Cloudflare response to public consultation on the draft BEREC Report on the IP Interconnection ecosystem

About Cloudflare

Cloudflare is a leading cybersecurity, performance, and reliability company on a mission to help build a better Internet. Cloudflare uses its presence at over 300 data centres in more than 120 countries to screen traffic for cybersecurity risks and to cache content at the network edge to improve website performance. Our services include a Content Delivery Network (CDN) service, protection against Distributed Denial of Service (DDoS) attacks, protection against malicious bots and crawlers attempting to scrape or alter the content of websites, as well as DNS (Domain Name System) services to enhance reliability of our customers' networks and Internet properties. Our Zero Trust platform and products enable our customers to add another layer of security, helping them to achieve further resilience across their organisations. Our developer platform enables developers to build and deploy code at the edge.

Cloudflare opened its first office in Europe in 2013, and our presence has grown rapidly over the years, to hundreds of employees in the region in 2024. We provide our services from more than 45 "Points of Presence" in Europe[1]. To further our mission to help build a better Internet, Cloudflare makes cybersecurity and performance services widely available: we protect millions of websites and applications, many of those for free or at a low cost. These services, used around the globe by every type of organisation, from Fortune 500 companies and government institutions, to small businesses, non-governmental organisations, and personal blogs, help protect against malicious cyberattacks and help the Internet operate more efficiently.

Executive Summary

Cloudflare welcomes the opportunity to respond to the consultation on BEREC's 2024 draft report on IP-Interconnection. We appreciate the thoroughness and extensive analysis that

[1] Wider Europe region - including UK, Switzerland, Moldova, Turkey, Norway, Iceland, Serbia

BEREC has undertaken to prepare this report, including by consulting organisations and companies from across the Internet ecosystem.

Cloudflare welcomes and agrees with BEREC's overall conclusions on the European IP-interconnection market in the draft report, which states that

- "Traffic volumes continue to increase, however, growth rates are currently stabilising", while "at the same time, competition and technological progress exert downward pressure on costs, which then feed through to prices (e.g. for transit or CDN services)".
- "[...]the internet has managed to cope with traffic growth and more accentuated peak traffic, both of which reflect changing usage patterns as well as increasing diffusion of IAS [Internet Access Services] throughout societies"; and
- "[...] there is currently no indication that this is likely to change in the future".

The draft report reinforces the point that the vast majority of the Internet is working well in its current structure. Traffic grows over time, and networks upgrade their shared interconnections at a small expense to each network in the interest of keeping the Internet working at its best. We welcome these conclusions and urge BEREC to maintain this assessment in their final report. We would furthermore like to stress that the whole Internet ecosystem depends on a well functioning interconnection market, which in 99% of the cases relies on settlement free or low cost peering relationships.[2]

Trying to assess the situation even-handedly, without taking a side in the ongoing ISP effort to force websites and apps to pay ISPs fees for the content they generate, the draft report concludes:

> "BEREC considers that the IP-IC ecosystem is still driven by functioning market dynamics and by the cooperative behaviour of market players. Despite this, BEREC is aware that a few IPIC disputes have occurred since 2017, and BEREC's workshops also revealed similar insights. BEREC notes that stakeholders typically did not call for regulation but suggested monitoring and a case-by-case assessment. BEREC will follow up on such issues, while also considering the relationship between IP-IC and the OIR as analysed in this report. This is important as otherwise end-user customers would ultimately suffer from disputes between different market players across the internet value chain. To conclude, BEREC considers that since its creation, the internet has managed to cope with both traffic growth and higher peaks of traffic. These trends reflect changing usage patterns as well as increasing diffusion of IAS throughout societies. Against this background, BEREC's observation that the developments in the IP-IC ecosystem are an "evolution rather than revolution" still holds".

The draft report highlights that national regulators rarely have to intervene into the contractual relationships between market actors. The few problem areas that were highlighted by stakeholders to BEREC (described in Chapter 6) show a common theme: a user of a large telecom is requesting content from a network providing applications and services such as

[2] Draft Report, page 17.

content delivery ("CAP"). Upon trying to return data to the requesting user, the CAP finds that many of the data paths to reach the telecom operator's network, which make the Internet fast and resilient in normal operation, are congested and provide a degraded experience to the end user. Meantime, the telecom operator is offering the CAP an uncongested path to reach their users for a price. Every highlighted dispute follows some version of this pattern.

It is also relevant to note that the majority of the disputes highlighted by BEREC involve a single operator in Germany, reinforcing the point that most operators maintain a cooperative approach. This also suggests that a single national regulator could solve most of the highlighted problems.

Helpfully, BEREC recognizes this reality. BEREC points out that National Regulatory Authorities (NRAs) are already in a position to hear these types of abuses by large telecom operators of their termination monopoly position. The draft report states that "NRAs may take into account the interconnection policies and practices of ISPs in so far as they have the effect of limiting the exercise of end-user rights under Article 3(1) [of the Open Internet Regulation]." The draft report also highlights the particular examples of this behaviour by vertically integrated IAS providers in more detail in Chapter 8 of its draft report, stating that "(...) selective routing policies and/or artificially manufactured scarcity (e.g. by abstaining from upgrading capacity on congested routes and/or by reducing or limiting the number of interconnections) may, in a given case, ultimately degrade the quality of the IAS experienced by end-users in an application-specific manner. In a technical sense, data packets might not be differentiated within the ISP's network, which is a key concern the OIR seeks to address."

Chapter 4: Pricing and Cost Developments

The draft report correctly notes that transit prices have continued to decrease in Europe. As a minor point of clarification, while we agree that there's a competitive market for *transit*, we would not agree that there's a competitive market for *peering*. Peering is the ability to reach the IP addresses behind a single network, and by definition there is no competition. By contrast, transit is a service where one network pays another network for the ability to reach the entire Internet, and there is competition from multiple providers for that service.

Different CDN Architectures

The draft report suggests that "increased prevalence of CDNs in IAS providers' networks has been a primary reason for the continuing decrease in transit prices." We'd offer that the decline in transit prices is due to the localisation of traffic closer to its destination, and the continued ability to reach most networks (not all) with congestion- and settlement-free interconnection. These two factors – more localisation, and continued settlement-free interconnection – mean transit providers have low costs themselves, with competition passing those cost decreases through to the market.

In our view there is little technical difference between on-net CDNs and public peering with CDNs. The benefits of on-net CDNs are the same as localised public peering. In the case of

Cloudflare on-net caches, the architecture is the same as bilateral peering: traffic is crossing the network boundary from the IAS provider network to Cloudflare's network, even though it is doing so within the physical boundary of the IAS provider's facility. Therefore, it is our recommendation to not ascribe changes to "on-net CDNs" specifically but rather localised interconnection.

Settlement-free peering vs paid peering

We appreciate the analysis about settlement-free peering agreements and the draft report's highlight that 99% of peering agreements by number of interconnections are "handshake" – though we'd suggest adding "settlement-free" if that is the implication of "handshake". That reflects that CAPs interconnect with CAPs on a settlement-free basis. ISPs connect with other ISPs on a settlement-free basis. Small ISPs interconnect with CAPs on a settlement-free basis. It's only a small number of interconnection agreements between large ISPs and CAPs where paid peering is applied.

On this point, we would recommend clarifying section 4.3.2 and the difference between Figure 5 and Figure 8. Figure 5 leaves the impression that the vast majority of peering *traffic*, even among the largest ISPs, is settlement-free. Meanwhile, ARCEP reports "that paid peering was applied to 48% of traffic of main ISPs". This discrepancy can be explained by the vertical integration of IAS providers with Tier 1 transit providers described in section 5.2. Vertical integrated providers often combine paid peering and transit, demanding the same payment for peering that they would receive for transit. Figure 8 in section 5.2 shows a clear picture: among Tier 1 retail ISPs, 9% of inbound traffic is peering (some of which is paid), 63% is internal transit (which is all paid), and 24% is on-net caches (which could be paid). The vertical integration of IAS providers with Tier 1 transit providers enabled those providers to demand payment not only for transit services, but also for access to users for which they have a termination monopoly.

Section 5.3 Substitutability

Peering and transit are substitutes when they both offer normal performance for one network to reach another network. For this reason we agree with the draft report's analysis that the presence of transit networks "contributes to competition and mitigates competitive bottlenecks."

We also agree that there has been an increase in the need for high bandwidth and low latency connectivity; however in our view this does not mean transit is less of a substitute for peering. Particularly in Europe, which has a high density of Internet exchange points given the geography, applications that need high-bandwidth and low latency would function well if a transit provider connected the application to end user ISPs, provided that the transit provider has uncongested links to ISPs. The ability to handle high bandwidth only requires the interconnecting parties to upgrade their interfaces, which as the draft report notes, is a small expense for both networks. Traversing a transit provider to reach an ISP doesn't by itself add meaningful latency to a connection by itself, so given the density of European interconnection, low latency can also be maintained through transit providers.

In the specific case of Tier 1 retail ISP's that offer transit services, it is important to recognize there is no difference between paid peering and using the Tier 1 transit service to reach the Tier 1 ISP's own network. In both cases it's a fee to the Tier 1 ISP to terminate traffic to their users.

Chapter 6: Generic structure of IP-IC issues

As an initial matter, we greatly appreciate BEREC's attention to the issues raised in this chapter. Overall we think the analysis is thoughtful and complete on a highly technical – but very important – topic to the quality of the Internet in Europe.

Congestion has the potential to affect the Internet experience for all users in Europe: when interfaces congest there is a dramatic decrease in the quality of the Internet traffic for end-users and services. First, data has higher latency as it waits to get through the congested interface. This is detrimental by itself to connectivity and security applications that rely on low-latency, but it also slows down access to everything on the Internet. Second, packet loss increases as packets are dropped going through the congested interface. Those packets will likely be re-tried, further adding to the congestion and slowing Internet access. Third, the receiver signals that it is overwhelmed, which causes the sender to send less data, which dramatically decreases the throughput of the data transfer.

We observe that when Cloudflare traffic goes through congested paths – whether it is our congestion with an interconnection partner, or the congestion of one of our partners with another network – that users experience a degraded experience. To the end users, it appears to be a bad Internet connection for unknown reasons. Some of the things the user might experience are jittery video calls; videos that spend a long time repeatedly buffering; downloads that are extremely slow; repeated disconnects while gaming, among many other symptoms. Anyone can observe posts on forums of large telecom providers about high latency, packet loss, and decreased throughput, though the end user is unlikely to know the real cause.

We agree with the draft report that the costs of upgrading congested interfaces is low. A direct connection between two networks is quite simply a fibre optic cable in a data centre that connects the router from one network to the other network. To resolve the congestion, both networks will allocate a new connection that adds capacity. For example, when a 100Gbps interconnection congests, the networks might agree to upgrade this capacity with another 100Gbps connection. These upgrades are trivial: it's 1 additional port on a linecard, 1 transceiver, and 1 cross connect. Only in the case where a network is trying to monetize the traffic delivery to their own users would they have the incentive to delay the upgrade and cause congestion.

We'd also note that it is possible there are uncongested paths into a large ISP network, but that those paths are not *available*. For example, imagine two large ISPs that interconnect with each other. Further imagine that historically their traffic exchange has been balanced such that they maintain settlement-free interconnection despite both ISPs asking for payment from CAP networks. If that interconnection is 100 gigabits and is utilised at 80 gigabits, it is unlikely that ISP 1 would allow other networks to use its transit service to reach ISP 2 in any appreciable volume. In this case, there is a transit provider (the transit service of ISP 1) that has uncongested capacity to ISP 2, but that interconnection is not available.

We strongly disagree with the implication that the congestion evaluated in this section is the fault of the CAPs.[3] In the rare – but still important – instances where Cloudflare suspects there is congestion between transit providers and ISPs (Cloudflare can't see that congestion directly as the interconnection between Cloudflare and the transit is uncongested), we spend considerable time and effort trying to find alternate paths with better performance, in the shared interest of our customers and the users of the ISP. We scour the Internet to find alternate uncongested and available paths because we have every incentive to find paths without congestion, and no incentive to cause it. Unlike ISPs that are hoping to monetize congestion, CAPs have no incentive to create a bad Internet experience for their users. This argument is used in Chapter 7 as well, and we similarly disagree that it adds "bargaining power" for CAPs with ISPs, as discussed below.

Chapter 7: Bargaining situation between CAPs and IAS providers

We appreciate the discussion of the relative bargaining power between CAPs and IAS providers. In particular, we appreciate the commentary that "'must have' content or a high market capitalisation does not automatically imply that large CAPs have higher bargaining power vis-à-vis IAS providers." We might go further. The fact that holders of "must have" content repeatedly end up paying IAS providers must mean that it is the large IAS providers that hold the bargaining power.

While we do agree that "smaller CAPs may have a relative bargaining disadvantage compared to larger CAPs" we do not agree with WIK when they wrote "it is questionable whether smaller CAPs…could also be affected by comparable restrictions [of capacity to reach large ISP networks]."[4] The next sentence in the WIK report adds needed context: "Furthermore, it is also questionable whether smaller CAPs in this situation would even be able to negotiate comparable conditions as Netflix with large ISPs in a similar time horizon." Faced with an ISP that limits transit capacity into their network, small CAPs (be they public-interest TV stations or medium-size tech companies) will suffer performance challenges that will impact their ability to be competitive. They're unable to buy IP transit with good performance on the market, they're not big enough (and couldn't afford) a direct paid peering agreement, and yet they will be competing against larger players, who can afford paid peering for good performance.

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[3] Draft Report, page 29, "CAPs would cause congestion issues as they would intentionally route traffic via congested interconnection links."

[4] https://www.bundesnetzagentur.de/EN/Areas/Telecommunications/Companies/Digitisation/Peering/download.pdf?__blob=publicationFile&v=1 page 79

It is precisely these types of situations that raise the concerns evaluated by the draft report in Chapter 8. We welcome the report's analysis that:

> "Selective routing policies and/or artificially manufactured scarcity (e.g. by abstaining from upgrading capacity on congested routes and/or by reducing or limiting the number of interconnections) may, in a given case, ultimately degrade the quality of the IAS experienced by end-users in an application-specific manner."

The Internet ecosystem in Europe is strong, showing resilience and the benefits of competition and a market-driven system. In the rare situations where end-user Internet experience is harmed by a lack of adequate interconnection capacity, the draft report is correct to evaluate whether the IAS provider has provided the end user with access to the open Internet without restriction, as is their obligation under Article 3(1) of the Open Internet Regulation.