is by definition a temporary problem. Consequently it would seem unfounded to make structural changes to the IP interconnection market for that reason by laying down a legal framework for the operation of termination monopolies.

The main fibre installer in Belgium, Proximus, moreover indicates that the peak in investment costs are temporary by nature. At the latest Capital Markets Day, a goal was set to return to normalized capex levels within three years. This shows that operators do indeed have to ride a temporary wave of investments to render their networks future-proof. Fibre networks are, however, expected to last at least 40 to 80 years even, causing incremental investments to turn out much lower in the medium term. The question thus remains why compensations would have to be imposed in the long term for external parties such as CAPs.

In this context state aid for rural fibre projects consequently makes more sense: one-time costs to address a one-off problem. As there is no structural change, the existing Internet architecture remains intact. With regard to 5G this matter is not relevant anyway: as spectrum is auctioned with corresponding coverage requirements, the relation between the expected investment costs and the expected returns will be reflected in the auction amounts.

[78] Decision (EU) 2022/2481 of the European Parliament and of the Council of 14 December 2022 establishing the Digital Decade Policy Programme 2030 L_2022323NL.01000401.xml (europa.eu)

[79] Axon/ETNO, May 2022. Europe's internet ecosystem: socio-economic benefits of a fairer balance between tech giants and telecom operators, p. 21.

5. The indirect contribution

5.1. The concept

The less intrusive way to develop a fair share contribution is through an indirect contribution to a (yet to be created) fund, for instance to finance social services or to subsidise rural fibre projects. The need for this was not substantiated either, so in principle, such market intervention cannot be justified either. As no actual proposals have been launched yet, we can only speculate as to what exactly the mechanism would look like. In any case, the following two elements should (have to) characterize an indirect contribution:

- The compensation for the Internet platform is **not** directly based on the volume of Internet traffic. This could place certain CAPs in a European or national category of large users, but there is no proportional link between the payment and for instance the peak load of a specific network. Other factors such as turnover or the number of active users can possibly play a role, following for instance the concept of gatekeepers in the Digital Markets Act, or very large online platforms in the Digital Services Act.
- The payment is **not** invoiced by an ISP or network operator but is centralised in a type of fund. It is not the sector itself but an independent body that determines to what means and under what circumstances the money can be used.

In the Axon/ETNO study this option is dismissed as less desirable than a direct payment:

> *"Other solutions could include a form of indirect compensation, e.g., through a special fund or a form of digital taxation. However, while seemingly more neutral, such a solution would likely also raise serious concerns. For example, a new fund would be difficult to set up, inherently controversial, and could risk being misdirected to other, unrelated, objectives. Similarly, any solution involving a new tax on digital services could create negative public perceptions about its purpose, at both the European and international level."* [80]

5.2. Preliminary analysis

Axon's reasoning as to why it would be harder to set up a fund, is lacking. However, it does not seem easier to develop a new and practicable legal framework to thoroughly change the IP interconnection ecosystem in a way that is compatible with fair competition and net neutrality. The argument that there is a risk that it is sent to non-related targets, should be considered rather as mitigating circumstances. As described above the increase in fibre and 5G investments is indeed a temporary phenomenon. A possible option could be to have the CAPs contribute to the geographical fund covering white spots based on their turnover.

If most fibre projects are rolled out within fifteen to twenty years, it cannot be the intention to continue to hand out fibre subsidies for instance in the areas that are already covered. If operators indicate that it is only profitable to roll-out a single network in certain areas - in particular in case state aid has already been granted - a continuing flood of subsidies for a second or third network would imply a suboptimal use of means just as much. This would turn the fund into a permanent mechanism "giving away" parts of their networks to network operators. To take into account the expensive roll-out in rural areas, the BIPT is currently examining under which circumstances the roll-out of multiple networks is to be expected and where some form of collaboration can be allowed. If the roll-out of two networks is considered to be disproportionately expensive, further subsidies can

[80] Axon/ETNO, May 2022. Europe's internet ecosystem: socio-economic benefits of a fairer balance between tech giants and telecom operators, p. 47.

be better used elsewhere to boost connectivity. In addition, an investment fund that is replenished each year, could even send the wrong message to network operators to postpone certain investments until they are finally subsidised.

Even if a fund is set up to centralise indirect contributions, it becomes a challenge to clearly indicate from the start which general purpose it will serve in the long run. For the current investment wave in fibre and 5G is of a passing nature and thus the long-term goal has to be defined in a sufficiently dynamic manner. Even in the case of a fund it is not easy to solely focus on investments of great general interest but presenting a weak business case for operators. Additional subsidies could be exacted by improperly postponing investments, which can harm the consumer and the European connectivity goals.

Both a direct contribution based on the termination monopoly and an indirect contribution to a fund distributed on the basis of certain criteria, can give rise to rent seeking. To obtain subsidies for certain projects or to set up private-public partnerships, network operators however are still competing each other to eventually secure the project. If this competitive effect is strong enough, this can reduce the amount of subsidies required.[81] In the case of negotiations on direct contributions based on the network operators' termination monopoly, competition among themselves plays less of a part because CAPs have to pass through the network of at least one specific ISP any way if they wants to get access to the end-customers.

Creating such a fund can also become tricky from an institutional point of view. The example of OTT players contributing to local audiovisual productions is sometimes used to argue that a similar system can be set up regarding network use. Article 13.2 of the Audiovisual Media Services Directive (AVMSD) for instance states:

> *"Where Member States require media service providers under their jurisdiction to contribute financially to the production of European works, including via direct investment in content and contribution to national funds, they may also require media service providers targeting audiences in their territories, but established in other Member States to make such financial contributions, which shall be proportionate and non-discriminatory."*[82]

[81] Or encourage more projects with the same amount of subsidies.

[82] Directive (EU) 2018/1808 of the European Parliament and of the Council of 14 November 2018 amending Directive 2010/13/EU on the coordination of certain provisions laid down by law, regulation or administrative action in Member States concerning the provision of audiovisual media services (Audiovisual Media Services Directive) in view of changing market realities. https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32018L1808&from=EN

The amendment of Article 13.2 is laid down in Article 18 of said EU Directive 2018/1808.

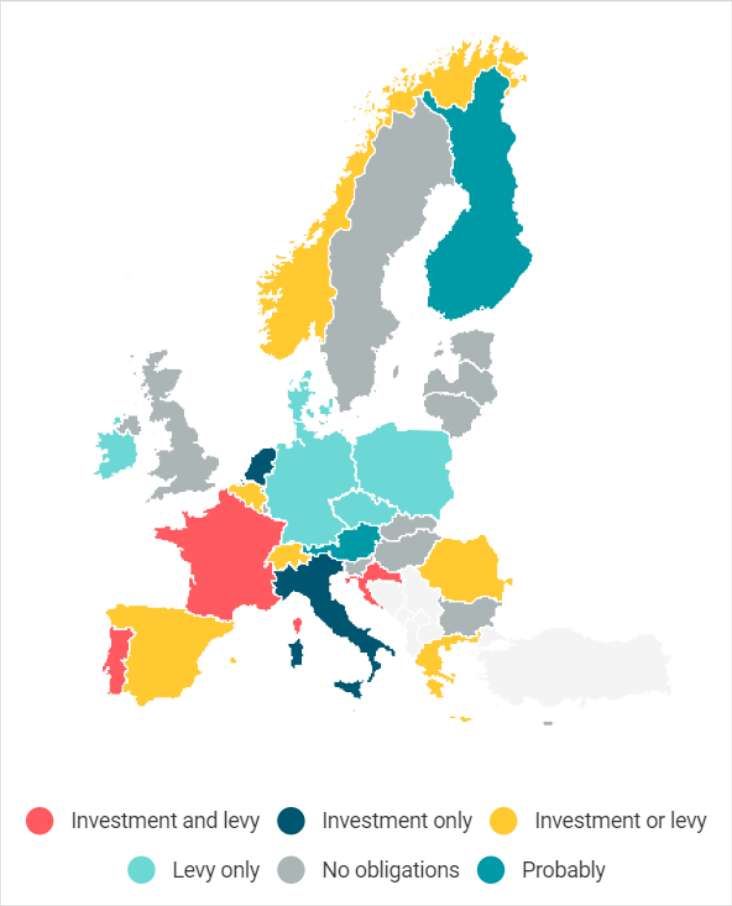


Figure 7. National interpretations AVMSD (source: Cullen International)

The interpretation is left to the Member States, resulting in a great variety of local requirements both in terms of contributions and of the eligibility criteria. A plethora of national specifications can possibly result in fragmentation of the currently decentralised and open interconnection system underlying the Internet. It can also drive up the transaction and compliance costs, possibly at the expense of the consumer or the CDN investments.

In any case it should be avoided that network operators use such a fund to pass on a part of their regular capex - i.e. for projects that will be carried out anyway - to an external party. In that case the fund would no longer serve the general interest but artificially lower the ISPs' costs for the benefit of their stakeholders. If the CAPs raise their consumer prices in order to maintain their profit margins, it would be nothing more than a price increase for broadband services, even indirectly.

Even though the need for indirect contributions to the fund for the Belgian market is not established either, it can be stated that it leaves the existing Internet architecture largely intact and thus lowers the risk of affecting the net neutrality and distorting the interconnection's win-win nature through transaction costs. This does not mean however that there is no market-distorting effect following the choice of criteria based on which the players have to contribute, most likely having a discouraging impact. Here as well legal (setting up a fund, calls for projects, project assessments and awards, disputes) and regulatory costs will skim off some of the benefits. The content platforms passing on these contributions to the end-user, comes down to having the Internet user subsidise the networks via a very large detour.

6. Conclusion

On the basis of this first study, the BIPT believes that the need for mandatory payments from Internet platforms to network operators is not sufficiently demonstrated. Firstly the traffic is initiated by the end-customers' free choice within their premium Internet subscriptions' possibilities. Secondly, Internet platforms and Internet providers are characterised by a mutual dependency resulting in a sustainable symbiosis in terms of interconnection, CDN investments and efficiency gains such as video compression. For they have similar interests in providing the end-customer with a qualitative connectivity, something both parties strive after.

Allowing for the possibility to monetize the ISPs' termination monopoly by means of mandatory, **direct payments** by CAPs reverses the existing, free IP interconnection market and brings about hard-to-assess shifts in the competitive dynamics on related markets.

Setting up a fund for **indirect contributions** leaves the interconnection market intact. However, this does not exclude the possibility of a market-distorting effect depending on the choice of the criteria based on which the players have to contribute. It is also unclear whether a permanent and separate fund to help finance a temporary investment peak, is the appropriate means as there are already a lot of commercial fibre roll-out plans and as in rural areas state aid is sometimes already provided.

In both cases it remains unclear to what extent it will be possible to pass on the payments from CAPs to their end-customers and whether this will discourage their investments, for instance in CDNs.

Whether or not direct or indirect payments are introduced does not preclude that CAPs can be incentivised to work together with operators to establish a robust broadband ecosystem. CAPs and ISPs have a mutual economic dependency due to the importance of both powerful networks and the availability of interesting content. It is in the interest of both ISPs and CAPs to deliver content as reliably as possible to the end-customer, which entails significant investments for both parties.

Axel Desmedt
Member of the Council

Bernardo Herman
Member of the Council

Luc Vanfleteren
Member of the Council

Michel Van Bellinghen
Chairman of the Council

Annex 1. Compression techniques and streaming protocols

Compression techniques

In addition to investing in physical infrastructure Internet platforms use different sorts of techniques to limit their required bandwidth for the data traffic to arrive at the end-customers as quickly and as reliably as possible. The ISP in question also reaps the benefits from this as there are less data to handle, which reduces the risk of congestion. The codec[83] and streaming protocols used also play a role in the way the content sent takes up network capacity. We will look at both aspects separately.

As early as 2016, a study by Communication Chambers, commissioned by the network operator Liberty Global, expressed hope:

> "The transition to HD is already well underway, and in time there will be a move to 4K (and eventually 8K). The additional pixels, greater colour depth and so on of these formats require more bandwidth, all else being equal. […] However, precisely because of the rise of video, there has been enormous attention to developing techniques for efficiently compressing video. […] This has resulted in substantial and ongoing improvements. The **bandwidth required to deliver a given video quality has halved every seven years**. […] Even 8K – the generation beyond UHD TV – only requires 50 Mbps and will likely require much less before it is widely available to consumers." [84]

Today there is a multitude of codecs and logically they all offer a different degree of compression. H.264 (or AVC) is the codec that is most often used and is supported by almost all apps, services and devices. This is today's Internet standard.[85] Its successor, H.265 (or HEVC), cuts in half the data needed for the same video. The future successor, H.266 (or VVC) will cut that in half again. The downside of these codecs is however that its use is subject to licensing. In the meantime, in addition to these codecs, there are a number of free alternatives such as VP9 and AV1, that are equivalent to H.265 and are developed by Google and the Alliance for Open Media respectively.

It would however be a mistake to solely focus on the compression to choose one codec's quality over the other. Other aspects such as the device's computing capacity (hardware support), browser support (software support), HTTP protocols support[86] and container formats[87] ... play an important role when it comes down to determining which compression to use for the transmission of the content to the end-customer.

In order to watch the content the compressed images in the codec have to be decompressed through software integrated in a certain app or browser. An app for content displaying (such as Netflix or

[83] Codec is short for compression/decompression. The algorithm compressing all frames of a video as optimally as possible to minimise data and bandwidth.

[84] Kenny, Robert and Williamson, Brian (Communications Chambers commissioned by Liberty Global), November 2016. *Connectivity for the Gigabit Society: A framework for meeting fixed connectivity needs in Europe*. p. 22-23. BIPT marking.

[85] https://www.streamingmediaglobal.com/Articles/Editorial/Featured-Articles/The-State-of-Video-Codecs-2023-157805.aspx

[86] Such as Real Time Streaming Protocol, HTTP Live Streaming, MPEG-Dynamic Adaptive Streaming over HTTP, HDS streaming, etc.

[87] A container format is a file format that allows to embed multiple data streams in a single file, usually together with metadata for the identification and further details of these streams. Well-known examples of container formats are the ZIP format and formats used to play multimedia, such as MP4. Although containers can identify how data are coded, they do not instruct on how to code those data. A program that can open a container should also use an adequate codec to decode its content. If the program is not equipped with the required algorithm, it cannot use the data included. In those cases the programs usually transmit an error message denouncing a missing codec that users can possibly receive.

YouTube) use the CPU[88] (the processor). At hardware level, an integrated chip in most CPUs support a number of codecs for the decompression of content. At software level, a plug-in ensures the decompression of images via the browser. Decompression through hardware is quicker and more efficient than through software.

Due to that codec complexity the CPU plays an important part in the battery's autonomy: the more complex the codec, the more computing power and energy is required to decompress. In other words, the implementation of codecs already transfers certain charges from the network (less data) to the content provider (codec licences) and the end-user (hardware requirements and battery autonomy). Using newer codecs on obsolete hardware will also cause the battery to run dry quickly. As an empty battery results in unsatisfied customers, content providers will ensure that end-customers receive content in a codec that is compatible with their hardware.

Below the five most frequently used codecs are discussed in depth:

- H.264/AVC already exists since 2003 and is supported by just about anything and anyone, from Blu-ray via streaming apps such as Netflix and YouTube to web software such as Adobe Flash Player and finally various HDTV broadcasts through terrestrial (ATSC, ISDB-T, DVB-T or DVB-T2), cable (DVB-C) and satellite (DVB-S and DVB-S2) systems.

- H.265 (or HEVC) was launched in 2013, but the licence fees are higher than for H.264. It is thus one of the main reasons why the take-up of HEVC on the web is low.[89] This codec is, however, often integrated in smart TVs for hardware support.

- H.266 (or VVC) from 2020 has a strong compression capacity but is not yet supported globally. The first TVs (with chips supporting this codec) only arrived in 2022. From a software point of view, this codec also requires too much computing and battery power.[90]

- AV1. A series of technology companies[91] have joined forces within the Alliance for Open Media (AOM) that launched the free alternative video coding format AV1 in 2018. Slowly but certainly AV1 is more widely supported: Netflix has been using this on Android, certain TVs and PlayStation 4 Pro since 2018. In 2019 Facebook followed suit and in 2020 YouTube did too. Apple, however, lagged behind and Safari 16.K only started supporting AV1 in March 2023.

- VP9, developed by Google. YouTube already uses VP9 for videos with thousands of views, reserving AV1 for videos with approximately 3.5 million views.[92] In the meantime Netflix is using VP9 as well and most browsers also support this.[93]

[88] In addition to a CPU (for general tasks) most chips are equipped with a specific GPU that is only used to decompress images. For the purpose of simplicity we will refer to the CPU in general.

[89] Apple's Safari browser was the only large-scale software supporting this until Google Chrome started offering this in October 2022 as well.

[90] The two most popular browsers, Chrome and Firefox, for instance do not support this and YouTube, Netflix, Amazon and Hulu have not yet announced that they will support this codec.

[91] Among others Amazon, AMD, Apple, ARM, Cisco, Google, Intel, Microsoft, Mozilla, Netflix and Nvidia.

[92] The State of Video Codecs 2022 (streamingmedia.com)

[93] Contrary to HEVC.

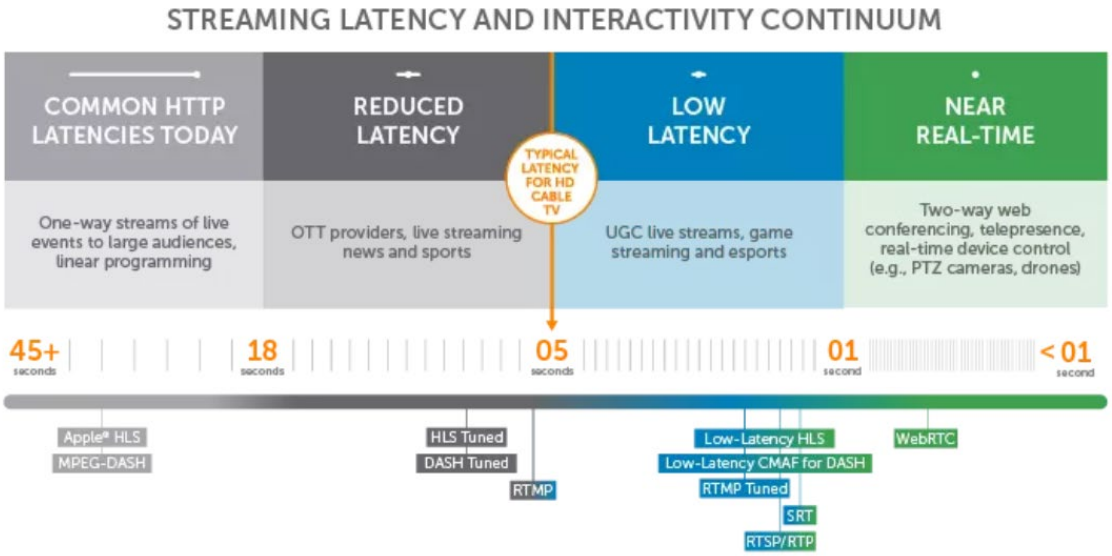
As the end-user is not always or not always immediately able to use the state-of-the-art codec, CDNs store multiple versions of the same file. These different versions are required to take into account the diversity of terminal devices: not every device is compatible with the latest versions.[94]

Streaming media protocols

Closely connected to the codecs are the streaming protocols[95] that, in combination with the use of a CDN[96], are crucial to deliver a live stream or video on demand in optimal quality to the end-user's terminal equipment.

Online videos use both the generic HTTP-based protocols and the specific streaming protocols. Streaming protocols such as Real-Time Messaging Protocol (RTMP) transport videos by means of specialised streaming servers and are used for live broadcasting thanks to their low latency. HTTP-based protocols (such as HLS[97] and MPEG-DASH) on the contrary rely on regular web servers to optimise the viewing experience and to shift gears quickly.

Below HLS and MPEG-DASH[98] are discussed in further detail as these are used by the main OTT services such as Netflix, Disney+, Youtube or Meta …



A stream sent through the HLS designed by Apple, is not restricted to viewers on iOS devices but can also be watched by a wide range of platforms such as Google Chrome browsers, Android, Linux, Microsoft and MacOS devices.

MPEG-DASH is the free, unpatented alternative for HLS and does guarantee the same scalability and quality. iOS and Apple TV do not support MPEG-DASH however.[99] YouTube, Netflix and Hulu do use

[94] Source: Analysys Mason, 14 July 2022. *Netflix's Open Connect program and codec optimisation helped ISPs save USD1 billion globally in 2021. p. 9.*

[95] https://www.wowza.com/blog/streaming-protocols

[96] http://highscalability.com/blog/2016/6/27/how-facebook-live-streams-to-800000-simultaneous-viewers.html

[97] https://www.ietf.org/rfc/rfc8216.txt

[98] https://cloudinary.com/guides/video-formats/what-is-mpeg-dash-and-mpeg-dash-vs-hls

[99] Not 'natively' in any case.

this as this problem is already solved thanks to the installation of the proprietary apps or Chrome browser.[100] The take-up of HLS and MPEG-DASH respectively amounts to 70% and 30%.[101]

Streams that are implemented through HTTP are technically not streams in the sense that they do not provide for a permanent connection between the media server and the end-customer, contrary to the RTMP that is used for live-streaming of sports competitions. They are rather progressivedownloads sent through regular web servers. In this manner HTTP Live Streaming can pass through any firewall or proxy server that allows standard HTTP traffic to pass.

By means of adaptive bitrate streaming HTTP-based protocols provide the best possible video quality and viewers experience, but adaptive bitrate streaming is only possible if the source content is compressed with different bit rates[102]:

- Every single bitrate stream is segmented into small sections, usually from two to ten seconds.
- First, the client downloads a manifest file describing the available stream segments and their associated bit rates, based on which the most appropriate transmission mode is chosen. An adaptive bit rate algorithm (ABR) in the terminal device performs the main function of deciding which bit rate segments to download.
- During the initiation of a stream the customer's terminal equipment usually requests the stream segments with the lowest bit rate.
- If the terminal equipment finds that the available bandwidth is larger than the bit rate of the segment downloaded, it will request a segment with a higher bit rate; and vice versa.[103]

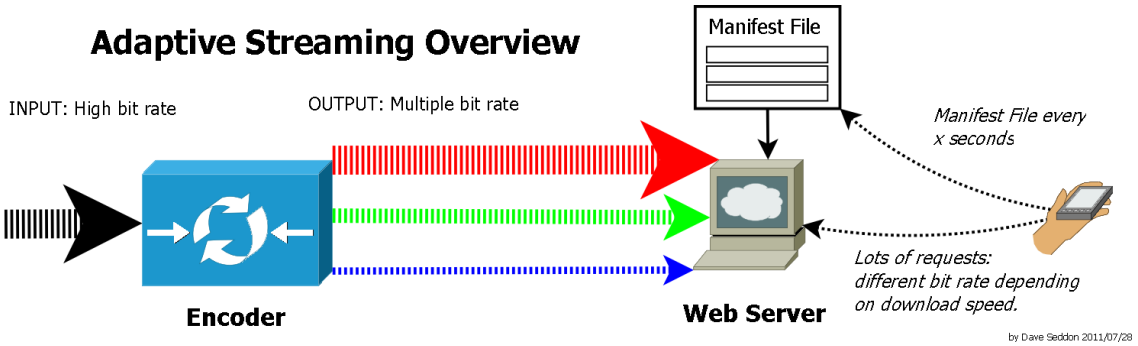


Figure 8. Adaptive streaming (source: Wikipedia)

Adaptive bitrate streaming thus adapts the media stream's quality to one or more parameters measured in real time.[104] It is those algorithms that decide which bandwidth is occupied to prevent video instability, unsteady quality and empty buffers. The main variables on which the algorithm is based for the end-user's equipment are the available bandwidth, the content buffer, the CPU load, the memory and the screen size.[105] This improves the quality of experience for the viewer, despite

[100] V. K. Adhikari et al., "Measurement Study of Netflix, Hulu, and a Tale of Three CDNs," in IEEE/ACM Transactions on Networking, vol. 23, no. 6, pp. 1984-1997, Dec. 2015, doi: 10.1109/TNET.2014.2354262

[101] https://www.wowza.com/blog/protocol-for-your-workflow-delivery

[102] https://speakofthedevrel.cloud/2017/10/26/how-hls-adaptive-bitrate-works/

[103] https://speakofthedevrel.cloud/2017/10/05/video-streaming-reducing-stalls-with-adaptive-bitrate/

[104] https://en.wikipedia.org/wiki/Adaptive_bitrate_streaming

[105] There are four types of parameters the bitrate adaptation can be based on: those of the end-customer, of the server, of the network and hybrid types. This note only discusses the first.

unexpected outages due to the end-user's network.[106] In light of the importance of these algorithms for the image quality, a lot of research is carried out in search of the optimal solution.

The HLS customer makes his bitrate decisions based on bandwidth and the possibilities of the equipment (e.g. CPU, resolution, memory, etc.). In an attempt to better use the available bandwidth, an HLS customer can request multiple segments at the same time. Netflix on the other hand uses MPEG-DASH and has developed its own decision-making algorithm: Hindsight[107], that takes account of the available bandwidth and buffer.

In other words: the streaming protocols used by the OTT providers and their streaming services, ensure that the image quality and the data traffic adapts itself to the end-user's possibilities.

- When a stream is sent with too many pixels, the device has to render each frame again and dismiss a part of the pixels in each frame in order for the image to match the screen correctly. This is not just a waste of data consumption but also puts pressure on the processors of for instance the smartphone, which increases the battery consumption.
- If platforms wish to push the highest quality (and thus bitrate) onto their customers, the buffer with downloaded segments will fill up in most cases, causing the image to falter. Thanks to above-mentioned media protocols, the requested segment quality is automatically lowered, reducing the bandwidth used.
- When a stream is initiated (or scrolled through to another point in the stream), the customer wants to get an image as quickly as possible. If the highest quality were to be used to this effect, the customer would have to wait the longest. In order to meet the end-customer's expectations, the lowest quality (and thus the lowest bandwidth) shall be retrieved in the first place.

[106] A. Bentaleb, B. Taani, A. C. Begen, C. Timmerer and R. Zimmermann, "A Survey on Bitrate Adaptation Schemes for Streaming Media Over HTTP," in IEEE Communications Surveys & Tutorials, vol. 21, no. 1, pp. 562-585, First quarter 2019, doi: 10.1109/COMST.2018.2862938.

[107] Huang, Te-Yuan & Ekanadham, Chaitanya & Berglund, Andrew & Li, Zhi. (2019). Hindsight: evaluate video bitrate adaptation at scale. 86-97. 10.1145/3304109.3306219.

Annex 2. Case Study: South Korea

The introduction of the SPNP model in South Korea makes for an interesting study case as it has led to a succession of increasingly extensive and imperative policies.

In 2016 an act was adopted obliging the three main Korean ISPs to charge the traffic exchanged among them in accordance with the SPNP principle instead of the settlement-free agreement used up until then. The three ISPs decided, however, to pass on these costs to the CAPs, whose content servers were located in their networks, and imposed network costs on them as they diffuse their content onto the two other networks through those transit connections. As the three main Korean ISPs serve 100% of the mobile customers and 95% of the fixed customers, these CAPs had no other option than to pay these network costs. That resulted in a steep increase of transit prices in Seoul, to a level many times higher than in Paris, London or Frankfurt.[108]

Prior to 2016 Facebook served al his Korean customers via cache servers in the network of 1 operator, KT. That meant that Facebook users could retrieve their content on the two other networks from the cache server in the KT network via a transit link. This palmed off a steep bill from the other two operators onto KT and as it concerned Facebook traffic, KT in turn passed on that bill to Facebook. Facebook refused and following fruitless negotiations regarding this bill, Facebook closed down the cache server in South Korea and moved its content to servers abroad where no mandatory network costs were due.[109] As a result of that policy, the data of Facebook end-users all of a sudden came from much further, decreasing the quality of the Facebook services considerably. Netflix also refused to pay the network costs another operator imposed.[110]

Smaller, local CAPs however do not have the possibility to divert their content abroad and they were consequently *de facto* obliged to pay the network costs. As the network costs depend on the traffic volume, they lowered the quality of their videos to save on the amount of traffic and the associated network costs.[111]

In order to tackle in particular the competitive disadvantage, South Korea adopted an additional measure in 2020, i.e. having CAPs stabilise their traffic by, among other things, maintaining sufficient server capacity, ensuring uninterrupted Internet connections and informing the ISPs before adapting the routing of their traffic. This way all CAPs were obliged to install caches in South Korea and consequently to pay the associated network costs as well.

This measure as well is (still) disputed by Netflix. This additional measure however did nothing to change the deteriorated competitive position of local CAPs and thus the policy was expanded in order to tackle this issue.

A number of bills submitted since 2021 aim to complete the 2020 legislation by obliging local and foreign content providers to conclude contracts with ISPs in South Korea in order to be able to use their networks. Another bill prohibits CAPs from using the ISPs' network without paying a fair contribution for its use. The bill thus implicitly enables ISPs to block traffic from CAPs who do not pay.

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[108] WIK-Consult commissioned by BNetzA, 28 February 2022. *Competitive conditions on transit and peering markets: Implications for European digital sovereignty.* p. 36

[109] Ibidem. p. 36

[110] https://www.internetsociety.org/blog/2022/09/sender-pays-what-lessons-european-policy-makers-should-take-from-south-korea/

[111] Park, K. S. & Nelson, M. R. (2021). "Afterword: Korea's Challenge to the Standard Internet Interconnection Model". In: The Korean Way With Data: How the World's Most Wired Country Is Forging a Third Way. Carnegie Endowment for International Peace. Retrieved from: https://carnegieendowment.org/2021/08/17/afterword-korea-s-challengeto-standard-internet-interconnection-model-pub-85166

These successive bills attest to a trend of ever more compelling rules that in fact 1) impose the practice of premium peering; 2) impose quality requirements on content providers; and 3) oblige content providers to conclude contracts with their local ISPs regarding their traffic.

It is expected that foreign CAPs will no longer wish to connect directly with the Korean ISPs or will at least no longer store the much-demanded content in the local caches. It comes to no surprise that new submarine cables, such as Google's and Facebook's Apricot, Google's Echo and Facebook's Bitfrost, provide no connections with South Korea, thus isolating it even further from the world wide web. This will increase prices for international interconnection even further and will push South Korea into a downward spiral.

The Korean example shows that an SPNP mechanism *either* creates possibilities of diversion *or* harms the net neutrality. In that sense, each proposal introducing contributions based on bandwidth or Internet traffic lies between the devil and the deep blue sea.

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