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# Net neutrality review

## Consultation Annexes 5 to 10

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Non-confidential version: [X] marks confidential redactions

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# A5. Draft Guidance on Ofcom's approach to assessing compliance with the net neutrality rules

## Purpose of this Guidance

- A5.1 The Open Internet Access Regulation (the 'Regulation'), which came into effect on 30 April 2016, introduced rules on net neutrality.<sup>1</sup> The Regulation aims to establish common rules to safeguard equal and non-discriminatory treatment of traffic in the provision of internet access services and related end users' rights.
- A5.2 The Regulation sets out that consumers have rights in relation to their internet access service to:
- access and distribute the information and content they want;
  - use and provide the apps and services they want; and
  - use the 'terminal equipment' or devices they want.
- A5.3 The Regulation sets out the core principle of net neutrality, that ISPs shall treat all traffic equally when providing internet access services, without discrimination, restriction or interference, and irrespective of the sender and receiver, the content being accessed, or the services or equipment used.
- A5.4 ISPs may reach agreements with end users as to the commercial and technical terms of the internet access service, but they must not limit consumers' core rights. ISPs may also engage in "reasonable" or "exceptional" traffic management measures, under certain defined conditions.
- A5.5 Under Article 5 of the Regulation, Ofcom has a duty to "*closely monitor and ensure compliance with Articles 3 and 4*" and to "*promote the continued availability of non-discriminatory internet access services at levels of quality that reflect advances in technology*".
- A5.6 Following the UK's departure from the EU, the Regulation was retained in UK law with minor amendments.<sup>2</sup> Ofcom's role in monitoring and ensuring compliance and in promoting the availability of non-discriminatory internet access remained. For the avoidance of doubt, where we refer to the Regulation in this guidance, we are referring to the version, as amended, that applies in the UK.<sup>3</sup>

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<sup>1</sup> [Regulation \(EU\) 2015/2120 of the European Parliament and of the Council of 25 November 2015 laying down measures concerning open internet access and retail charges for regulated intra-EU communications \(legislation.gov.uk\)](#).

<sup>2</sup> See [The Open Internet Access \(Amendment etc.\) \(EU Exit\) Regulations 2018 \(legislation.gov.uk\)](#).

<sup>3</sup> See [Regulation \(EU\) 2015/2120](#) as amended by [The Open Internet Access \(Amendment etc.\) \(EU Exit\) Regulations 2018](#).

A5.7 This document sets out Ofcom’s approach to assessing compliance with certain aspects of the Regulation, namely:

- use of terminal equipment;
- zero-rating;
- retail offers with different quality standards;
- traffic management;
- specialised services;
- internet access services provided on board transport;
- public interest exceptions:
  - approach to emergency communications;
  - approach to restricting access to scams; and
  - approach to parental control content filters.

A5.8 We have reviewed the functioning of the net neutrality rules taking into account three overarching policy objectives and the positive market outcomes we want them to deliver. These objectives are:

- safeguarding citizens’ and consumers’ access to an open internet;
- safeguarding the open internet as an engine of innovation, so that providers of online content, apps and services have strong incentives to continuously innovate; and
- safeguarding well-run, efficient and robust networks.

A5.9 Based on this review, we set out here updated guidance. This guidance replaces the guidance we published in 2019.<sup>4</sup>

A5.10 The guidance also sets out the information we may gather from time to time as part of our monitoring activities, and to assess compliance with the Regulation, including ensuring that where ISPs use the scope in this guidance to offer a range of services, general internet access services are not undermined. This information will allow us to monitor compliance in the areas listed above and assess the general quality of internet access services being provided.

A5.11 In monitoring and assessing ISPs’ compliance with the Regulation in areas not covered by this guidance, stakeholders should consider the BEREC guidelines on the implementation of the Regulation.<sup>5</sup> Since leaving the EU, we are no longer required to follow the BEREC guidelines but we may have regard to them where we consider it appropriate. ISPs should also ensure they comply with requirements set out in the General Conditions (GCs).<sup>6</sup>

A5.12 We will take our enforcement guidelines into account alongside this guidance when determining whether to take enforcement action.<sup>7</sup>

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<sup>4</sup> Ofcom, 2019. [Ofcom's approach to assessing compliance with net neutrality rules](#) – Frameworks for assessing zero rating offers and traffic management measures for compliance with the Open Internet Regulation.

<sup>5</sup> Specifically, we refer to the BEREC guidelines of 9 June 2022. [BEREC Guidelines on the Implementation of the Open Internet Regulation \(europa.eu\)](#).

<sup>6</sup> Ofcom. [General Conditions of Entitlement](#).

<sup>7</sup> We consulted on revised draft enforcement guidelines earlier this year: Ofcom, 24 May 2022, [Draft Regulatory Enforcement Guidelines for consultation \(ofcom.org.uk\)](#).

## Scope of the net neutrality rules

A5.13 The Regulation is principally concerned with internet access services as specified in Article 1(1), which describes the subject matter and scope:

This Regulation establishes rules to safeguard equal and non-discriminatory treatment of traffic on the provision of internet access services and related end-users' rights.

A5.14 Article 2 defines an internet access service as follows:

'Internet access service' means a publicly available electronic communications service that provides access to the internet, and thereby connectivity to virtually all end points of the internet, irrespective of the network technology and terminal equipment used.

A5.15 Additionally, Article 3(5) provides that 'providers of electronic communication to the public' may offer services other than internet access which are optimised for specific content applications or services, subject to certain conditions. Such services are commonly referred to as 'specialised services', which is the term used in the BEREC Guidelines, although it is not used in the Regulation.

A5.16 Article 2 defines 'provider of electronic communications to the public' as follows:

'Provider of electronic communications to the public' means an undertaking providing a public communications network or a publicly available electronic communications service.

A5.17 For the purposes of this guidance, we interpret an internet access service, as defined in Article 2(1), to mean a service which:

- provides access to the global system of interconnected networks which forms the internet;
- allows generally unrestricted access to end-points on those networks;<sup>8</sup> and
- is a publicly available electronic communications service.

A5.18 We interpret publicly available electronic communications services to mean services offered by communications providers that are generally available to end-users, i.e. people and businesses, including content and application providers (CAPs). This includes services targeted at certain end-user groups (such as gamers).

A5.19 Services that are offered only to pre-determined, closed end-user groups, so that access is limited to specific institutions or individuals, even at multiple locations, would not normally be considered publicly available.

A5.20 Networks provided exclusively within the site(s) of an individual user/consumer (for example a business) may be considered unlikely to be publicly available. This would be the case, for example, for:

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<sup>8</sup> i.e. access to end-points is not restricted, other than in accordance with legal requirements, and permitted traffic management practices in accordance with Article 3.

- corporate private networks;
- machine-to-machine networks in factories, ports, etc.; or
- networks within campuses (for example, hospitals and academic institutions).

- A5.21 Services that provide restricted access to the internet (e.g. by restricting access to certain content, applications, or services, or that allow access to a limited part of the internet) are sometimes referred to as ‘sub-internet offers’. Such services are likely to be contrary to the requirement in Article 3(3) to treat all traffic equally.
- A5.22 As noted above, the specialised services conditions in Article 3(5) apply to services other than internet access offered by providers of electronic communications to the public. We discuss specialised services later in this guidance.

## Terminal equipment

- A5.23 Article 3(1) of the Regulation ensures that consumers have the right to use the terminal equipment of their choice when accessing the internet. Further, Article 3(2) of the Regulation requires that commercial agreements between ISPs and consumers concerning the commercial and technical characteristics of an internet access service must not limit the consumer rights specified in Article 3(1) of the regulation. Article 3(3) also requires ISPs to treat all internet traffic equally irrespective of the terminal equipment used.
- A5.24 ISPs should not therefore include commercial terms, including in fair usage policies, which restrict the terminal equipment which can be used to access the internet via their internet access services.
- A5.25 Restrictions on the practice of tethering, which allows an end-user to share the internet connection of a phone or tablet with other devices such as laptops, are likely to constitute a restriction on terminal equipment.
- A5.26 Restrictions on terminal equipment in relation to specialised services fall outside the scope of the Regulation.

## Zero-rating

- A5.27 Under a zero-rating offer, an ISP gives its customers more favourable access to certain content over other types of content by not subtracting usage of the zero-rated content from the user’s data allowance.
- A5.28 The Regulation provides that Ofcom, as the relevant enforcement authority, should be empowered to intervene against agreements or commercial practices which, by reason of their scale, lead to situations where end-user choice is materially reduced.<sup>9</sup> This is the norm against which zero-rating offers are assessed.

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<sup>9</sup> See Recital (7) of the Regulation.

A5.29 We are only likely to have concerns about zero-rating offers in limited circumstances. We define three types of zero-rating offers for the purposes of this guidance, to provide clarity on when offers will be subject to greater scrutiny:

- a) **'Type One' zero-rating offers** are those where ISPs zero-rate access to information and services from public sector bodies (e.g., Government, NHS) that provide a public benefit and are not in competition with other suppliers. This type of offer is beneficial to consumers and is unlikely to have a detrimental impact on other CAPs. Therefore, once we are satisfied that an offer is a Type One zero-rating offer, we are unlikely to consider them any further.
- b) **'Type Two' zero-rating offers** are offers that are genuinely open to all CAPs of a particular class. They are unlikely to reduce the choice of CAPs available to consumers, as any equivalent CAPs will be able to join should they so wish. Therefore, once we are satisfied that an offer is a Type Two zero-rating offer, we are unlikely to consider them any further.
- c) **'Type Three' zero-rating offers** are all other offers that do not meet the Type One or Type Two criteria. We will continue to monitor and review such offers, where appropriate, on a case-by-case basis, taking into account a range of factors to determine if they are likely to raise concerns to warrant opening a formal investigation.

## Type One offers

A5.30 A zero-rating offer will be classified as Type One if it has all of the following features:

- a) **Socially beneficial** – the information or services that are being zero-rated clearly provide social benefit to citizens and consumers. This could include, for example, public health information or benefit claims sites.
- b) **Public sector organisation** – the information or services being zero-rated are provided by a public sector body not operating in a commercial capacity. This would include the Government, as well as other public institutions such as local authorities and government agencies.<sup>10</sup>
- c) **Absence of competition** – due to the type of content, there is no competing supplier that provides, or is capable of providing, a comparable alternative to the information or services being zero-rated.

A5.31 Once we are satisfied that an offer is a Type One offer, we will not normally carry out any further assessment, in the absence of any complaints or concerns being raised with us.

## Type Two offers

A5.32 A zero-rating offer will be classified as Type Two if it has all of the following features:

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<sup>10</sup> The UK departments, agencies and public bodies set out on [this website](#) are likely to fall under this criterion. UK Government website, [Departments, agencies and public bodies](#). [accessed 14 September 2022].

- a) **Class-based** – The zero-rating offer is open to CAPs of a particular class, as opposed to a single CAP.
- b) **Absence of undue requirements to join** – CAPs of the same class should be able to apply to join the offer without any undue requirements (e.g., financial, legal or technical).<sup>11</sup> To meet this requirement, we would expect ISPs not to request payments from CAPs, as this may deter some CAPs from joining.
- c) **Non-discriminatory treatment** – All CAPs included (or seeking to be included) in the zero-rating offer should be treated equally, including any CAPs owned by the ISP.
- d) **Transparency for CAPs and timely responses by ISPs** – The process for a CAP to join the offer should be clear and publicly available (i.e., on the ISP’s website). This should include an accurate description of the process for joining and relevant contact details. We would also expect a timely response to any request by a CAP to join an offer.
- e) **Transparency for consumers** – The ISP must make clear to its customers which CAPs are zero-rated as part of their mobile tariff (including what aspect of a CAP’s content is zero-rated). This information should be made available on the ISP’s website. This should include information on legacy contracts (i.e., contracts which are still active, but not being offered to new customers). We also expect updates to be provided to customers whenever new relevant CAPs join the class-based zero-rating offer.

A5.33 Where an offer has all of these features, it is unlikely to raise any material concerns. Once we are satisfied that an offer is a Type Two offer, we will not normally carry out any further assessment, in the absence of any complaints or concerns being raised with us.

### Type Three offers

A5.34 Zero-rating offers that do not meet the Type One or Type Two criteria will be classified as Type Three offers. We will focus on identifying any Type Three zero-rating offers that are likely to undermine CAPs’ ability to compete effectively and in turn could materially reduce consumer choice of CAPs and services in the long-term.

A5.35 We therefore outline a list of factors that will help us assess whether the zero-rating offer is likely to have a material impact on consumer choice: (i) whether relevant CAPs are excluded from a zero-rating offer; (ii) whether zero-rating is important for a CAP to compete effectively in a market; and (iii) whether the offer is likely to influence consumer behaviour.

A5.36 For those offers that are likely to have a material impact on consumer choice, we then highlight the factors that will help us assess whether the impact is likely to be positive or negative for consumers and citizens, notably the presence of market power, and broader policy considerations. Not all factors will be relevant or need to be evaluated for all offers, and additional factors may need to be considered in certain cases.

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<sup>11</sup> When we say there must not be any “undue” requirements, we expect compliance with all requirements must be necessary in order for the zero-rating offer to function and be technically possible.



A5.37 When assessing if a zero-rating offer would materially reduce consumers' choice of CAPs and services in the long-term, our decisions will not be based on a single factor. Instead, we will consider any relevant factors in the round when reviewing Type Three offers. Therefore, even if certain elements of an offer indicate that it could be problematic, it will not automatically be found to be in breach of the Regulation.

i) Relevant CAPs are effectively excluded from the zero-rating offer – We would consider the extent to which a zero-rating offer excludes a relevant CAP and undermines its ability to compete by assessing:

- **Openness of a zero-rating offer** – The more CAPs included in a zero-rating offer and the easier it is for CAPs to join, the less likely it will undermine the ability of CAPs to compete effectively. Even if an offer does not meet all the Type Two criteria, those criteria would still be relevant when assessing the degree of openness of a Type Three offer and whether it may undermine certain CAPs' ability to compete.

ii) Whether it is important for a CAP to be zero-rated in order to compete effectively – Even if a CAP is excluded from a zero-rating offer, if only a small number of consumers actually make use of the offer, the overall impact of the offer may not be sufficient to materially affect the non-zero-rated CAP's ability to compete. However, if zero-rated access to a certain class of content was pervasive among consumers, a CAP of the same class may otherwise find it difficult to compete effectively. Therefore, we may consider:

- **Scale of take-up** – the higher the overall take-up of a zero-rating offer by consumers, the higher its potential impact on competition in a CAP market. The take-up could be measured by the proportion of UK customers who have zero-rated access to the same CAPs.<sup>12</sup>
- **Duration of the offer** – when zero-rated access to a CAP is only provided for a short-duration (e.g., a limited trial period) the offer is unlikely to have an impact on how a CAP market operates in the long-term. However, a CAP market is more likely to be affected if consumers have zero-rated access to a CAP for a sustained or indefinite period of time.

iii) Influence on consumer behaviour – Even if relevant CAPs were excluded from a zero-rating offer and zero-rated access was pervasive among consumers, a CAP's ability to compete would not be materially affected if consumers' behaviour is unlikely to be influenced by the offer. We expect consumers are most likely to be influenced by an offer when they are cautious about their data usage, and therefore seek to minimise deductions to their data allowance by using zero-rated CAPs. We may consider the following factors:

- **Data scarcity** – We may consider how much spare data the typical consumer with that zero-rating offer is likely to have in each month. This will be driven both by

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<sup>12</sup> We recognise that take-up could be high due to either many customers of a single large ISP having zero-rated access, or customers of several different ISPs having zero-rated access.

their monthly data allowance and the amount of data that they typically use.<sup>13</sup> The larger their data allowance and the less data they typically use (and so the less scarce data will be for them), the less likely it is that an offer would influence their choice of CAP.

- **Data usage of zero-rated CAPs** – The heavier the data usage for a zero-rated CAP, the more likely it is that consumers will prefer to use zero-rated CAPs, in order to preserve their data allowance. As part of this, it will be relevant to consider if using a CAP is highly reliant on mobile data (as opposed to Wi-Fi internet access), as the zero-rating of such CAPs is more likely to influence consumers' choice of which CAP to use.<sup>14</sup>
- **Other relevant features of an offer** – Other factors could compound the effect that a zero-rating offer may have. For example, if an ISP provides free or discounted access to a CAP (which normally requires a subscription) in addition to zero-rating the CAP, the potential for the offer to influence consumer behaviour will increase.

A5.38 Where we consider an offer is likely to have a material impact on consumer choice based on criteria i) to iii) above, we will have regard to other factors related to market dynamics, as well as broader policy considerations, in undertaking any assessments as to whether the offer is likely to have a positive or negative impact on consumers and citizens.

i) Market power and market dynamics<sup>15</sup> – The market position of ISPs or CAPs (i.e., their size, capabilities and relative constraints from their competitors) may potentially give them a degree of market power over consumers. We are likely to be more concerned about zero rating offers where the CAP or ISP has market power, as they may be able to use the zero-rating offer to entrench that market position. We may therefore consider:

- **Market position of zero-rated CAP** – CAPs with a strong market position are more likely to have the ability and incentive to use zero-rating offers to stifle competition and undermine smaller CAPs in order to preserve their strong existing position. In contrast, where the offer relates to a smaller, challenger CAP competing against a rival with a strong established position, it is more likely to have a pro-competitive impact.
- **Market position of zero-rating ISP** – An ISP with a strong market position would be better able to give preferential treatment to a narrow selection of CAPs (by zero-rating them).

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<sup>13</sup> To determine whether consumers are likely to be concerned about data scarcity, we may consider evidence on data allowance and usage of consumers who take up the offer, as well as average monthly data usage by UK consumers (where such information is available).

<sup>14</sup> For example, ride-hailing services (e.g., Uber, Bolt) are more likely to be dependent on using mobile data (as opposed to Wi-Fi data) as consumers are likely to be outside the home when using such CAPs.

<sup>15</sup> When assessing the market position held by either a zero-rated CAP or a zero-rating ISP, we intend to broadly consider the extent to which alternatives exist to these firms and their overall use by consumers. We do not intend to undertake a full market definition exercise and economic assessment similar to a Competition Act case. Nor are we seeking to establish if a firm possesses 'significant market power', as defined in the Communications Act.

- **Vertical Integration** – A vertically-integrated ISP-CAP will have a greater incentive and ability to create a zero-rating offer that could give itself an advantage over rival CAPs (so-called ‘self-preferencing’).<sup>16</sup>
- **Characteristics of CAP market** – Zero-rating offers could compound or reduce the barriers to entry (or expansion) in certain CAP markets, depending on whether they apply to incumbents or challengers.

ii) Other benefits to citizens and consumers – We may consider other policy considerations, where relevant. Below are some examples of these:

- **Health and safety** – we will recognise the inherent benefit zero-rated access to certain websites provide to improving UK citizens’ health and safety (e.g., charity helplines, mental health support, support for victims of crime).
- **Assisting low-income consumers** - we will recognise the benefit when zero-rating offers assist low-income consumers who are more likely to depend on mobile data, by increasing their access to relevant content (e.g., zero-rated information from Citizens Advice).

## Our approach to zero-rating when the general data allowance has expired

A5.39 In general, when an end user’s data allowance has expired, any zero-rated data should be treated the same as all other data. If all other data is blocked, the zero-rated data should also be blocked. Similarly, if all other data is allowed to continue but at a much-reduced bandwidth, the zero-rated data should be treated equivalently.

A5.40 However, where ISPs allow access to certain content to continue to be used without equivalent treatment to non-zero-rated data, we are unlikely to consider enforcement a priority where the content that can still be accessed is limited to:

- i) access to the ISP’s own website or application in order for a user to top-up their data allowance;
- ii) access to content under a Type One offer; or
- iii) access to the emergency services (as explained below in paragraphs A5.102 to A5.103).

## Our approach to monitoring zero-rated offers

A5.41 When considering whether to introduce a zero-rating offer, ISPs should self-assess their proposed offers against the criteria set out above and should be able to provide Ofcom with information to assess any offer against those criteria, on request. Ofcom may gather this information periodically to monitor compliance with the rules. This information may also be used in our annual reporting on net neutrality.

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<sup>16</sup> Self-preferencing is where a company gives preferential treatment to its own services when they are in competition with the services provided by other companies.

## Retail offer differentiation

A5.42 In the same way that ISPs may offer retail packages with different speeds, the net neutrality rules also permit ISPs to offer retail packages with different levels of quality such as latency, jitter or packet loss, where the quality of internet access service on each individual package is independent of the content, applications and online services accessed.<sup>17</sup> Subject to considerations regarding transparency and internet access services generally meeting the contracted level of service quality, retail offers which facilitate different levels of quality of service for different ISP subscriptions are permitted. These offers may:

- apply the same quality of service to all traffic for a given subscriber; or
- provide multiple quality of service levels within a single subscription providing the level of quality of service is independent of the content and apps that that customer uses. An example of such a retail offer is where a customer can subscribe to an add-on to (temporarily) boost their quality of service or vary the contracted quality of service across the day.

A5.43 Where an ISP offers internet access services with different levels of quality of service through different retail offers, they are permitted to manage these services differently in order to deliver the respective contracted levels of performance in line with our general approach to traffic management set out below.

A5.44 These packages can only be offered where sufficient transparency is provided. Specifically, these offers will need to comply with the transparency measures set out in Article 4 of the Regulation, which include requirements on ISPs to ensure that all their customers, *including customers on packages with a lower quality tier*, can understand what is offered under different packages and how this might affect customer quality of experience. This could include both contracted performance standards on elements such as latency, jitter or packet loss and information that allows customers to form meaningful expectations about standards of quality and what this means in terms of their expected experience.

A5.45 In demonstrating compliance with Article 4 of the Regulation, the BEREC Guidelines are also relevant in relation to the transparency measures on quality of service parameters. These state ISPs should seek to ensure that the information in relation to quality parameters should be effects-based and should help understand how these parameters might affect usage and user experience.<sup>18</sup> ISPs may further consider BEREC Guidelines on contractual speeds, a well-established quality parameter.<sup>19</sup>

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<sup>17</sup> Under Article 3(2) of the Regulation.

<sup>18</sup> Particularly para 137: “Besides speed, the most important QoS parameters are delay, delay variation (jitter) and packet loss. These other QoS parameters should be described if they might, in practice, have an impact on the [internet access service] and use of applications. NRAs should ensure that ISPs provide end-users with information which is effects-based. End-users should be able to understand the implications of these parameters to the usage of applications and whether certain applications (e.g. interactive speech/video or 4K video streaming) cannot in fact be used due to the long delay or slow speed of the IAS. Categories of applications or popular examples of these affected applications could be provided.”

<sup>19</sup> See BEREC Guidance, paragraphs 140-157.

- A5.46 ISPs are also required to ensure that customers can identify and take effective action where there are significant, continuous or regularly occurring discrepancies between the actual performance and what has been agreed in the contract. This includes the requirements set out in Article 4 of the Regulation that ISPs:
- a) provide a clear and comprehensible explanation of the remedies available to the consumer which can be used in the event of any continuous or regularly recurring discrepancy;<sup>20</sup> and
  - b) put in place transparent, simple and efficient procedures to address the complaints of end-users.<sup>21</sup>

## Our approach to monitoring differentiated retail offers

- A5.47 When considering launching a retail offer that provides a different level of quality of service, an ISP should self-assess their offers against the criteria set out above. ISPs should be able to provide Ofcom with information to assess any differentiated retail offers, including:
- a) information demonstrating that the different levels of quality of service through different retail offers apply independently of the content, applications and online services accessed;
  - b) information demonstrating compliance with the requirements regarding transparency and services meeting the contracted level of quality of service set out in Article 4 of the Regulation; and
  - c) information in relation to the application of traffic management measures, as set out below.
- A5.48 We anticipate we may gather this information periodically, to monitor compliance with the rules. This information may also be used in our annual reporting on net neutrality.
- A5.49 We may take enforcement action where we have grounds for believing ISPs may be using traffic management beyond the scope allowed or failing to meet their obligations under Article 4 of the Regulation.<sup>22</sup>

## Approach to traffic management

- A5.50 The Regulation provides for traffic management of internet access services in certain specific circumstances and does not impose any restrictions on traffic management for services that are not publicly available internet access services. On this basis, the following flowchart sets out how we will determine what approach to traffic management is appropriate.

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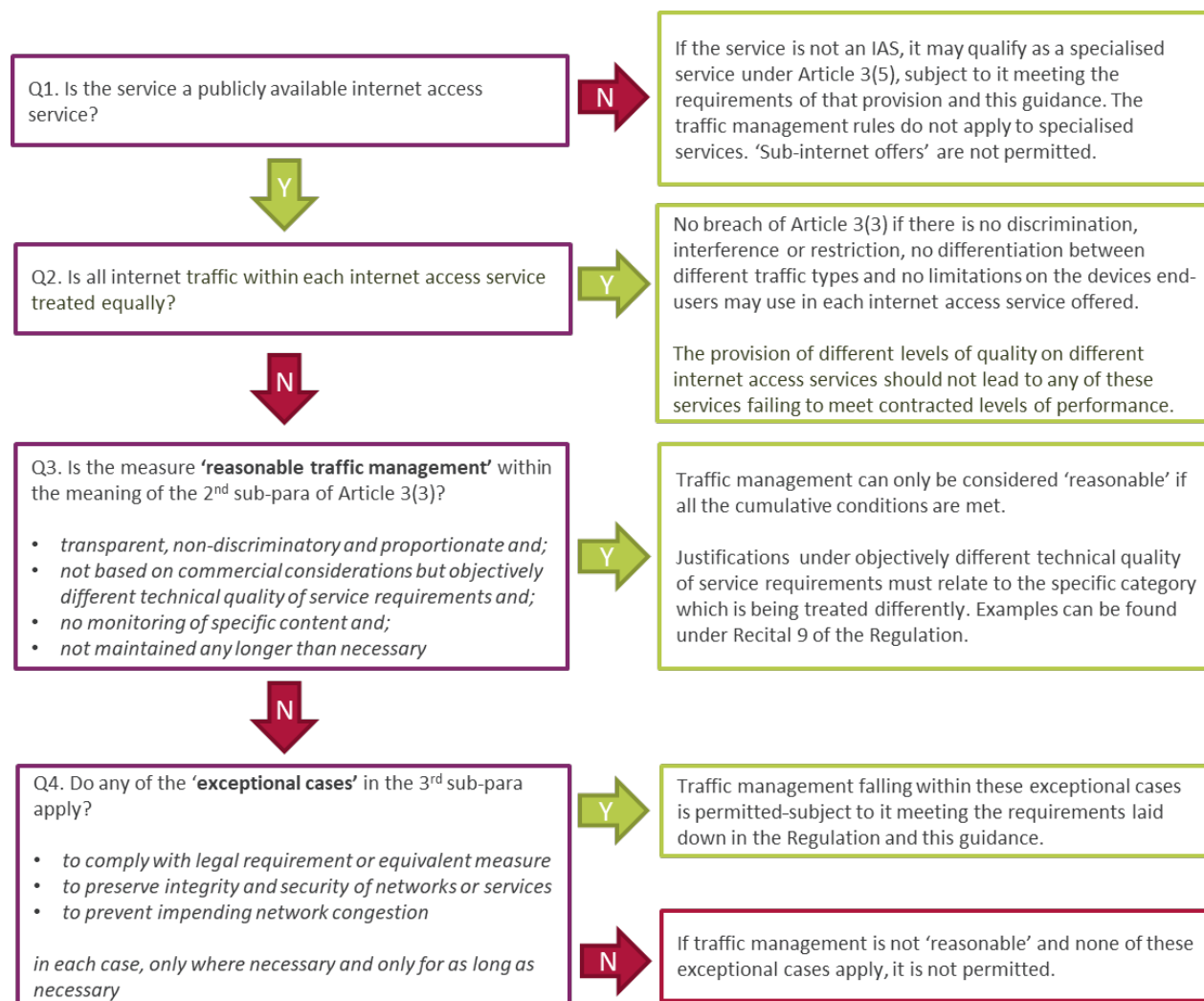
<sup>20</sup> Article 4(1)(e) of the Regulation.

<sup>21</sup> Article 4(2) of the Regulation

<sup>22</sup> This includes where CAPs provide us evidence that indicates ISPs may be using traffic management beyond the scope allowed.

A5.51 We note that some traffic management measures may be configured permanently in the network provided that they only take effect at certain times or under certain circumstances. We discuss our approach to these in paragraphs A5.72 to A5.75 below.

**Figure A5.1: Flowchart illustrating how we will assess what approach to traffic management is allowed in particular circumstances**



## Reasonable traffic management

A5.52 The second sub-paragraph of Article 3(3) of the Regulation refers to reasonable traffic management. In order for traffic management to be considered reasonable, it must:

- be transparent, non-discriminatory and proportionate;
- not be based on commercial considerations but on objectively different technical quality of service requirements of specific categories of traffic;
- not monitor the specific content; and
- not be maintained for longer than necessary.

- A5.53 These factors must all be met for traffic management to be considered reasonable within the meaning of Article 3 of the Regulation.
- A5.54 In considering whether traffic management meets these cumulative tests, ISPs may have regard to the BEREC guidelines.

### Traffic management in exceptional cases

- A5.55 Beyond reasonable traffic management, the third sub-paragraph of Article 3(3)<sup>23</sup> allows for exceptional traffic management in three specific circumstances:

Providers of internet access services shall not engage in traffic management measures going beyond those set out in the second subparagraph, and in particular shall not block, slow down, alter, restrict, interfere with, degrade or discriminate between specific content, applications or services, or specific categories thereof, except as necessary, and only for as long as necessary, in order to:

- (a) comply with national legislation, to which the provider of internet access services is subject, or with measures giving effect to such national legislation, including with orders by courts or public authorities vested with relevant powers;
- (b) preserve the integrity and security of the network, of services provided via that network, and of the terminal equipment of end-users;
- (c) prevent impending network congestion and mitigate the effects of exceptional or temporary network congestion, provided that equivalent categories of traffic are treated equally.

- A5.56 In relation to sub-paragraph (a), we consider that ISPs may rely on this exception where the specific traffic management action is proportionate and the minimum necessary to meet the obligation in the relevant legislation, order or administrative measure. Examples of the types of obligation that might fall into this exception would include legislation, court orders and GCs imposed by Ofcom.<sup>24</sup>
- A5.57 In relation to the exception in sub-paragraph (b), we are not providing specific additional guidance but ISPs may have regard to the BEREC guidelines in considering whether they are compliant.
- A5.58 We discuss our approach to the exception in sub-paragraph (c) in more detail below.

### Traffic management to prevent impending network congestion

- A5.59 ISPs are permitted to apply non-discriminatory traffic management to prevent impending congestion, and/or mitigate the effects of congestion, subject to the relevant proportionality and transparency requirements.

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<sup>23</sup> As amended by [The Open Internet Access \(Amendment etc.\) \(EU Exit\) Regulations 2018 \(legislation.gov.uk\)](#).

<sup>24</sup> We also consider that where ISPs block access to unlawful content identified by the Internet Watch Foundation (<https://www.iwf.org.uk/>), this is likely to fall under the criteria in sub-paragraph (a).

- A5.60 Use of traffic management to address congestion should be limited in duration and frequency. To achieve this we expect that ISPs will build sufficient capacity to carry the traffic offered in the busiest period for each part of their network. The busiest period is the period of time where traffic is highest. This may, for example, be weekday evenings between 7 and 10pm.
- A5.61 In planning their networks and considering the use of traffic management, ISPs must ensure they have regard to their obligations in relation to network resilience.
- A5.62 We are unlikely to consider the following traffic management as discriminatory:
- a) throttling all traffic to the same extent;
  - b) prioritising all the traffic for a set of ISP retail customers, in order to ensure the contracted levels of quality of internet access service are met. In applying such traffic management in the case where ISPs offer internet access services with different levels of quality of service, prioritising traffic for one set of customers should not result in the service provided to other customers not meeting the minimum quality offered for their service; and
  - c) applying traffic management which ensures that equivalent categories are treated equally, where ISPs are able to identify equivalent categories of traffic across their networks.<sup>25</sup>
- A5.63 If possible, such traffic management should be targeted at the affected parts of the ISP's network, i.e. the parts of the network which are congested or where congestion is imminent, including the circumstances where it is (or expected to be) triggered by an exceptional peak in traffic. If this results in a differential treatment of traffic in the affected parts of the network compared to the rest of the network (e.g. throttling all traffic in the affected parts of the network to the same extent, while applying no active traffic management in the rest of the network), this would not be considered as a discriminatory traffic management practice. For clarity, where congestion is isolated to traffic on a dedicated link from a single CAP, action can be localised to this.
- A5.64 For each internet access service offered by an ISP, it should not treat specific content, applications or services differently to other content of a similar category within the affected part of the network. Where ISPs cannot identify all traffic in order to treat similar traffic equivalently, the ISP should seek to treat all traffic the same. In this instance, similar categories of traffic should be understood as traffic with similar technical characteristics, for example in terms of bandwidth, latency, jitter or packet loss requirements.
- A5.65 Traffic management applied in the above circumstances needs to be proportionate, i.e. the extent of traffic management needs to be necessary to address the concern it seeks to prevent or mitigate and be reflective of the severity of that concern.<sup>26</sup> In particular, ISPs need to ensure that the degree of traffic management reflects the severity of congestion

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<sup>25</sup> We understand that currently ISPs may have limited ability to identify traffic categories consistently.

<sup>26</sup> As per Article 3(3) third subparagraph.



and should aim to bring traffic load close to the maximum design parameters set by the network operator.

A5.66 We will consider that traffic management practices are disproportionate where they are applied:

- when the network is not congested or is not at risk of imminent congestion; or
- for a prolonged period or to areas of the network that are no longer congested.

A5.67 Traffic management as described above can be applied to a particular part of the network (i.e. any specific link, node or combination of them), in line with the following:

- a) we would consider that part of the network is congested where the underlying network or network component (such as a link or node) is offered a greater traffic load than it can deliver within the design parameters set by the network operator. The parameters set by the network operator may include some or all of: maximum latency, maximum jitter, maximum packet loss and utilisation; or
- b) we would consider that a part of the network is at imminent risk of congestion, where an ISP identifies:
  - i) a scheduled traffic event, including an exceptional peak in traffic, which is expected to increase traffic load to the point where congestion is likely, based on the parameters above; or
  - ii) the ISP has not identified a scheduled event, but traffic is above the normally expected level to an extent that if traffic remained this far above the normal level, or continued to increase, congestion would be expected to occur.

A5.68 ISPs will also need to ensure that they are transparent about the traffic management practices they apply, to enable their customers to make informed and effective choices according to Article 4 of the Regulation, and the relevant BEREC Guidelines.<sup>27</sup> In particular they should clearly explain when traffic management will be used, how it will be applied, and the impact this may have on specific users. Where ISPs offer retail services with differentiated quality, ISPs should set out to customers of their services how traffic management will impact them, including informing users of internet access the impact of traffic management on their service.

A5.69 ISPs will also need to ensure that their practices comply with the requirements in relation to meeting contracted levels of quality, laid down in Article 4 of the Regulation. ISPs are required to ensure that customers can identify and take effective action where there are significant, continuous or regularly occurring discrepancies between the actual performance and what has been agreed in the contract. This includes the requirements set out in Article (4) of the Regulation that ISPs:

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<sup>27</sup> See for example, paragraphs 135-136 of the BEREC Guidelines.

- a) provide a clear and comprehensible explanation of the remedies available to the consumer which can be used in the event of any continuous or regularly recurring discrepancy;<sup>28</sup> and
- b) put in place transparent, simple and efficient procedures to address complaints of end-users.<sup>29</sup>

## **Our approach to monitoring the use of traffic management**

A5.70 To enable us to perform necessary monitoring and supervision, ISPs should be able to provide Ofcom with information to assess whether its use of traffic management is compliant with the Regulation on request. The ISP should be able to provide information to Ofcom for each instance where they have applied traffic management to demonstrate that the traffic management approach taken was compliant with the Regulation. That information should cover:

- a) Which parts of the network were affected, for how long, and how this satisfied the criteria set out in paragraph A5.67.
- b) Where traffic management was used to address congestion, the information used to determine this was occurring or was imminent.
- c) The dates/times when traffic management was used on their network, including where traffic management is configured permanently in the network as discussed in paragraphs A5.72 to A5.75 below.
- d) The specific traffic management measures that were applied in which part of the network, the reasons why (e.g. to address congestion; to ensure the contracted quality of service standards are met), and how these measures met the non-discrimination, proportionality and transparency requirements set out in paragraphs A5.62 to A5.66.
- e) The impact of this traffic management on different internet access services, including information on the network performance in terms of latency, jitter and packet loss and congestion, and how this compares with the contracted quality levels.

A5.71 We anticipate Ofcom will gather this information periodically, to monitor compliance with the rules. This information may also be used in our annual reporting on net neutrality.

## **Our approach to monitoring traffic management measures configured on a permanent basis**

A5.72 Some traffic management measures may be configured in the network on a permanent basis. However, these measures should be programmed so as to only take effect to address the circumstances outlined above, namely:

- a) to undertake reasonable traffic management as per sub-paragraph 2 of Article 3(3); or

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<sup>28</sup> Article 4(1) (e) of the Regulation.

<sup>29</sup> Article 4(2) of the Regulation.

- b) to undertake traffic management in relation to the exceptions under sub-paragraph 3 of Article 3(3), including where this is required to manage traffic related to retail offers with different quality levels.

A5.73 Some of the exceptions under sub-paragraph 3 may mean that it is necessary for the measure to have permanent effect (for example, blocking access to illegal content). In all other cases, the measure should not affect traffic outside the specific and temporary conditions which it is targeted to address.

A5.74 Where ISPs implement such measures on their networks, the ISP should be able to provide Ofcom with information to assess the use of these measures:

- a) What permanent measures have been implemented on their network, and which parts of the network are covered by each measure, explaining what traffic management practice is applied and the traffic to which this is applied.
- b) The circumstances under which the measure is expected to impact traffic, and how these measures meet the relevant requirements (for example, if such measure is used to address congestion, how it meets the non-discrimination, proportionality and transparency requirements set out in paragraphs A5.62 to A5.66.
- c) The dates, times, duration and location on the network when this traffic management measure has impacted traffic.

A5.75 As above, we anticipate we may gather this information periodically to monitor compliance to the rules. This information may also be used in our annual reporting on net neutrality.

## Specialised services

A5.76 Article 3(5) of the Regulation provides that ISPs may offer services other than internet access services which are optimised for specific content, applications or services:

Providers of electronic communications to the public, including providers of internet access services, and providers of content, applications and services shall be free to offer services other than internet access services which are optimised for specific content, applications or services, or a combination thereof, where the optimisation is necessary in order to meet requirements of the content, applications or services for a specific level of quality.

Providers of electronic communications to the public, including providers of internet access services, may offer or facilitate such services only if the network capacity is sufficient to provide them in addition to any internet access services provided. Such services shall not be usable or offered as a replacement for internet access services, and shall not be to the detriment of the availability or general quality of internet access services for end-users.

A5.77 Such services are commonly referred to as 'specialised services', which is the term used in the BEREC Guidelines, although it is not used in the Regulation.

A5.78 Article 3(5) imposes certain conditions on the provision of specialised services, including that:

- i) optimisation is necessary in order to meet requirements of the content, applications or services for a specific level of quality;
- ii) network capacity is sufficient to provide them in addition to any internet access services provided;
- iii) such services shall not be usable or offered as a replacement for internet access services; and
- iv) such services shall not be detrimental to the availability or general quality of internet access services for end-users.

A5.79 We set out our approach to assessing if these conditions are met below.

### **Optimisation is necessary in order to meet requirements of the content, applications or services for a specific level of quality**

A5.80 A specialised service is a service which is optimised for specific content, applications or services which have a quality requirement that is not supported by an internet access service.

A5.81 When assessing whether a service meets this requirement, we would expect the ISP to be able to demonstrate that:

- i) The service provides access to specific content, applications or services, and is optimised for such content, applications or services.
- ii) The service has quality requirements which necessitate optimisation because they cannot be met consistently by the ISP's internet access services during normal operation (e.g. when the network is not congested). This could be done by identifying the parameters which are not supported by a internet access and the impact on the service if it is not optimised (that is, the service features which would not be able to function fully if delivered via a general internet access service).<sup>30</sup>

A5.82 The quality requirements might include, for example, latency, jitter, packet loss, requirements for guaranteed bandwidth, security requirements or the need for certainty that the service will operate at all times (for example, critical network infrastructure related applications).

A5.83 The requirements of new services, and their need for optimisation, may not be completely understood until the service has been launched and has gained a degree of maturity. ISPs should be able to demonstrate a reasonable expectation of the need for optimisation

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<sup>30</sup> Different approaches may be taken by ISPs to deliver specialised services over the access connection to end users, which may include delivering traffic as part of an IAS or on a separate logical or physical channel. Assessment of whether the specialised services criteria are met should be based on the end-to-end requirements of the service and not the technical approach to delivery to the end user.

through, for example, service trials, where new services are launched using specialised services.

- A5.84 A specialised service may provide access to content, applications or services which are accessible using an ISP's internet access service, provided that it is optimised to meet quality requirements that cannot be supported by the internet access service. For example, an ISP could offer a specialised service to provide access to a virtual reality application, which has quality requirements (such as latency) for optimal performance which are not supported by the internet access service. In this example, the application may still work using internet access but at a sub-optimal level, for example where functionality that depends on the specialised service operates inconsistently or this functionality is not available at all via internet access.
- A5.85 ISPs may offer specialised services to CAPs, but ISPs must not require CAPs to use such services to deliver their traffic. We would be particularly concerned if the quality of service delivered by an ISP's internet access service reduced, or an ISP did not invest in normal network improvements, in order to encourage CAPs (or consumers) to use a specialised service to guarantee traffic delivery. We are likely to view this as inconsistent with our duty<sup>31</sup> to promote the continued availability of non-discriminatory internet access services at levels of quality that reflect advances in technology.

### **Network capacity is sufficient to provide the specialised service, such that the specialised service is not detrimental to the availability or general quality of internet access services**

- A5.86 ISPs must ensure there is sufficient network capacity to support the provision of a specialised service in addition to any internet access service, such that the specialised services are not detrimental to the availability or general quality of internet access for end-users.
- A5.87 When assessing whether an ISP has met these requirements, we would expect it to be able to demonstrate that it has taken steps to ensure there is sufficient network capacity to support the specialised service in addition to any internet access service. In particular, we would normally expect the ISP to be able to demonstrate that:
- its capacity planning takes account of the forecast demand for the specialised service and any internet access; and
  - that sufficient capacity has been provided to maintain the quality of internet access.
- A5.88 We note that in some cases it may be sufficient to demonstrate that a specialised service would not have a significant impact on an internet access service, for example because:
- the specialised service traffic is logically or physically separated from internet access traffic;
  - the specialised service does not make significant demands on network resources; or

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<sup>31</sup> Under Article 5(1) of the Regulation.

- the specialised service is used outside peak traffic periods.
- A5.89 We would be most likely to consider that an assessment of the impact of a specialised service on an internet access service is warranted where the introduction of a specialised service has an ongoing effect on the quality of the ISP's internet access service, particularly where the ISP has indicated that a CAP should use a specialised service to guarantee traffic delivery.
- A5.90 When assessing the impact of a specialised service on internet access, we would consider the impact to be detrimental to the availability or general quality of the internet access service if it causes the quality to fall below the applicable contractual quality standards for the service.
- A5.91 In the absence of contractual quality standards, we would consider the impact to be detrimental to the availability or general quality of the internet access service if it causes the quality to degrade significantly, as measured by standard quality parameters such as bandwidth, latency, jitter, packet loss and congestion.
- A5.92 Where the ISP offers multiple internet access services of different levels, we would expect quality to be maintained on all of its services.
- A5.93 Where ISPs provide specialised services, they may still apply traffic management to their general internet access offers in accordance with Article 3(3), in line with the traffic management guidance above. They should set out to customers of their internet access services how traffic management will impact them (as set out in paragraphs A5.68 to A5.69).
- A5.94 The traffic management requirements in Article 3(3) do not apply to specialised services and ISPs are free to manage these services as they choose.

### **Such services shall not be usable or offered as a replacement for internet access services**

- A5.95 Internet access services provide connectivity to virtually all end points on the internet whereas specialised services should provide access to specific content, applications and services (where optimisation is needed). Specialised services should not be capable of being used to generally access services or end points across the internet (where the need for optimisation has not been established), as this would suggest the end user is accessing internet content without the equal treatment of traffic rules applying, so that the aims of the Regulation are being circumvented.

### **Our approach to monitoring specialised services**

- A5.96 Where an ISP launches a specialised service, it should be able to provide Ofcom with information to demonstrate that the above criteria are met, on request.
- A5.97 This information will need to address the points raised above in regard to how we assess whether optimisation is required, whether network capacity is sufficient, and to

demonstrate that specialised services are not detrimental to internet access services or being used as a replacement for internet access services.

- A5.98 We anticipate we will gather information periodically to monitor compliance with the rules in relation to the deployment of specialised services and their impact on the general quality of internet access services. This information may also be used in our annual reporting on net neutrality.

## Internet access services provided on board transport

- A5.99 While we would consider specific services on a case-by-case basis, our view is that internet access services provided on transport are likely to constitute publicly available internet access services and, as such, are in scope of the Regulation.
- A5.100 We recognise that there may be circumstances where technical limitations mean providers of these services are likely to need to use certain traffic management techniques on an ongoing basis to ensure consumers receive a service of acceptable quality.
- A5.101 These cases are unlikely to be a priority for enforcement action in the absence of specific consumer harm.

## Public interest exceptions

### Approach to emergency communications

- A5.102 Voice telephone calls to 999 are treated as a priority and communications providers are required by Ofcom's GCs to ensure uninterrupted access to the emergency services for voice 999 calls. Some newer, alternative means of contacting the emergency services, including emergency video relay, rely on internet access for connectivity. We are considering whether the GCs should be updated so as to ensure that emergency communications that rely on internet access can be exempted from the traffic management rules. This will allow those services:
- to be prioritised over other internet traffic; and
  - continue to be accessed, and zero rated, when general data allowances are exhausted.
- A5.103 Until we conclude on this, cases where ISPs manage emergency services communications in this way are unlikely to be an enforcement priority.

### Approach to restricting access to scam websites

- A5.104 Internet access may be used to access scam websites and fraudulent content. Ofcom is currently considering policy approaches to addressing these questions. In the meantime, traffic management to restrict access to scams and fraudulent content are unlikely to be a priority for enforcement action, provided that this is undertaken by ISPs on a reasonable, proportionate, targeted and appropriately evidenced basis.

## Approach to parental controls

- A5.105 We support the provision and use of content filters, provided end-users have control over their operation. These content filters can operate within ISP networks or over-the-top (e.g. in devices or through apps). Where they operate over-the-top, they are out of scope of the Regulation.
- A5.106 Content filters provided as part of the internet access services (i.e. within the ISP's network) are within the scope of the Regulation. However, they are unlikely to be an enforcement priority provided that any content filtering that is undertaken by ISPs is done on a reasonable, proportionate, targeted and appropriately evidenced basis and provided consumers are able to take informed, free choices over the use of these filters.

## Information on general network performance

- A5.107 Under Article 5 of the Regulation, Ofcom has a duty to promote the continued availability of non-discriminatory internet access at levels of quality that reflect advances of technology. Data on general network performance will be important to allow us to report on the quality of internet access offered by ISPs, particularly where they offer a range of retail offers or specialised services. ISPs should be able to provide, on request, data relating to the quality of service they are providing on their internet access services.
- A5.108 We anticipate we will gather information periodically on network performance, including the following data for each month:
- a) traffic throughput;
  - b) maximum latency, jitter and packet loss; and
  - c) other measures of congestion, such as proportion of network elements (for example, the number of cell sites in an MNO's network) experiencing a measure of congestion such as utilisation above the planned maximum utilisation or other measures as recorded by the ISPs.
- A5.109 This data may be requested for several time periods including during:
- a) the highest traffic peak(s);
  - b) the average in the busy period (for example between 6pm and 10pm); and
  - c) the average outside the busy period.

## Information retention

- A5.110 The information set out above may be used for Ofcom's general monitoring and annual reporting. As such, ISPs should maintain data for a period of time to provide to Ofcom on request for monitoring and reporting purposes, in addition to any specific request related to compliance monitoring or assessments.

Where data relates to a specific offer (such as zero rating, differentiated retail offers and specialised services) we would expect the ISP to be able to provide the relevant data



throughout the period the offer is active and for 18 months afterwards. In relation to general network performance monitoring and data on the use of traffic management, we would expect ISPs to keep this data for 18 months after the end of the month to which the data relates.

## A6. Annual report for monitoring compliance with the Open Internet Regulation

### Introduction

- A6.1 Ofcom is responsible for monitoring and ensuring compliance with the net neutrality rules in the UK and is required to publish an annual report of its findings. This annex constitutes our sixth annual report.
- A6.2 As part of our review of the net neutrality framework, we are considering how we could improve our annual monitoring report going forward. A number of stakeholders who submitted responses to our 2021 Call for Evidence also provided views on the usefulness of our previous reports and recommended changes.<sup>32</sup> Overall, stakeholders thought our report has been helpful in ensuring compliance with the net neutrality rules however some suggested we could use it to provide better clarity and transparency of our enforcement decisions.
- A6.3 We will review the format of future reports once we have finalised our review, so we can take into account any changes to the interpretation of the rules. In the meantime, this report will broadly maintain the same structure and approach as our previous reports.

### Measuring quality of internet access services

- A6.4 To fulfil our obligations under Article 5(1) of the Open Internet Access Regulation (the 'Regulation'),<sup>33</sup> we look at various indicators including broadband speeds, web browsing performance, conducting market surveys and technical network monitoring.
- A6.5 Overall, we have found that the roll-out of gigabit capable broadband has increased significantly since December 2021, while mobile coverage continues to increase at pace. This has led to greater access to better quality internet access services.<sup>34</sup>

### Fixed broadband network IAS quality

- A6.6 Ofcom measures the quality of fixed broadband internet access using two complementary methods: we gather data from ISPs on their retail and wholesale services and we work with the broadband performance company, SamKnows Limited, to assess fixed-line residential broadband speeds.<sup>35</sup>

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<sup>32</sup> The responses to our 2021 Call for Evidence are available on our website [here](#).

<sup>33</sup> [Regulation \(EU\) 2015/2120](#) of the European Parliament and of the Council of 25 November 2015 laying down measures concerning open internet access and retail charges for regulated intra-EU communications and amending Directive 2002/22/EC and Regulation (EU) No 531/2012, as amended by [The Open Internet Access \(Amendment etc.\) \(EU Exit\) Regulations 2018 \(legislation.gov.uk\)](#).

<sup>34</sup> Ofcom, 2022. [Connected Nations update: Spring 2022](#).

<sup>35</sup> Ofcom, 2021. [UK Home Broadband Performance: Technical Annex](#).

Figure A6.1: Latest figures on the speed, coverage and quality of fixed broadband

Speed	Coverage	Quality
<p>The roll-out of superfast broadband means that <b>96% of UK homes have access to download speeds of at least 30 Mbit/s</b>. This is enough to support multiple devices, gaming and streaming in 4K.</p> <p>As for the average connections users typically receive during peak hours, the latest Home Broadband report noted <b>connections were 6% slower on average than their maximum speed in the peak period</b> (8pm to 10pm). ADSL2+ and 145 Mbit/s full-fibre services delivered 89% of maximum speeds in peak periods, compared to 95% for 213 Mbit/s cable services and 50 Mbit/s FTTC services.<sup>36</sup></p>	<p><b>68% of homes are now able to get gigabit capable broadband.</b> This is up from 47% in 2021. This has been <b>driven by the continued roll-out of full-fibre broadband</b> by many network operators, and the conclusion of Virgin Media O2’s upgrade programme. As of May 2022, over a third (37%) of UK homes have full fibre coverage.</p> <p>The number of premises unable to get decent broadband (defined as at least 10 Mbit/s download and 1 Mbit/s upload speed) has dropped from 123,000 to 83,000 premises since our last report.</p>	<p>The UK Home Broadband Performance report indicates that the average (median) actual download speed of UK residential fixed broadband services over a 24-hour period increased by 9 Mbit/s (80%) to 59.4 Mbit/s between March 2021 and March 2022.</p> <p>Over the same time period, the average (median) upload speed increased by 0.9 Mbit/s (9%) to 10.7 Mbit/s.</p>

Source: *Connected Nations Update (Autumn 2022)* and *UK Home Broadband Performance 2022 (Speed,<sup>37</sup> Coverage,<sup>38</sup> Quality<sup>39</sup> of fixed broadband)*

## Mobile broadband network IAS quality

- A6.7 Ofcom publishes maps of mobile coverage based upon mobile network operators’ (MNOs) coverage predictions.<sup>40</sup>
- A6.8 The Mobile Matters report describes how people are using their mobile services, and the experience they receive.<sup>41</sup> The next report is due to be published early next year.
- A6.9 The table below summarises some of the data and trends we have on mobile internet access quality.

<sup>36</sup> Ofcom, 2022. [UK Home Broadband Performance report](#). Subsequent references are to this publication.

<sup>37</sup> Ofcom, 2021. [Connected Nations 2021: UK Report](#), p.7.

<sup>38</sup> Ofcom, 2022. [Connected Nations Update: Autumn 2022](#), p.6. Subsequent references are to this publication.

<sup>39</sup> Ofcom, 2022. *UK Home Broadband Performance*.

<sup>40</sup> See Ofcom’s [Mobile and broadband checker](#). Mobile coverage is generally updated monthly. Ofcom periodically undertakes drive testing to ensure that the coverage predictions provided by the MNOs are reasonable.

<sup>41</sup> Ofcom, 2021. [Mobile Matters 2021: Using crowdsourced data to assess people’s experience of using mobile networks](#). Subsequent references are to this publication.

Figure A6.2: Latest figures on the speed, coverage and quality of mobile broadband

Speed	Coverage	Quality
<p>Around 92% of the UK landmass is predicted to have good 4G coverage from at least one operator, and this area includes nearly all of the premises in the UK. This means that almost all are benefitting from download speeds of 20-40 Mbit/s and strong phone signal strength. 4G accommodates general web browsing, social media, gaming, video streaming.</p>	<p>Coverage of 4G mobile networks across the UK has not seen a notable change since December 2021. On the other hand, 5G coverage is steadily expanding as 5G coverage from at least one MNO now ranges from 48% (very high confidence) to 64% (high confidence) of premises outdoors, up from 47% and 62% respectively when last reported in May 2022.</p>	<p>The last Mobile Matters report noted the video streaming experience for 4G users to be either “Good” or “Excellent” for 70% or more of 4G users. We found latency had held up well when compared to 2020 data. The next Mobile Matters report will reveal whether user experience has continued to improve as it will detail average response rates across the 2G, 3G, 4G and 5G networks.</p>

Source: *Connected Nations Update* (Autumn 2022) and *Mobile Matters* (Speed,<sup>42</sup> Coverage,<sup>43</sup> Quality<sup>44</sup>)

## Safeguarding open internet access

- A6.10 Article 3 of the Regulation sets out the rights of end-users and ISPs’ obligations (other than those relating to transparency, which are set out in Article 4).
- A6.11 To ensure compliance with these rules, we have continued to monitor complaints and publicly available information on the zero-rating and traffic management policies of ISPs.

## Using terminal equipment

### Article 3(1) of the Regulation

End-users shall have the right to access and distribute information and content, use and provide applications and services, and use terminal equipment of their choice, irrespective of the end-user’s or provider’s location or the location, origin or destination of the information, content, application or service, via their internet access service.

### Enforcement action

- A6.12 In November 2021, we were made aware of a broadband provider whose terms and conditions appeared to restrict their customers’ rights to use terminal equipment of their

<sup>42</sup> Ofcom, 2022. *Connected Nations update – Autumn 2022*, p.2.

<sup>43</sup> Ofcom, 2022. *Connected Nations Update: Spring 2022* (p.3); Ofcom 2022. *Connected Nations Update: Autumn 2022* (p.3).

<sup>44</sup> Ofcom, 2021. *Mobile Matters 2021: Using crowdsourced data to assess people’s experience of using mobile networks*, p.15.

choice. The broadband provider informed us that they had already scheduled an update to remove this clause in December 2021. We decided not to take any formal enforcement action as the provider was taking action to address the issue – we followed up with the provider in December 2021 and it confirmed it had removed this clause.

## Zero-rating

### Article 3(2) of the Regulation

Agreements between providers of internet access services and end-users on commercial and technical conditions and the characteristics of internet access services such as price, data volumes or speed, and any commercial practices conducted by providers of internet access services, shall not limit the exercise of the rights of end-users laid down in paragraph 1.

### Enforcement action

- A6.13 As set out in our 2020 and 2021 annual monitoring reports, in 2020 a number of MNOs started giving their customers free online access to certain services and websites, including NHS health information about coronavirus, and information supporting victims of domestic and sexual abuse.<sup>45</sup> We are aware that since then, a number of MNOs have expanded their list of zero-rated websites to include websites providing financial support and advice.<sup>46</sup>
- A6.14 As was the case in 2020/21, we have not conducted a detailed review of these zero-rating offers as they are clearly aimed at supporting consumers during challenging periods and there appears to be little to no risk of the offers limiting the rights of end-users under Article 3(1). As part of our ongoing review into the net neutrality framework, we are consulting on proposals to update our zero-rating guidance to make it clearer to providers where we are less likely to have concerns.

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<sup>45</sup> Ofcom. [Monitoring compliance with the net neutrality rules](#).

<sup>46</sup> For example: Three, September 2022, [Three UK expands number of zero-rated websites to further support customers during cost-of-living crisis](#); and Virgin Media O2, July 2022, [Virgin Media O2 boosts list of data-free services as part of measures to support customers in cost-of-living crisis](#). [accessed 7 October 2022].

## Traffic management

### Article 3 (3) of the Regulation

Providers of internet access services shall treat all traffic equally, when providing internet access services, without discrimination, restriction or interference, and irrespective of the sender and receiver, the content accessed or distributed, the applications or services used or provided, or the terminal equipment used.

### Enforcement action

- A6.15 In February 2022, we reviewed a broadband provider's traffic management policy which appeared to suggest it was using prioritisation to categorise online activity into high, medium, or low based on how time-sensitive the traffic is, and to manage compliance with data caps and download limits. While this raised some concerns, we decided against taking enforcement action as the provider outlined plans to move away from this platform by FY 2022/23, and we have asked them to provide an update towards the end of 2022.

## Specialised services

### Article 3(5) of the Regulation

Providers of electronic communications to the public, including providers of internet access services, and providers of content, applications and services shall be free to offer services other than internet access services which are optimised for specific content, applications or services, or a combination thereof, where the optimisation is necessary in order to meet requirements of the content, applications or services for a specific level of quality. Providers of electronic communications to the public, including providers of internet access services, may offer or facilitate such services only if the network capacity is sufficient to provide them in addition to any internet access services provided. Such services shall not be usable or offered as a replacement for internet access services and shall not be to the detriment of the availability or general quality of internet access services for end-users.

### Enforcement action

- A6.16 Ofcom has not conducted any recent reviews of specialised services, nor have we taken any enforcement action against providers offering these services.

## Transparency measures

- A6.17 Article 4(1) requires ISPs to provide clear, accessible and comprehensive information on factors that could impact the quality of internet access services or potentially infringe on end users' rights.

- A6.18 Ofcom has continued to monitor the information included in consumer contracts by ISPs and related consumer complaints received through our Consumer Contact Team. To date, we have not received complaints that have generated a significant cause for concern.
- A6.19 As part of the implementation of the end-user rights protections in the European Electronic Communications Code<sup>47</sup> we have set out a requirement in our General Conditions for ISPs to include the information set out in Article 4(1) in consumer contracts.<sup>48</sup> We have published guidance on how we expect this contract information to be provided to customers in order to comply with these rules.<sup>49</sup>
- A6.20 The provisions set out in our “Voluntary Codes of Practice on Better Broadband Speeds” (the ‘Codes’) are consistent with the requirements set out in the Regulation.<sup>50</sup> Currently the Codes require signatories to, among other things, provide consumers with clear and comprehensible explanations of the minimum, normally available, maximum and advertised download and upload speed to give them a minimum guaranteed download speed before signing up to a deal. In May 2022, we published a compliance report which assessed how providers have implemented the latest version of the Codes.<sup>51</sup> We found that customers are given information on their expected and minimum guaranteed speeds early in the sales process, and that there are sufficient procedures in place to ensure compliance. However, we also identified a few transparency and accuracy concerns which are detailed in the report.

## Complaints and remedies

- A6.21 Article 4(2) of the Regulation requires ISPs to have procedures to manage complaints about consumers’ core rights under the Regulation.

## Complaints procedures and complaints to Ofcom

- A6.22 Under our complaints handling rules, ISPs are required to inform customers how their complaints will be handled, how long it will take, and that they have the right to use alternative dispute resolution if, for instance, their complaint is not resolved to their satisfaction.<sup>52</sup>

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<sup>47</sup> Directive (EU) 2018/1972 of the European Parliament and of the Council of 11 December 2018 establishing the European Electronic Communications Code (Recast), as implemented by the Electronic Communications and Wireless Telegraphy (Amendment) (European Electronic Communications Code and EU Exit) Regulations 2020.

<sup>48</sup> See General Condition C2, Ofcom, 2022. [Revised General Conditions of Entitlement \(Unofficial Consolidated Version\)](#), with effect from: 17 June 2022.

<sup>49</sup> Ofcom, 2022. [Ofcom’s guidance under General Condition C1 – contract requirements \(June 2022\)](#).

<sup>50</sup> Ofcom, 2018. [Better broadband speeds information – voluntary codes of practice. Revised Codes](#) will be introduced on 21 December 2022.

<sup>51</sup> Ofcom, 2022. [Voluntary Codes of Practice on Better Broadband Speeds 2022: Report on the 2018 Residential and Business Codes](#), p.3.

<sup>52</sup> See [Annex to General Condition C4](#).

## Remedies and redress

- A6.23 Article 4(4) of the Regulation gives end-users the right to invoke remedies through national law (e.g., consumer or contract law) if there are significant continuous or regularly recurring problems with ISPs' performance relating to speed or other quality of service measures. Additionally, our Broadband Speeds Codes of Practice grants customers of signatories the right to cancel their contract without penalty if their speeds fall below the minimum guaranteed level for a sustained period of time.
- A6.24 Furthermore, under our voluntary automatic compensation scheme participating ISPs must pay residential landline and broadband customers automatic compensation for delayed installations, delayed repairs following a total loss of service and for missed appointments. In April 2022, we increased the amount of compensation that participating ISPs pay customers, to keep up with recent inflation increases.<sup>53</sup> As set out in our comparing customer service report, in 2021, over £58.5m was paid in automatic compensation, more than double the £27.5m figure reported in 2020.<sup>54</sup> This increase can be partially explained by the fact that providers were temporarily exempt from paying the fees in 2020 because the pandemic disrupted their ability to install and repair services.

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<sup>53</sup> Ofcom, 2022. [Automatic compensation: What you need to know](#). Compensation payments amounts increase annually in line with inflation. Customers of signatories are now entitled to £8.40 each calendar day for delayed repairs following a loss of broadband if not resolved within two working days; £26.24 per missed appointment and £5.25 each calendar day if there is a delay to the start of a new service.

<sup>54</sup> Ofcom, 2022. [Comparing customer service: mobile, home broadband and landline](#), p.27.



## A7. International case studies

- A7.1 As part of our review, we have assessed the net neutrality frameworks of several international jurisdictions to inform our thinking.
- A7.2 In this annex, we detail case studies from the EU (including a short focus on Italy), the US, Singapore and South Korea.
- A7.3 Apart from the US, which currently does not currently have a net neutrality framework in place at the federal level, we note that the basis of the frameworks in the EU, California, Singapore and South Korea are similar to that in the UK in that they are concerned with preventing the blocking of legitimate content, requiring information transparency and allowing reasonable traffic management in certain circumstances.
- A7.4 However, the exact nature of the rules differ from jurisdiction to jurisdiction, e.g. Singapore allows traffic management based on commercial considerations (including allowing ISPs to offer priority for gaming services), and the EU has recently clarified that 'non-application-agnostic' zero rating offers are incompatible with EU law.
- A7.5 In addition, recent cases in South Korea and Italy have respectively demonstrated the existence of other complementary market arrangements and legislative levers to help ensure network integrity and functioning that sit outside of their net neutrality frameworks.

### European Union

- A7.6 Net neutrality in the EU is governed by the Regulation, which was agreed in 2015 and came into effect at the end of April 2016.<sup>55</sup>
- A7.7 Under Article 5(3) of the Regulation, the Body of European Regulators for Electronic Communications (BEREC) is obliged to issue guidelines for the implementation of the obligations of NRAs to help ensure consistency of the application of the Regulation and to promote an effective internal market in the electronic communications sector.

### Zero-rating and CJEU rulings

- A7.8 Historically, BEREC had recommended that NRAs should undertake a comprehensive case-by-case assessment of zero rating offers against a list of factors set out in its guidelines (including the likely effects of such offers on competition and end users).
- A7.9 However, in September 2021, the Court of Justice of the European Union (CJEU) issued three rulings<sup>56</sup> that found that zero rating offers by Vodafone and Telekom Deutschland in

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<sup>55</sup> [Regulation \(EU\) 2015/2120](#) of the European Parliament and of the Council of 25 November 2015 laying down measures concerning open internet access and retail charges for regulated intra-EU communications and amending Directive 2002/22/EC and Regulation (EU) No 531/2012. Following the UK's departure from the EU and subsequent transition period, the EU rules on net neutrality became part of UK domestic law.

<sup>56</sup> These relate to ECJ C-854/19 Vodafone (roaming), C-5/20 Vodafone (tethering) and C-34/20 Telekom Deutschland (throttling), 2 September 2021.

Germany were “contrary to the general obligation of equal traffic, without discrimination or interference, as required by the regulation on open internet access” and thus also incompatible with EU law.<sup>57</sup>

A7.10 In light of these rulings, BEREC consulted on updating its guidelines, culminating in a revised set of guidelines in June 2022.<sup>58</sup>

A7.11 As part of the update, BEREC confirmed that:

- There was still room for price differentiation when traffic is treated equally.
- “Any non-application-agnostic pricing practices are inadmissible”, and that this would mean that ISPs would “need to cease their non-application-agnostic zero-rating practices”.<sup>59</sup>
- Examples of “typically admissible” commercial practices would include:
  - Application-agnostic offers where data consumption during a certain period (e.g. weekends) is not counted against the general data cap
  - A lower quality tariff option selected by an end-user
  - Internet access service tariffs with different speeds, different volumes or for different user groups.

A7.12 Given BEREC’s revised position, its guidelines no longer require NRAs to carry out case-by-case assessments of zero-rated offers.<sup>60</sup>

A7.13 It should be noted that the UK is no longer obliged to take the CJEU’s rulings on zero rated offers or the BEREC Guidelines into account following its departure from the EU.

## Italy

A7.14 Some respondents to the 2021 ‘Call for Evidence’ referenced the case between the global sports streaming provider, DAZN, and the Italian national regulatory authority, Autorità per le Garanzie nelle Comunicazioni (AGCOM) as a possible example of where a different approach to net neutrality has been taken and one that Ofcom might wish to look into further.

A7.15 However, in our view AGCOM’s intervention in this case was not based on net neutrality considerations but rather mainly on network integrity and consumer protection grounds, as explained below. A summary of the case is provided below for completeness.

A7.16 On 26 March 2021, the Italian Premier League (Lega Serie A) announced it had assigned the two main packages of football rights for seasons 2021-2024 to DAZN in a deal reported to be worth €2.5bn, and which would make DAZN the largest broadcaster of Serie A matches. It was also announced on the same day that DAZN and the Italian telecoms company,

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<sup>57</sup> CJEU press release, 2021. [\*‘Zero tariff’ options are contrary to the regulation on open internet access.\*](#)

<sup>58</sup> BEREC, 2022. [\*BEREC Guidelines on the Implementation of the Open Internet Regulation.\*](#)

<sup>59</sup> BEREC, [\*Update to the BEREC Guidelines on the Implementation of the Open Internet Regulation\*](#), presented at public debriefing on the outcomes of the 51st BEREC ordinary meetings, 15 June 2022.

<sup>60</sup> BEREC, 2022. [\*BEREC Report on the outcome of the public consultation on the draft BEREC Guidelines on the Implementation of the Open Internet Regulation.\*](#)

Telecom Italia (TIM), had signed a distribution agreement that would see all the matches be shown on TIM's streaming platform.

A7.17 Following the awarding of the rights to DAZN, ISPs asked for AGCOM's intervention on issues relating to network capacity saturation due to the probable increase in traffic arising from DAZN live streaming these matches. AGCOM shared some of the concerns raised by operators about how the new arrangements could potentially adversely affect the functioning of the network. As a result, on 24 June 2021 AGCOM published its decision 206/21/CONS,<sup>61</sup> which set out measures aimed at avoiding network congestion relating to people watching the Serie A football matches online.<sup>62</sup>

A7.18 The decision stated that the measure had two purposes:

- avoiding network congestion resulting from traffic peaks, which could occur as a result of the simultaneous transmission of one or more football matches; and
- preventing connection issues for subscribers and degradation of the quality of the internet access service for all users.

A7.19 According to decision 206/21/CONS, AGCOM stated that DAZN and network operators had to define and agree (prior to the start of the football season in August 2021) the "operating procedures for distributing traffic within their networks and for managing any malfunctions, using technical solutions based on the so-called CDN "Edge" Content Delivery Network), which make it possible to minimise the delay in the use of the content requested while preserving its quality".<sup>63</sup>

A7.20 In particular, DAZN was required to provide ISPs with a national market share of more than 15% (i.e. Fastweb, Vodafone, WindTre) with storage and transmission equipment to be integrated into their transport networks (so called "DAZN Edge") in sufficient volume and geographic distribution to handle a substantial share of the overall DAZN-originated live streaming data traffic.<sup>64</sup> In addition, the use of multicast (whenever possible) was suggested in order to reduce the probability of network congestion.

A7.21 ISPs were also required to communicate to AGCOM the agreements reached with DAZN relating to the installation of DAZN Edge. AGCOM stated that it would monitor the agreements implemented and assess the impact on competition and on quality of service. AGCOM said that it would intervene with further decisions whenever necessary to protect users and the market.

A7.22 There are further AGCOM measures<sup>65</sup> relating to:

- *Public Interest* – given the popularity of football in Italy, AGCOM intervened on the back of constitutive law 481/95 which allows regulators to adopt binding decisions

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<sup>61</sup> AGCOM, 2021. [Delibera 206-21-CONS - Atto di indirizzo per il corretto dimensionamento e la dislocazione geografica della rete di distribuzione \(CDN\) delle partite di calcio di serie A per le stagioni 2021-2024 in live streaming.](#)

<sup>62</sup> AGCOM Comunicato Stampa, 2021. [Campionata di Serie A su DAZN, consiglio adotta atto di Indirizzo.](#)

<sup>63</sup> Ibid. (English translation by Ofcom).

<sup>64</sup> The number of caching servers required for ISPs with a market share of less than 15% was proportionately less.

<sup>65</sup> AGCOM, [Delibera 334-21-CONS](#) (10 October 2021); [Delibera 17-22-CONS](#) (20 January 2022); [Delibera 232-DDA-22](#) (18 May 2022); [Delibera 250/22/CONS](#) (approved 5 July 2022).

toward providers of services of public interest (e.g. energy, telephony, internet) in order to guarantee a minimum quality of service to customers and dispute resolutions and indemnities.

- *Definition of Quality of Experience parameters for dispute resolution* – this related to customer complaints relating to shortcomings in DAZN customer assistance and also quality of service issues (i.e. general difficulties in accessing the platform and poor picture resolution). For example, AGCOM has subsequently fixed the maximum buffering time when live-streaming matches, stipulated a maximum number of attempts that a customer should be able to access the platform as well as defining a minimum picture quality resolution.
- *Customer assistance* – these measures related to the fact that there was originally no facility for customers to call DAZN by telephone for technical help (i.e. only Chatbot/Live Chat functionality).

A7.23 Lastly, it should be noted that in December 2021, the Italian Government adopted the new Italian Audiovisual Media Services (AVMS) Code, transposing EU Directive No.2018/1808 into Italian law.<sup>66</sup>The Code asks AGCOM to define, for all public interest events (as defined by the Ministry of Economic Development), the necessary quality of service parameters and customer technical assistance procedures. As a result of this, AGCOM is starting proceedings in July 2022 to generalise what was determined for DAZN to other media live streaming providers that also distribute public interest events.

## United States

A7.24 The topic of net neutrality has been a long-running issue in the United States. As it currently stands, there is no net neutrality framework at the federal level in place.

A7.25 A central component of the debate in the United States is less about the principles of net neutrality and more about whether ISPs should be classified under the Communications Act of 1934 as either Title I “information services”<sup>67</sup> or Title II “common carrier” services.<sup>68</sup> A classification under the latter would not only allow the Federal Communications Commission (FCC) to impose net neutrality rules but also give it the ability to regulate ISPs as if they were utilities and subject to price controls.

A7.26 Broadband has traditionally been classified as a Title I information service, and in May 2010, the FCC introduced strong net neutrality protections using Title I’s section 706 of the Telecommunications Act of 1996 that prohibited ISPs from blocking websites or imposing limits on users. This set out three core net neutrality principles that apply to ISPs (i.e. transparency, no blocking, and no unreasonable discrimination) and in effect saw the FCC

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<sup>66</sup> [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.

<sup>67</sup> Per [47 USC § 153\(24\)](#), the term “[information service](#)” means “the offering of a capability for generating, acquiring, storing, transforming, processing, retrieving, utilizing, or making available information via [telecommunications \[...\]](#)”.

<sup>68</sup> Per [47 USC § 153\(11\)](#), the term “common carrier” means “any person engaged as a common carrier for hire, in interstate or foreign communication by wire or radio or interstate or foreign radio transmission of energy [...]”.

adopt its first-ever rules to regulate internet access. However, in January 2014 a Federal Appeals Court struck down the FCC's 2010 rules.<sup>69</sup>

- A7.27 In 2015, through the '2015 Open Internet Order', the FCC decided to reclassify broadband as a common carrier Title II service as opposed to an information service. According to the FCC Chairman at the time, this would ban paid prioritisation, as well as prohibit the blocking and throttling of lawful content and services.<sup>70</sup> A change in the US administration led to the FCC repealing the order in 2017 and the FCC "returning to the traditional light-touch framework that was in place until 2015".<sup>71</sup>
- A7.28 President Joe Biden has encouraged the FCC to "restore net neutrality rules undone by the prior administration".<sup>72</sup> On 28 July 2022, legislation in the form of the 'Net Neutrality and Broadband Justice Act'<sup>73</sup> was introduced by House Democrats that aims to classify broadband as a telecommunications service under Title II. If successful, the legislators believe that this would give the FCC "the appropriate authority to reinstate net neutrality protections".<sup>74</sup> However, while welcoming the proposed legislation, FCC Chairwoman Jessica Rosenworcel stated that she trusted that the FCC already "has the authority it needs to adopt net neutrality rules".<sup>75</sup>

## California

- A7.29 In response to the FCC repealing the '2015 Open Internet Order', a number of states took legislative action to restore net neutrality rules in their jurisdiction. Most notably, California introduced its own net neutrality legislation (known as S.B. 822) in 2018.<sup>76</sup> The decision was challenged (via a lawsuit) by four different ISP trade associations but this was eventually abandoned in May 2022 after a series of adverse court rulings.<sup>77</sup>

## Singapore

- A7.30 Singapore is deemed to have one of the world's most advanced telecoms markets with four main providers for a relatively small market, and high-performing metrics.<sup>78</sup>
- A7.31 Singapore's position on net neutrality is set out in the June 2011 decision document of the Info-Communications Development Authority (IDA).<sup>79</sup> The IDA was superseded by the

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<sup>69</sup> US Court of Appeals for the District of Columbia Circuit, *Verizon vs FCC*, decided 14 January 2014

<sup>70</sup> WIRED, 2015. *FCC Chairman Tom Wheeler: This Is How We Will Ensure Net Neutrality*. [accessed 14 October 2022].

<sup>71</sup> FCC News Release, December 2017. *FCC Takes Action to Restore Internet Freedom*.

<sup>72</sup> The White House, July 2021. *FACT SHEET: Executive Order on Promoting Competition in the American Economy*.

<sup>73</sup> *H.R.8573*: Net Neutrality and Broadband Justice Act of 2022.

<sup>74</sup> Congresswoman Doris Matsui Press Release, July 2022. *Matsui, Markey, and Wyden introduce legislation to reinstate net neutrality, reverse Trump-era deregulation*.

<sup>75</sup> Ibid.

<sup>76</sup> *SB-22 Communications: broadband Internet access service*, date published 1 October 2018

<sup>77</sup> Ars Technica, May 2022. *Stung by 3 court losses, ISPs stop fighting California net neutrality law*. [accessed 14 October 2022].

<sup>78</sup> For example, it is ranked number one for fixed broadband speeds in the Ookla Speedtest Global Index in June 2022 (see: *Speedtest Global Index – Internet Speed around the world*).

<sup>79</sup> IDA Singapore, 2011. *Decision issued by the Info-Communications Development Authority of Singapore, Net Neutrality*.

Infocomm Media Development Authority (IMDA) in 2016, but the current policy approach remains the same.

A7.32 ISPs are allowed to manage internet traffic based on commercial considerations so long as minimum Quality of Service (QoS) standards are fulfilled, legitimate internet content is not blocked, and ISPs continue to comply with IMDA’s competition and interconnection rules.<sup>80</sup>

A7.33 The IDA/IMDA decision document summarises the policy position as follows:

<b>No blocking of legitimate internet content</b>	<ul style="list-style-type: none"> <li>• ISPs and telecom network operators are prohibited from blocking legitimate internet content</li> <li>• ISPs and telecom network operators cannot impose discriminatory practices, restrictions, charges or other measures which, while not outright blocking, will render any legitimate internet content effectively inaccessible or unusable.</li> </ul>
<b>Comply with competition and interconnection rules</b>	<ul style="list-style-type: none"> <li>• ISPs and telecom network operators must comply with IMDA’s competition and interconnection rules in the Telecom Competition Code (TCC).</li> </ul>
<b>Provide information transparency</b>	<ul style="list-style-type: none"> <li>• ISPs and telecom network operators must comply with IMDA’s information transparency requirement and disclose to end-users their network management practices and typical internet broadband download speeds.</li> </ul>
<b>Meet minimum QoS standards</b>	<ul style="list-style-type: none"> <li>• ISPs must meet the minimum broadband QoS standards to ensure a reasonable broadband internet experience for end-users.</li> <li>• Reasonable network management practices are allowed, provided that the minimum internet broadband QoS requirements are adhered to, and that such practices will not render any legitimate internet content effectively inaccessible or unusable.</li> </ul>
<b>Niche or differentiated internet services allowed</b>	<ul style="list-style-type: none"> <li>• ISPs and telecom network operators are allowed to offer niche or differentiated internet service offerings that meet IMDA’s information transparency, minimum QoS and fair competition (including on interconnection) requirements.</li> </ul>

A7.34 The decision document clarifies that ISPs or network operators can offer specialised or customised internet content, applications and services based on commercially negotiated

<sup>80</sup> Minimum quality of service standards can be found at [www.imda.gov.sg/regulations-and-licensing-listing/ict-standards-and-quality-of-service/quality-of-service](http://www.imda.gov.sg/regulations-and-licensing-listing/ict-standards-and-quality-of-service/quality-of-service).

arrangements or specialised terms and conditions. This has allowed telecommunication providers to partner with over-the-top (OTT) service providers to offer add-on services for consumers without any degradation in user experience. As ISPs are allowed to offer specialised or customised plans to differentiate themselves from the competition, telecommunication providers are allowed, for example, to offer zero rating plans.<sup>81</sup>

- A7.35 In addition, ISPs and network operators are also allowed to perform reasonable network management practices provided that IMDA's QoS and information transparency requirements are adhered to.
- A7.36 It should also be noted that ISPs or network operators cannot impose discriminatory practices, restrictions, charges or other measures which, while may not be viewed as outright blocking, will render any legitimate Internet content (for example, a website, application or service) effectively inaccessible or unusable. Complaints on such anti-competitive effects or where consumer interests are harmed are dealt with on a case-by-case basis under IMDA's regulatory framework.

## South Korea

- A7.37 In South Korea, the net neutrality framework consists of both guidelines (in place since 2011 and revised in 2020 to incorporate 5G network slicing) and "criteria for reasonable traffic management and transparency" (in place since 2013). These are administered by the Ministry of Science and ICT (MSIT). It should be noted that several of the provisions in the guidelines mirror those found in the existing UK and EU net neutrality frameworks.
- A7.38 Services provided through the IP network are divided into internet access services and specialised services.
- A7.39 A number of net neutrality principles exist for internet access services. These pertain to end user's rights, a prohibition of blocking, and unreasonable discrimination (e.g. throttling and paid prioritisation).<sup>82</sup> However, the latter two may not apply in cases where there is need for reasonable traffic management (with MSIT stipulating the principles of transparency, proportionality, non-discrimination and technical characteristics as the determining criteria). The criteria for reasonable traffic management and transparency include scenarios where action is required for the purposes of network security and stability and to protect the interests of most users from network congestion due, for example, to temporary network overload.
- A7.40 ISPs are allowed to offer specialised services if a number of defined attributes are satisfied. As in the UK and the EU, specialised services shall not be provided for the purpose of circumventing the basic principle of net neutrality by substituting for internet access services.

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<sup>81</sup> For example, telecommunication providers may offer "unlimited data" for applications like Spotify or WhatsApp.

<sup>82</sup> ISP traffic management for commercial considerations is not explicitly prohibited by the net neutrality guidelines but MSIT has made it clear that traffic management of internet access services like paid prioritisation is a kind of unreasonable discrimination practice.

- A7.41 Zero rating is an example of an acceptable commercial consideration in South Korea, and it is not prohibited as it not deemed to be technical discrimination of traffic. However, regulators are able to intervene if zero rating is suspected to be anti-competitive using a case-by-case approach.
- A7.42 Complementary to the net neutrality guidelines, MSIT conducts QoS evaluations once a year on the wired and wireless internet services of the major telecommunications companies. MSIT has informed us that the evaluation results to date have been found to be satisfactory with respect to overall performance.

### **Netflix and South Korea Broadband dispute**

- A7.43 There is currently a legal dispute in South Korea between Netflix and a local ISP, SK Broadband. In South Korea, privately negotiated bilateral commercial contracts are commonplace between CAPs and ISPs relating to network access. The fees are not regulated (but are typically determined by bandwidth or traffic volume). Different CAPs have different arrangements with ISPs. Netflix claimed that such arrangements violated the principles of net neutrality and that there was no basis for such a network usage fee as was being demanded by SK Broadband.
- A7.44 Due to the popularity of Netflix in South Korea, SK Broadband has claimed that it has been necessary to expand the international leased line between the Netflix server in Japan (which has been the main route for traffic delivery) and SK Broadband's local network in order to accommodate the increase in usage and traffic resulting from customers using Netflix.
- A7.45 SK Broadband requested Netflix to bear the cost of the international leased line service that was built exclusively to serve Netflix traffic. SK Broadband's argument was that since Netflix was using SK Broadband's resources to connect to its network, Netflix was obligated to pay for it. In response, Netflix proposed that SK Broadband install a cache server known as Open Connect Alliance (OCA) that would reduce the amount of traffic that SK Broadband would have to carry over its leased international submarine cables. However, this proposal was rejected by SK Broadband.
- A7.46 SK Broadband requested negotiation arbitration to the Korea Communications Commission (KCC) in November 2019 with respect to its network use contract discussions with Netflix.<sup>83</sup> In response, Netflix filed a lawsuit against SK Broadband in April 2020 stating that it had no obligation to pay for network use as this violated net neutrality principles, and that peering beneficial to both parties should not entail network usage fees. However, according to South Korean commentary on the guidelines on net neutrality because SK Broadband was

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<sup>83</sup> It is our understanding that in this case KCC was focused on whether any anti-competitive issues had arisen during the negotiation process between SK Broadband and Netflix. If such issues were found, then KCC would have the authority to recommend a remedy to correct the issue.



not blocking or unreasonably discriminating against Netflix's service traffic, then it was not violating the net neutrality guidelines.<sup>84</sup>

- A7.47 Netflix's case against paying network usage fees was dismissed in a District Court judgement in June 2021. The Court found that because Netflix's traffic was carried on a separate international submarine line, there was economic value for the connection and so Netflix had an obligation to bear the cost of using the network, stating that "it needs to be determined by negotiations between the parties involved whether or not some fees will be paid".<sup>85</sup> The Court found that there was no relationship between the paid for transport and net neutrality.
- A7.48 A second trial is currently in progress at the Seoul High Court.

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<sup>84</sup> MSIT and Korea Information Society Development Institute (KISDI), December 2021. [\*Understanding Net Neutrality Policy \(Commentary on the "Guidelines on Net Neutrality and Internet Traffic Management"\)\*](#) (망 중립성 정책의 이해), pp.39-40.

<sup>85</sup> Tech Crunch, June 2021. [\*Korean court sides against Netflix, opening door for streaming bandwidth fees from ISPs.\*](#) [accessed 14 October 2022].

## A8. Data traffic and costs

A8.1 In this annex, we look at recent trends in traffic volumes and peaks, as well as evidence on network costs. This provides background to our review. In particular, it informs our assessment in Sections 6 and 7 of the impact, if any, that restrictions due to the net neutrality rules may have on how ISPs manage traffic and invest in capacity efficiently.

### Data gathering

A8.2 We issued formal information requests to the largest fixed and mobile ISPs in the UK, a broad range of CAPs, as well as a small number of CDN providers.<sup>86</sup>

A8.3 We requested information on the volumes and throughput of UK data traffic, how this traffic is distributed, managed and monitored by ISPs, CAPs and CDNs and the costs involved in these activities.

A8.4 For ISPs, we asked for data broken down by different parts of their network (i.e. backhaul, core, etc.). We use core data below, except where indicated.

A8.5 We have used the responses to our requests to inform the analysis below and in other sections in this document. We have also used other Ofcom research to inform our thinking, such as the Communications Market Report.<sup>87</sup>

### Traffic volumes

#### Overall traffic volumes are expected to continue to increase significantly

A8.6 Data traffic volumes across fixed and mobile ISPs continue to increase significantly each year. Trends in our Communications Market Report suggest the average year on year growth of data used over the period 2013 to 2021 was 42% for the average fixed broadband customer, and 37% for the average mobile data customer.<sup>88</sup>

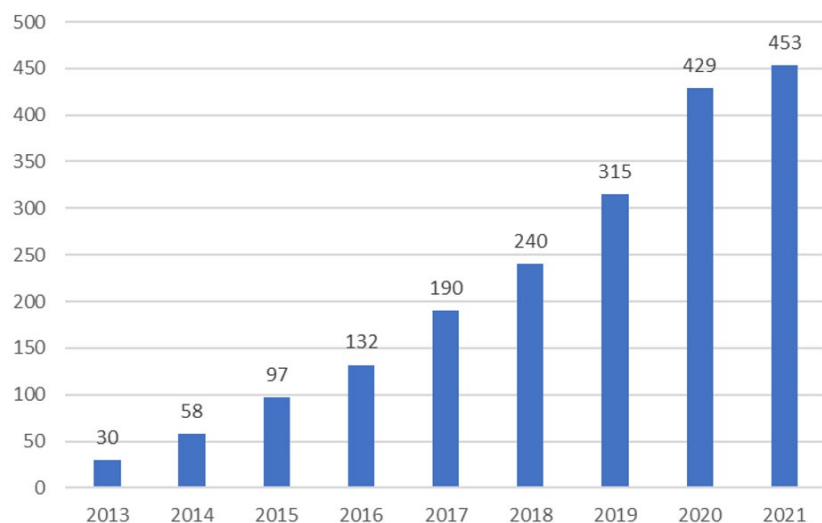
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<sup>86</sup> We asked for data from fixed and mobile ISPs (BT Group, TalkTalk, Sky, VMO2, Vodafone, and Three), CAPs (Netflix, Amazon (UK), BBC, ITV, Meta, Microsoft, Google) and third party CDN providers (Amazon Web Services, Akamai).

<sup>87</sup> Ofcom, 2022. [Communications Market Report](#).

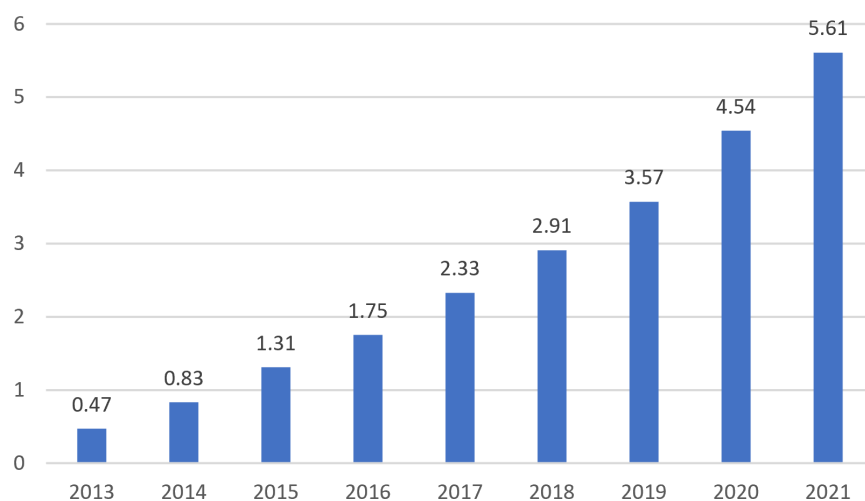
<sup>88</sup> We set out in more detail our expectations for future mobile demand in a discussion paper published earlier this year. A medium growth scenario assumes a continuation of recent historical growth with 40% year on year growth for mobile data to 2035. Ofcom, 2022. [Mobile networks and spectrum: Meeting future demand for mobile data](#).

**Figure A8.1: Average fixed broadband data use per month per subscription (GB)**



Source: *Communications Market Report*<sup>89</sup>

**Figure A8.2: Average mobile data use per month per subscription (GB)**



Source: *Communications Market Report*<sup>90</sup>

**A8.7** Both fixed and mobile ISPs suggested that traffic will continue to grow in future. Many ISPs expected subscriptions would increase,<sup>91</sup> as would average data use per subscriber, identifying an increase in the streaming of popular sports as a key driver of this. Some fixed ISPs identified other factors, including seasonal trends, migration of television from digital

<sup>89</sup> Ofcom, 2022. *Communications Market Report*, Interactive Data.

<sup>90</sup> Ofcom, 2022. *Communications Market Report*, Interactive Data.

<sup>91</sup> We note, most fixed ISPs expected a modest increase in subscribers from April 2022-23 with an average increase of around 2%. Many mobile ISPs also had modest expectations, for example [3<]. We note there were larger expected changes for [3<].

terrestrial television (DTT) to IP delivery, increase in the number of connected devices, and the emergence of the Metaverse(s).

- A8.8 Although growth rates are significant, they have been fairly consistent over the last ten years. We note that future demand projections are inherently uncertain and future trends could have a significant impact on demand. In particular, the migration of TV from DTT to IP delivery is currently uncertain in terms of timescales and how this traffic will be delivered, as is growth of the metaverse. However, we currently do not see any strong reasons to expect that growth rates will increase in the period up to 2030, compared to growth rates over the last decade.

## The majority of busy hour traffic relates to five large CAPs and two CDNs

- A8.9 The data indicates that a large portion of busy hour<sup>92</sup> traffic (in the region of 50%) on fixed networks relates to traffic from five large CAPs, specifically, Amazon, Facebook, Google, Netflix and Sky.<sup>93</sup>
- A8.10 In addition, two CDNs,<sup>94</sup> Akamai and Limelight, also contribute a material proportion<sup>95</sup> of traffic throughput in the busy hour. The ISP cannot identify which CAP generates this traffic. This means that some CAPs who use these (and other third party) CDNs as their main means to distribute traffic will not be identified as large providers. [§<]. Moreover, those same CDNs may well be carrying additional traffic from the five CAPs identified above, as many large CAPs use third party CDNs to distribute some of their traffic.

## Traffic patterns

### Traffic demand tends to peak daily in the evening and annually in December

- A8.11 Understanding the pattern and variation of traffic through the day and across the year is important for traffic management and network planning purposes.
- A8.12 Traffic demand tends to peak daily in the evening (around 8pm) when residential consumers have more time to access and use popular services and the traffic in this busy hour has also grown.
- A8.13 Figure A8.3 illustrates a typical seasonality profile of traffic data in the backhaul network for two fixed ISPs.<sup>96</sup> We estimated the profile shown in the graph by firstly determining the ratio of traffic in a month over the average monthly traffic for that year, and secondly, estimating an average ratio over the three years 2019-2021. The annual traffic growth

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<sup>92</sup> The busy hour was defined as “the busiest 60 minute period of the day on average during the month”. We sought this information for ISPs backhaul, core and IP interconnect domains.

<sup>93</sup> We note there were limitations to the data received. A number of the [§<].

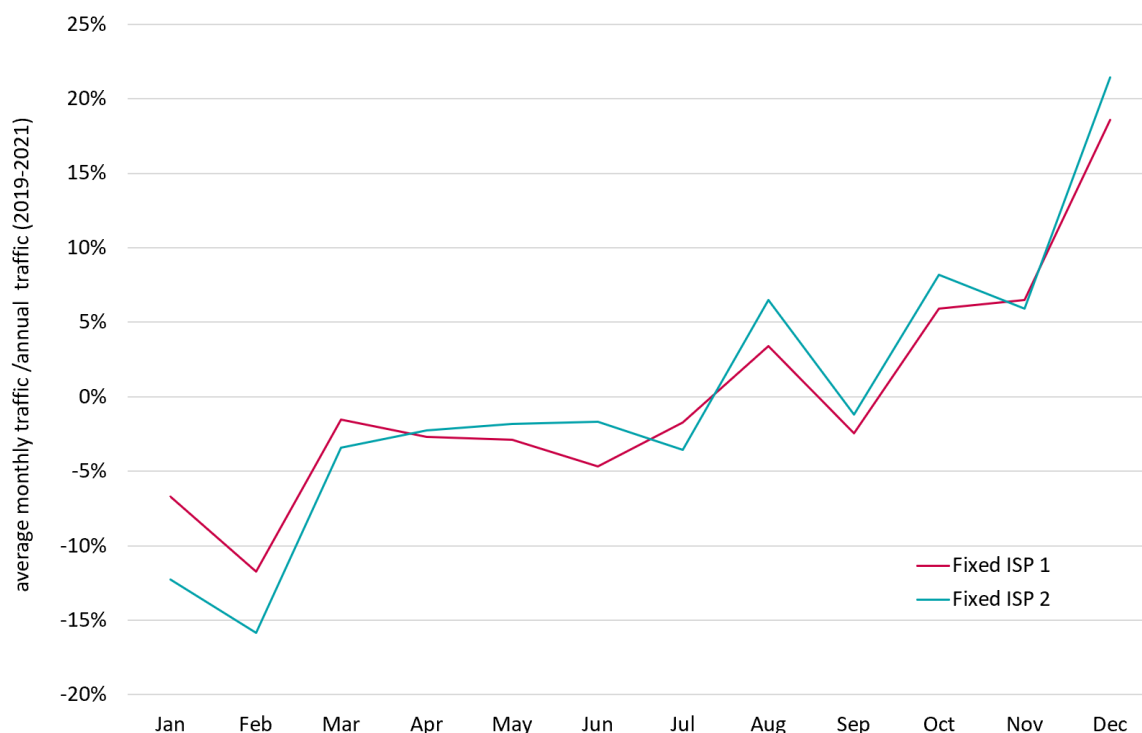
<sup>94</sup> We note that ISPs [§<]. Therefore, a significant portion of Amazon traffic will also be attributable to its own CDN, which will be carrying both Amazon and other CAPs traffic.

<sup>95</sup> The two CDNs contribute in the region of [§<]%, 13-25% of traffic together.

<sup>96</sup> For mobile ISPs, seasonal traffic profile is similar to that shown in Figure A8.3 for fixed but with occasional peaks spread throughout other times of the year as well.

rates outlined above of ~30% p.a. mean that traffic is increasing significantly through the year and so demand in December tends to have the highest monthly traffic.<sup>97</sup>

**Figure A8.3: Average seasonal traffic profile across the years 2019-2021 for two fixed ISPs [redacted]**



Source: Ofcom analysis from RFI data<sup>98</sup>

## Traffic peaks

A8.14 We asked ISPs to identify the top ten traffic peaks in each of the last three years on their networks.<sup>99</sup> There were some limitations to the data that we received.<sup>100</sup>

A8.15 In some cases, ISPs were able to identify specific events that coincided with the top peaks on their networks.<sup>101</sup> Where events and the associated CAP could be identified<sup>102</sup> (which was for 94 peaks out of the 250 peaks reported), the livestreaming of football was a big

<sup>97</sup> We note traffic was high in January 2021 due to strict lockdown conditions.

<sup>98</sup> [redacted], and [redacted].

<sup>99</sup> In our RFI, we asked the ISPs to provide, for each year of January 2019-January 2022, the top ten highest traffic peaks. We asked for the date, time and traffic throughput of the peak. These top 10 peaks for each ISP are used in the analysis above.

<sup>100</sup> Some ISPs were unable to identify traffic peaks in the backhaul domain [redacted], one was only able to identify some of the peaks [redacted], and others were not able to identify the service driving the peaks – [redacted]. Also, there were some ISPs that could sometimes identify the service driving the peak, but not in each instance [redacted]. Therefore, we have focused on data from the core domain, which is more complete.

<sup>101</sup> While there will be many different sources of traffic on the network, these events tend to generate the significant volumes of traffic that lead to top peaks.

<sup>102</sup> ISPs were better able to identify the events when reporting traffic on their core networks, and less able in relation to backhaul networks.

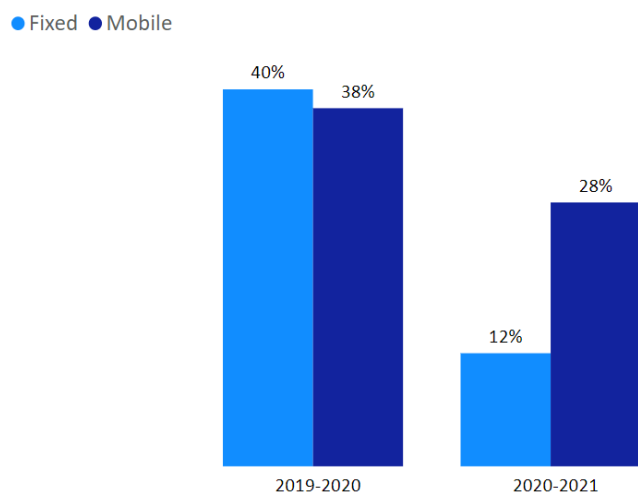
driver (82 peaks).<sup>103</sup> Peaks were less frequently due to gaming downloads (such as launches of a popular game title<sup>104</sup>) and peaks were only very rarely caused by a gaming download on its own.<sup>105</sup> We note that 13 of the 23 peaks that were associated with gaming downloads or launches, occurred in conjunction with another event such as livestreaming football or other games downloads/launches.

A8.16 Some events (or types of events) led to peaks across most or all ISPs. Traffic from Amazon was identified as the single largest driver of traffic peaks, causing 66 out of the 94 top peaks identified (70%). Out of these 66 peaks, Amazon traffic was solely identified for 61 with Amazon and gaming related traffic coinciding for the other five.

A8.17 However, some events only impacted a single ISP. For example, BT Sport was associated with 7 peaks on BT’s network, but none on others.<sup>106</sup>

A8.18 Responses indicated that the magnitude of top peaks in fixed and mobile core networks have continued to grow over the last two years. For fixed networks, the average increase was 40% from 2019-20 and 12% from 2020-21. For mobile networks, the average increase was 38% from 2019-20 and 28% from 2020-21.<sup>107</sup>

**Figure A8.4: Growth in the magnitude of top peaks**



Source: Ofcom analysis based on RFI data

<sup>103</sup> An additional 17 of the 250 peaks were identified as football related but the specific CAP showing the football was not identified.

<sup>104</sup> These launches or updates came from a range of gaming titles including, Call of Duty, Apex Legends, Red Dead Redemption 2 and Fortnite.

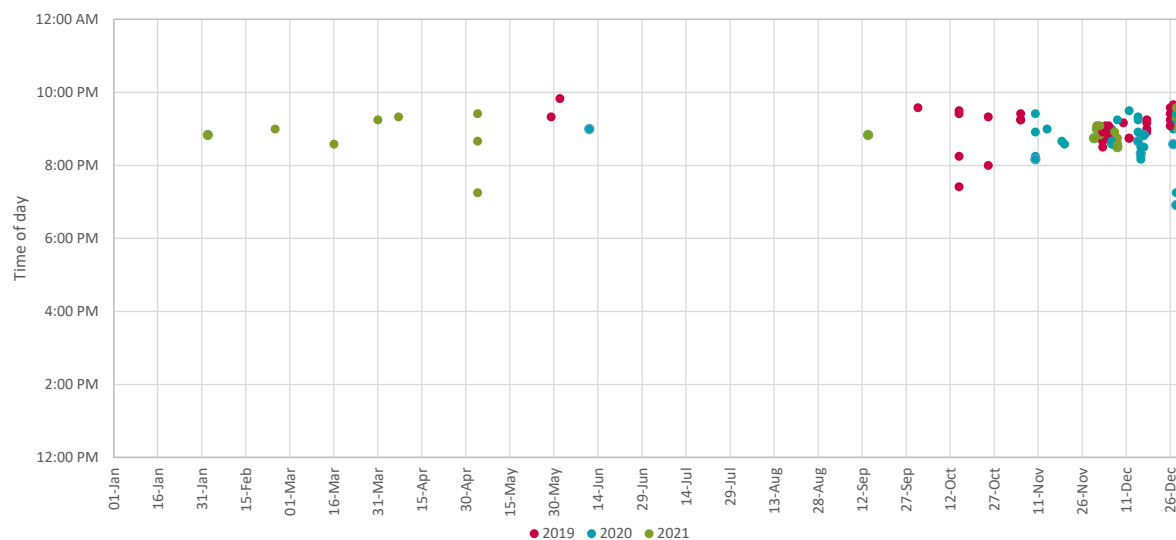
<sup>105</sup> We note that we have not seen evidence to suggest gaming peaks have become more or less frequent over the three-year period. In addition, the data indicates that top peaks which have gaming downloads as a reported driver are less frequent for mobile than fixed ISPs.

<sup>106</sup> We note that access to BT Sport via ISPs other than BT is limited.

<sup>107</sup> We note that [§<].

- A8.19 These top peaks were most likely to occur in the evening, with 97% of fixed and 74% of mobile peaks occurring between 8-10pm. However, there was a wider distribution of peaks for mobile, with a larger portion occurring earlier in the day.<sup>108</sup>
- A8.20 They were also more likely to occur towards the end of the year. For fixed, 90% of peaks occurred between October and December, with 74% of the peaks occurring in December. For mobile, 75% of peaks occurred in the last few months of the year, with 44% occurring in December.
- A8.21 Figures A8.5 and A8.6 below show the distribution of peaks by time of day and when they occurred during the year for fixed and mobile ISPs.

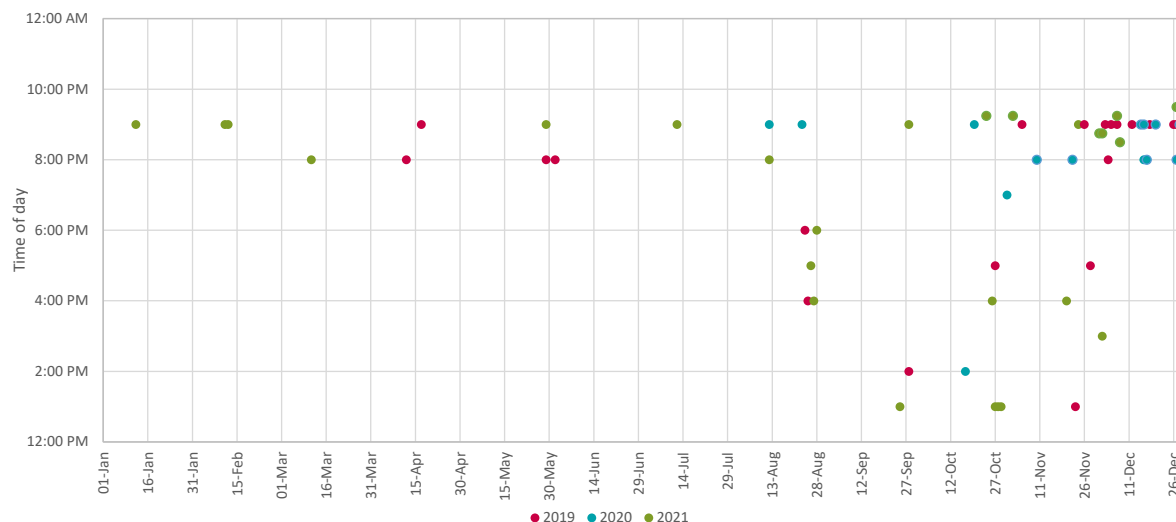
**Figure A8.5: Timing of Top 10 peaks by year – Fixed ISPs**



Source: Ofcom analysis based on RFI

<sup>108</sup> For example, 7% of mobile peaks occurred between 1-2pm, and 6% of mobile peaks occurred between 4-5pm.

Figure A8.6: Timing of Top 10 peaks by year – Mobile ISPs<sup>109</sup>



Source: Ofcom analysis based on RFI

- A8.22 When considering future capacity requirements, ISPs need to consider not only average busy hour traffic but also the scale of peaks above this. The higher these peaks, the more capacity ISPs may need to build for very occasional use.<sup>110</sup>
- A8.23 We have examined the ratio of peak demand in a year over the average busy hour throughput, to examine the extent to which the traffic is becoming peakier. The data available to us indicates that the ratio of peak to average busy traffic has not been increasing (and if anything may have slightly reduced).<sup>111</sup>
- A8.24 This indicates that while top traffic peaks are getting larger in overall terms as reported above, they have been growing at the same, or slightly lower rate than average busy hour throughput. Decreasing peaks relative to the busy hour reduces the additional capacity ISPs would need to build that would be used only very occasionally.

## Network capacity and the impact of traffic peaks on networks

**In general, networks have been built to handle peaks so there has been only limited impact on quality of service**

- A8.25 Networks have been built to carry peak traffic. ISPs in general forecast this peak based on the traffic throughput experienced in the busy hour (i.e. evenings, as shown above) and project forwards. They may also include adjustments for expected events that could alter these volumes (such as forecasted growth in IP delivery of TV content). The ISP will build

<sup>109</sup> Note that data from some Mobile ISPs peaks was not always provided at a sufficiently granular level to be included in this chart. No peaks occurred outside the time periods shown in this graph.

<sup>110</sup> It is also likely that it is more difficult to forecast these peaks which occur relatively infrequently.

<sup>111</sup> We concluded this by comparing ISP throughput data for peaks against the busy hour in the month, where available. We requested the relevant data from a number of ISPs, but not all ISPs were able to provide data or provide it in a comparable way.



the network to provide capacity to meet this peak, usually allowing for some additional capacity for exceptional peaks, with the objective that, at the busiest times on the network, adverse impacts on network performance (such as congestion, higher latency, jitter or packet loss) are not material.<sup>112</sup> Where the network does suffer material impacts, which may be most likely during exceptional traffic peaks above the level normally experienced in the busy hour, consumers may be affected by issues such as videos buffering, gameplay becoming disrupted, data taking a long time to connect, or being unable to connect to the network at all.

- A8.26 Based on data submitted by both fixed and mobile ISPs, we found very few instances where traffic peaks had been close to full utilisation of network capacity.<sup>113</sup>
- A8.27 Some ISPs noted that the top peaks had not resulted in any impact on performance, due to how they dimension their networks. [X]<sup>114</sup> noted that network capacity is managed with the aim of mitigating any congestion in advance via upgrades and traffic management and [X]<sup>115</sup> noted that it has been able to manage peaks by dimensioning the network to be much greater than required for average traffic delivered in the busy hour. It added that the peaks do have an impact on network resilience, which puts the network at risk of not being able to maintain full load.
- A8.28 Other ISPs noted that they did not record, track or monitor the impact of traffic peaks on their networks and/or had no evidence of these events affecting their network.<sup>116</sup>
- A8.29 Finally, some ISPs did measure aspects of how the peaks affected their networks. Some of those ISPs observed slight increases in latency, jitter, and downstream congestion, while others had to carry traffic on infrastructure normally used to provide resilience. This would mean packet loss would be likely to occur if the peak coincided with a failure in part of their network. One ISP [X]<sup>117</sup> observed slight increases in latency, jitter and congestion during some of the top ten peaks on its network. Another ISP, [X]<sup>118</sup> explained that it did not capture the effects on latency and jitter, but it did measure the proportion of traffic carried on infrastructure suffering packet loss and the proportion of traffic carried on non-resilient infrastructure (i.e. would suffer traffic loss at peak under failure). This data indicates that the impact of peaks did not change significantly over the period 2019 to 2021.

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<sup>112</sup> Latency is a measure of how long the content takes to be delivered from the server to the end-user's device. Jitter is a measure of the variation in latency. Increased latency or jitter can make services slow to load or to be inconsistent in performance, and could be particularly disruptive to delay sensitive content such as online gaming. Packet loss means some data does not get passed through the network. This could cause voice or video calls to be broken up. It can also result in the calls "freezing up" making the service un-useable.

<sup>113</sup> As a proxy, we looked at where the peaks reached over 95% of the networks built capacity. The built capacity was an estimate provided by each ISP of the peak throughput in bits per second their network was built to carry. We found that over the 37 month period, there were only a small number of instances where ISPs reached this level. For example, [X].

<sup>114</sup> [X].

<sup>115</sup> [X].

<sup>116</sup> For instance [X].

<sup>117</sup> [X].

<sup>118</sup> [X].

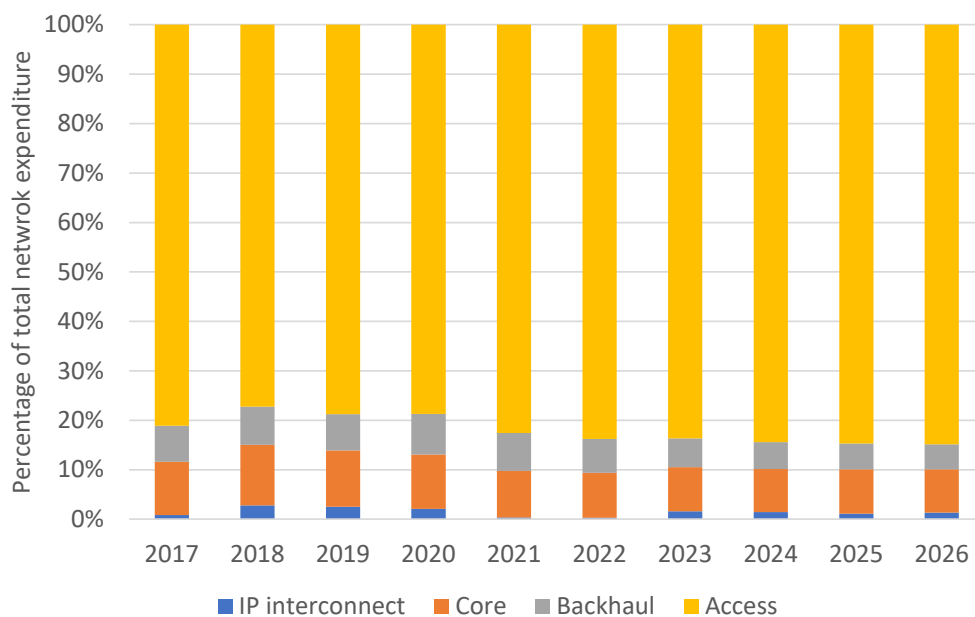
## Network costs

### To date, traffic growth has been met with investment in networks

#### Fixed ISPs

- A8.30 Retail ISPs incur a number of costs to support their business including investment in network infrastructure.<sup>119</sup> Some of the investment in network infrastructure will be sensitive to traffic volume (noting that the ISP will need to build based on forecasts of peak traffic volumes).
- A8.31 For a fixed network, the main costs affected by the volume of data traffic are generally in the core and backhaul network. Investment in the additional capacity in these network domains is driven by the need to dimension that capacity to meet the peak demand for any particular year. Figure A8.7 shows that these costs typically make up about 20% of total network costs.<sup>120</sup>
- A8.32 The majority of the network costs relate to the access network. These costs are generally invariant to traffic, being driven more by the number of customers that can be connected to the network and the technology used.

**Figure A8.7: Percentage of network costs for each layer of a typical fixed network**



Source: Ofcom analysis based on RFI<sup>121</sup>

- A8.33 Total network costs only make up part of a domestic consumer's retail bill. The price will also need to cover retail costs not related to network infrastructure (e.g. customer

<sup>119</sup> Other costs would include the costs of customer services (such as call centres), marketing and customer acquisition, and general business expenses.

<sup>120</sup> IP interconnect costs can also be affected by peak demand, but are a very small percentage of costs.

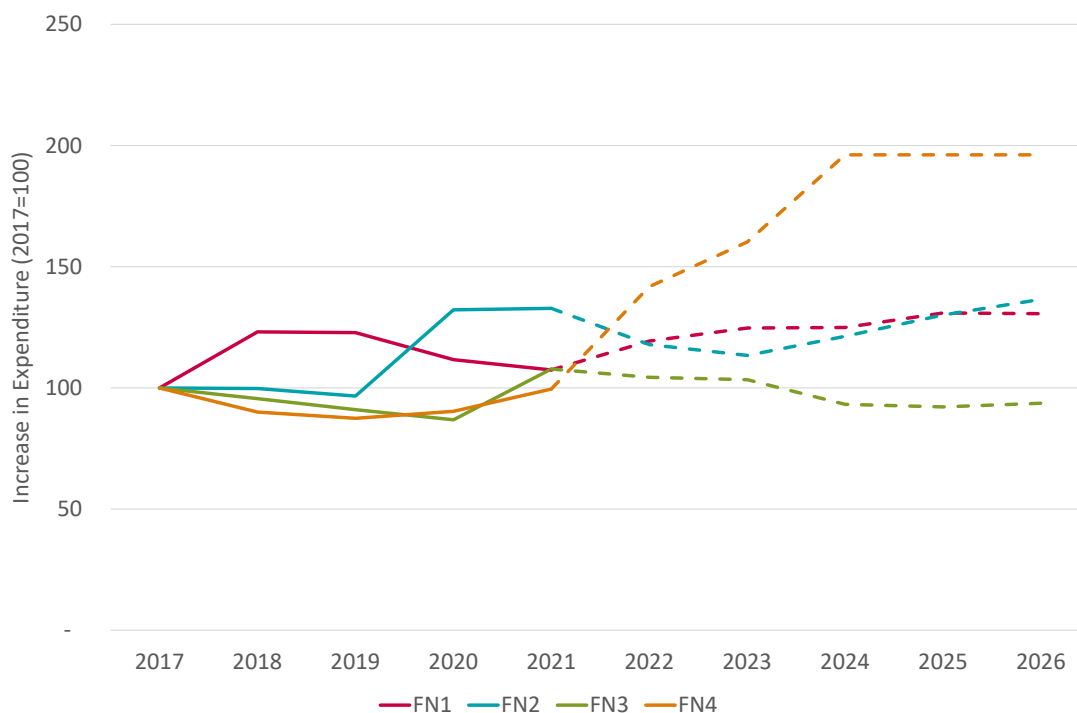
<sup>121</sup> [3].

support). We have estimated the backhaul and core network costs to be approximately £60 a year<sup>122</sup>, which is likely to be approximately 10-15% of a domestic consumer’s retail bill.<sup>123</sup> However, only some of the backhaul and core network costs vary specifically in relation to the level of traffic at peak times. The information we have suggests that 50-75% of these costs are likely to vary with the level of traffic at peak times.<sup>124</sup>

A8.34 Fixed core and backhaul network expenditure has been broadly consistent over time. The average expenditure over the period 2017-2021 for the five largest ISPs was approximately £[redacted]m per year per ISP.<sup>125</sup> A relatively consistent level of expenditure has been achieved despite the high year on year growth in traffic volumes outlined above. This implies significant levels of unit cost decreases in network capacity investments.<sup>126</sup>

A8.35 Figure A8.8 shows that most fixed ISPs are forecasting for expenditure to continue at a broadly similar level, with one ISP expecting a step change in expenditure.

**Figure A8.8: Change in nominal expenditure levels (capex and opex) for 4 major fixed ISPs since 2017**



Source: Ofcom analysis based on RFI<sup>127</sup>

<sup>122</sup> This estimate is calculated by looking at historical and forecast opex and capex provided by suppliers across the backhaul and core network over 10 years (2017-2026). This has then been divided by the number of current subscribers.

<sup>123</sup> Estimated using Fixed ISP revenue data from Ofcom’s Communications Market Report 2022.

<sup>124</sup> We have estimated this using data from [redacted], and [Estimating OTT traffic-related costs on European telecommunications networks, a report by Frontier for Deutsche Telekom, Orange, Telefonica and Vodafone.](#)

<sup>125</sup> This is both capex and opex and covers [redacted].

<sup>126</sup> Unit costs here refer to costs of equipment per unit of traffic.

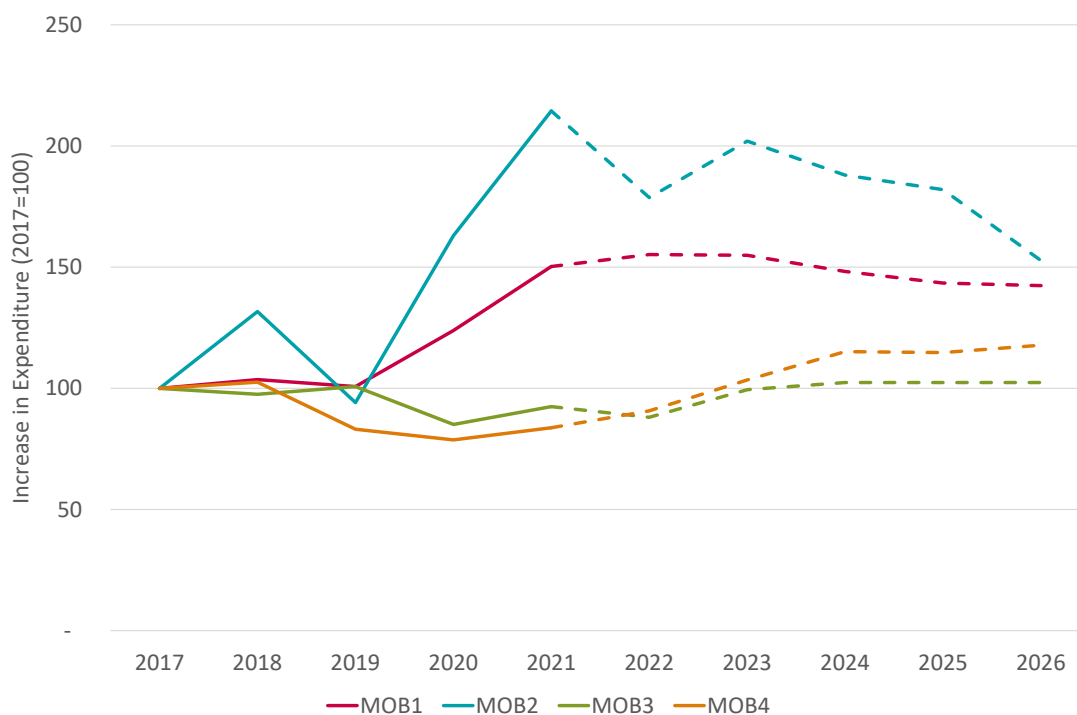
<sup>127</sup> Note that one ISP is missing from this chart compared to the historical data as they were not able to provide a full forecast over the time period. Data from [redacted]

### Mobile ISPs

A8.36 For mobile networks, most of the network costs are affected by an ISP’s data traffic, including the access network, rather than varying in relation to the number of subscribers.<sup>128</sup> The total network costs of the mobile ISPs per subscriber are around ~£40 a year on average.<sup>129</sup> The information we have suggests that, similar to fixed ISPs, about 50-75% of these costs are likely to vary with the level of traffic at peak times.<sup>130</sup>

A8.37 MNOs’ network cost trends appear relatively consistent across the MNOs. This trend is slightly different compared to fixed networks. There appears to be a decrease in forecast capex and an increase in opex over the next 5 years. Overall forecast expenditure appears to be broadly stable over the period with average expenditure per mobile network per year at around £[redacted]m over the period 2021 to 2026.<sup>131</sup>

**Figure A8.9: Change in nominal expenditure levels (capex and opex) for 4 major mobile networks since 2017**



Source: Ofcom analysis based on RFI<sup>132</sup>

<sup>128</sup> This approach is consistent with the approach taken in *Estimating OTT traffic-related costs on European telecommunications networks, a report by Frontier for Deutsche Telekom, Orange, Telefonica and Vodafone*.

<sup>129</sup> This estimate is calculated by looking at historical and forecast opex and capex provided by suppliers across their mobile network over 10 years (2017-2026). This has then been divided by the number of current subscribers.

<sup>130</sup> We have estimated this using data from [redacted] and *Estimating OTT traffic-related costs on European telecommunications networks, a report by Frontier for Deutsche Telekom, Orange, Telefonica and Vodafone*.

<sup>131</sup> Average expenditure here is given in nominal terms.

<sup>132</sup> RFI data from [redacted].

## Investment in and use of CDNs and caching helps meet the demand on networks

A8.38 Larger CAPs have also been making investments to help deliver traffic more efficiently to ensure a good quality experience for users. For example, by avoiding using parts of the core and IP interconnect network, they can lower the network cost to the ISP of delivering data traffic.<sup>133</sup>

A8.39 Information from CAPs shows a diverse approach to investment in traffic delivery technologies, with the main areas of expenditure in caches hosted in the ISP network, caches hosted in shared data centres, and payments to third party CDNs to host and deliver traffic.<sup>134</sup>

A8.40 UK based investments made by each large CAP can vary significantly but they tend to have an order of magnitude of about £[redacted]m to [redacted]m per year.<sup>135</sup>

**Figure A8.10: Spending by CAPs on UK traffic delivery methods in 2021**<sup>136</sup>

[redacted]

Source: Ofcom analysis based on RFI<sup>137</sup>

A8.41 Some CAPs have also suggested that they made significant investments in codec and adaptive bit rate technology, that enables traffic to be delivered more efficiently.<sup>138</sup>

A8.42 For example, Netflix suggested that between 2015 and 2020, Netflix investment in codec technology has halved the amount of bits needed to carry a film or series of the same video quality.<sup>139</sup>

A8.43 Some CAPs also noted that they make significant investment in research and development globally to improve technology related to content delivery networks. For example:

- [redacted]:
  - [redacted].<sup>140</sup>
  - [redacted].<sup>141</sup>

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<sup>133</sup> For example a [BT report from 2018](#) outlined how “Caching content deeper in the network offloads c 60% of core capacity”.

<sup>134</sup> See, Section 3, paragraphs 3.18-3.21.

<sup>135</sup> [redacted].

<sup>136</sup> Note that this graph only includes direct infrastructure expenditure related to delivery of content in UK networks. I.e., it does not include research and development costs of ABR technology or infrastructure operations.

<sup>137</sup> [redacted].

<sup>138</sup> BBC response to the 2021 Call for Inputs, paragraph 17; ITV Response to the 2021 Call for Evidence, pages 2 and 3. Meetings with [redacted].

<sup>139</sup> Netflix response dated 15 May April 2022 to the RFI dated 17 March 2022, page 5.

<sup>140</sup> [redacted].

<sup>141</sup> [redacted].

- [3<].<sup>142</sup>

- A8.44 Several CAPs appear to be increasing investments in their own network infrastructure more generally to improve the quality of their content to the end user. For example, Microsoft, Meta and Google are investing in subsea cables to allow them to deliver content closer to the end user on their own networks rather than via other providers' networks.<sup>143</sup>
- A8.45 The use of CDNs (either owned by CAPs or 3<sup>rd</sup> parties) can also provide some incentive to a CAP to manage traffic flows efficiently. CAPs may wish to reduce traffic at peak times to limit the required investment in CDN infrastructure or avoid peak-based charging from 3<sup>rd</sup> party CDNs.<sup>144</sup>
- A8.46 The extent to which CAPs use transit, peering (both public and private), caching, and multicast<sup>145</sup>, may also have an impact on CAP and ISP costs. Based on data from the main ISPs and largest CAPs, over the period 2019-21, on-net caching and private peering were used for the distribution of most traffic and transit and public peering volumes are relatively small. The percentage of traffic delivered by each method has been relatively consistent over that time.
- A8.47 The data suggests that on average for the major ISPs, just over 50% of all traffic is delivered via on-net caches, just under 40% via private peering, about 4% via public peering and about 7% via IP transit.<sup>146</sup> Traffic delivered via caches in data centres is likely to make up most of the traffic delivered via private peering.

### **Large ISPs, CDNs and CAPs appear to coordinate network planning and the upcoming peaks in demand**

- A8.48 The data suggests that the majority of top traffic peaks on the network have been driven either by a live sporting event or a major gaming update. In relation to both of these categories of peaks, CAPs have suggested they have worked with ISPs to manage expected demand peaks, and have made decisions to shift traffic out of busy periods of ISP networks. CAPs have noted they have:
- Prepared briefings for ISPs to help plan live sporting events. These preparations include more detailed demand forecasts, operational support during the event, test events and a breakdown of all CDN delivery partners.<sup>147</sup>

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<sup>142</sup> [3<].

<sup>143</sup> See for example: <https://news.microsoft.com/features/microsoft-facebook-telxius-complete-highest-capacity-subsea-cable-cross-atlantic/> and <https://cloud.google.com/blog/products/infrastructure/learn-about-googles-subsea-cables>.

<sup>144</sup> For example, the BBC CFI response para 11 notes that "CAPs currently incur material distribution costs, e.g. through peering, transit and/or CDN charges. These are all elements of the value chain which CAPs control. These costs incentivise CAPs to distribute their content as efficiently as possible and allow them to make best value decisions in these areas."

<sup>145</sup> We note that we received little insight into the use of multicast, as most ISPs do not use it and BT Group was not able to provide the data as requested.

<sup>146</sup> RFI data from fixed and mobile ISPs.

<sup>147</sup> For example, [3<].

- Released video game content at off peak times to try and minimise the impact of downloads on ISP networks.<sup>148, 149</sup>

A8.49 A number of other CAPs and a CDN we spoke to suggested they regularly work with ISPs for network planning purposes.<sup>150</sup>

## Traffic demand could become 'peakier' in the future

A8.50 While ISPs have generally coped well with peak demands to date, there are potential reasons why the 'peakiness' of demand may start increasing in future years. In particular, a move to IP distribution for broadcast TV over the coming years could potentially lead to higher peaks relative to average traffic demand. Increases in live sporting events delivered over IP could cause significant peaks on ISPs networks. [redacted].<sup>151</sup> Also set out in Section 3, new services may also begin to emerge that require additional capacity (and in some cases may have other specific quality of service requirements) leading to greater demands on networks, and a wider variety of demands from consumers of their internet services. It is possible that the usage patterns of these services could further compound the 'peakiness' of traffic.

## Encrypted, VPN or otherwise unrecognisable traffic

A8.51 Traffic that is encrypted, carried by a VPN or otherwise unrecognisable is likely to be more difficult for ISPs to identify and as such could have a bigger impact when considering how the net neutrality rules may affect their ability to manage traffic on their networks.

A8.52 The majority of respondents were unable to provide information about the volume of such data carried by their networks. Some ISPs did not monitor or store this information. Others noted that they were unable to identify this traffic. [redacted]<sup>152</sup>, [redacted]<sup>153</sup>, [redacted]<sup>154</sup>, [redacted]<sup>155</sup>, and [redacted].<sup>156</sup>

A8.53 A small number of respondents were able to provide estimates or more accurate figures of this traffic [redacted]<sup>157</sup> and [redacted].<sup>158</sup> While the data is limited, we think it is reasonable that for at least some networks the share of unrecognizable traffic could be material.

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<sup>148</sup> For example, [redacted].

<sup>149</sup> Even though game releases may be released at off-peak times, they can contribute to peak demand as downloads can often be started at any time by the user and potentially can take several hours depending on the speed of the connection.

<sup>150</sup> Meetings with [redacted].

<sup>151</sup> BT Group response to the 2021 Call for Evidence, page 4.

<sup>152</sup> [redacted].

<sup>153</sup> [redacted].

<sup>154</sup> [redacted].

<sup>155</sup> [redacted].

<sup>156</sup> [redacted].

<sup>157</sup> [redacted].

<sup>158</sup> [redacted].

## Specialised services

- A8.54 We also sought to understand the volume of traffic delivered by specialised services<sup>159</sup>, as it is informative to understand the current materiality of these volumes.
- A8.55 A small number of ISPs were able to provide estimates or figures of their specialised service traffic. The estimates that we received suggest that specialised service traffic is in most cases<sup>160</sup> a very small proportion of overall traffic volumes. [X].<sup>161</sup>
- A8.56 Some ISPs were unable to provide this information. [X],<sup>162</sup> [X]<sup>163</sup> and [X].<sup>164</sup> Others ([X])<sup>165</sup> commented that they did not provide specialised services, and therefore couldn't provide any traffic data.

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<sup>159</sup> See Section 2 for a description of specialised services.

<sup>160</sup> One area where we were not able to obtain information was BT's multicast volumes. It is reasonable to assume these volumes could be more material.

<sup>161</sup> [X].

<sup>162</sup> [X].

<sup>163</sup> [X].

<sup>164</sup> [X].

<sup>165</sup> [X].



## A9. Consumer outcomes

### Context

A9.1 In this annex, we present data on consumer outcomes, looking at how they use the internet, their views on internet usage, and their experience, including the internet access services they use and the prices they pay for them.

### Research

A9.2 To inform our views, in late 2021/early 2022 we conducted qualitative research among residential and small and medium enterprise (SME) users of the internet to explore their experiences of using the internet and attitudes towards the principles of net neutrality.<sup>166</sup> We also conducted quantitative research among UK SMEs<sup>167</sup> that included some questions around net neutrality as well as experience of using the internet.<sup>168</sup> These pieces of research are referred to in the following paragraphs as ‘qualitative research’<sup>169</sup> and ‘SME quantitative research’.

### Consumer behaviour and views

A9.3 We set out below our findings on the importance of broadband to residential and SME users, and how satisfied consumers are generally with their broadband services.

#### Small and medium enterprises (SME) findings

A9.4 The SME quantitative research shows how SMEs are reliant on the internet. Of the SMEs in the research, 94% of them said they had a form of internet connectivity, and the majority (70%) used a fixed-line broadband service and 23% accessed the internet via a mobile network. Half who used a mobile network and approaching two-thirds (62%) who used a fixed network said that service (respectively) is “absolutely vital”.<sup>170</sup> Around two fifths (39%) of SMEs said, “The business would not be able to operate” without it, and a further 36% said losing it would have “quite a big impact”.<sup>171</sup> The recent pandemic increased reliance on internet services, with 41% of mobile internet consumers, and 31% of fixed internet consumers saying internet services had become more important since the pandemic.<sup>172</sup>

A9.5 SMEs in the qualitative research indicated that they strongly valued reliability. It found that SMEs were less tolerant than residential users of broadband failures, as this could lose

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<sup>166</sup> We have also referred to existing Ofcom research on customer satisfaction to outline satisfaction levels with both mobile and fixed broadband services. See, for example, the [2021 Customer Satisfaction Tracker and 2022 Online Nations](#).

<sup>167</sup> In total this involved 2,109 respondents.

<sup>168</sup> Ofcom, 2022. [SME consumer experience in the communications market](#). Subsequent references are to this publication.

<sup>169</sup> Oxygen, 2022. [Qualitative Research Report on Net Neutrality](#). Subsequent references are to this publication.

<sup>170</sup> This compares to just over a quarter (27%) of users of fixed landline services.

<sup>171</sup> Just 3% said it would have “no impact” on their business, and 6% said they don’t use the internet.

<sup>172</sup> Ofcom, 2022. [SME consumer experience in the communications market](#), report pages 50-53.

them time and customers and have a direct impact on their businesses. In order to get a very stable and high-quality connection and/or faster services, some SMEs had invested in business contracts for fixed or mobile internet access. SMEs were also more demanding than residential users, when it came to service standards, securing value for money or obtaining redress/refunds.<sup>173</sup>

## Residential findings

- A9.6 The internet is a core part of most peoples' lives in the UK. Ofcom research shows that 94% of adults accessed the internet in 2021.<sup>174</sup> On average UK adults spend almost four hours online a day, of which three hours are spent on smartphones.<sup>175</sup>
- A9.7 The vast majority of households in the UK have access to both a fixed and mobile internet connection. According to our 2022 Technology Tracker, most households have access to fixed broadband and over 8 out of 10 adults have access to a smartphone with a 4G or 5G connection. The majority who have both types of connectivity only use fixed while in the home.<sup>176</sup> Therefore, we expect that both fixed and mobile ISPs will continue to be important channels for consumers to access content.<sup>177</sup>
- A9.8 In our qualitative research, all respondents claimed great reliance on both their fixed and mobile broadband. For fixed broadband, residential consumers reported that a good in-home or in-premises connection was an expectation, as so much of what people needed to do was now online. The mobile internet was similarly essential, as an important access point to everything online and potential backup for their fixed service.<sup>178</sup> Younger respondents were more reliant on mobile internet services than older respondents.<sup>179</sup>
- A9.9 In general, the majority of residential respondents noted that typically problems connecting to the internet were infrequent or minor. A minority had a lot of problems connecting to the internet and noted that these problems were significant and important to them.<sup>180</sup>
- A9.10 Respondents noted some of the problems they had encountered with their internet service. For fixed consumers, this included buffering, freezing of streams, time delays on gaming, intermittent disconnections, slow loading of content or evening slowdowns. For

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<sup>173</sup> Oxygen, 2022. *Qualitative Research Report on Net Neutrality*, page 46.

<sup>174</sup> Ofcom, 2022. [Online Nation 2022 Report](#), page 10.

<sup>175</sup> Ofcom, 2022. [Online Nation 2022 Report](#), page 12.

<sup>176</sup> 87% of households have fixed broadband internet access; only 4% of households only access the internet via a mobile network. 83% of adults have access at home to a smartphone with a 4G or 5G connection. However, only 21% of those with both a fixed broadband and a mobile network connection access the internet via a mobile network when at home. Bespoke analysis from our [2022 Technology Tracker Main Data Tables](#).

<sup>177</sup> We note that our qualitative consumer research found that some people tethered their laptop or tablet to their mobile inside the home when their broadband connection was slow or unavailable and outside the home when they wanted to ensure they had a secure connection or did not want to use public Wi-Fi. Some who had unlimited/large amounts of data on their mobile, continued to use mobile data in-home, rather than switch to Wi-Fi on their fixed broadband. During lockdown, when people were spending more time than usual at home, this habit had led to some running out of data on their mobile.

<sup>178</sup> Oxygen, 2022. *Qualitative Research Report on Net Neutrality*, page 15.

<sup>179</sup> Oxygen, 2022. *Qualitative Research Report on Net Neutrality*, page 16.

<sup>180</sup> Oxygen, 2022. *Qualitative Research Report on Net Neutrality*, pages 18-19.

mobile internet consumers, some noted problems with the slow loading of content, mobile data blackspots or being unable to call or message other people or connect to the internet.

### Customer satisfaction

- A9.11 Our 2021 *Customer Satisfaction Tracker*<sup>181</sup> indicates that overall, mobile users appear satisfied with the service they receive from their mobile providers. They consider core aspects of their service positively, including the overall service, value for money and reception or signal strength available.<sup>182 183</sup>
- A9.12 Most fixed broadband users are also satisfied with many aspects of their service,<sup>184</sup> though their satisfaction levels tend to be lower than for mobile services, with the difference being most pronounced when considering value for money<sup>185</sup>, where just 66% of fixed respondents were net satisfied vs 85% of mobile respondents.<sup>186</sup>

### Networks are meeting increased demands

- A9.13 Network deployment by fixed network operators means consumers are getting access to better fixed broadband services:
- 68% of homes have access to services capable of providing gigabit speeds, including 38% that have access to full fibre connections.<sup>187</sup> In 2017, only 3% of UK homes had access to full fibre.
  - The average download speed has increased to 59.4 Mbit/s in 2022, up from 36 Mbit/s in 2017.
  - The average upload speed has increased to 10.7 Mbit/s in 2022, up from 5 Mbit/s in 2017.<sup>188</sup>
- A9.14 In our recent discussion paper about our future approach to mobile markets, we considered that the mobile user experience had generally been good overall, with sustained investment in networks, wide coverage<sup>189</sup> and generally good reliability. We noted that the continued investment in networks, enabled by the rollout of 4G, was “*providing faster, more reliable data to support online services, and increased network capacity to carry increasing volumes of data*”.<sup>190</sup> This investment has continued since the

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<sup>181</sup> The online survey was conducted using Yonder’s online panel (YonderLive) to reach adults aged 16+. See the [2021 Technical Report](#) for further details.

<sup>182</sup> With net satisfaction for overall service (91%), value for money (85%) and reception/signal strength (83%) all high.

<sup>183</sup> We note that a customer’s mobile internet service is only part of the package offered by mobile providers, and hence the findings from this research will encompass voice, text and mobile internet services. However, in recent years, usage of mobile internet has become a more important part of that overall package. Hence, we consider this research both informative and relevant.

<sup>184</sup> With net satisfaction for overall service (83%), speeds they get (80%) and reliability (82%) also all fairly high.

<sup>185</sup> 66% of fixed respondents were either very satisfied (18%) or fairly satisfied (48%) with the value for money of the service provided. With 16% very dissatisfied or fairly dissatisfied with the value for money of the service (Table 40).

<sup>186</sup> We note that overall net satisfaction is also higher for mobile services (91%) than for fixed (83%).

<sup>187</sup> Ofcom, 2022. *Connected Nations update: Autumn 2022*.

<sup>188</sup> Ofcom, 2021. [Home Broadband Performance report](#); Ofcom, 2022. *UK Home Broadband Performance report*.

<sup>189</sup> Ofcom, 2022. [Ofcom’s future approach to mobile markets: A discussion paper](#), Table 4.3. Subsequent references are to this publication.

<sup>190</sup> Ofcom, 2022. *Ofcom’s future approach to mobile markets: A discussion paper*, page 5.

emergence of 5G, expanding the benefits of mobile to more users.<sup>191</sup> We also found evidence to suggest that users could access 4G data on the vast majority of occasions (96%) when they attempted to do so. Although this did not vary significantly by MNO, nation, or rurality, we did find that at peak times it was less reliable. More widely, we identified significant challenges to improving indoor coverage,<sup>192</sup> and the user experience on trains.<sup>193</sup>

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<sup>191</sup> For example, industrial internet of things (IoT) applications.

<sup>192</sup> Ofcom, 2022. *Ofcom's future approach to mobile markets: A discussion paper*, page 66.

<sup>193</sup> Ofcom, 2022. *Ofcom's future approach to mobile markets: A discussion paper*, page 21.

## A10. Glossary and abbreviations

**Access network:** The 'last mile' segment of a network, which connects users to their service provider's network infrastructure. This includes both fixed and radio access networks.

**the Act:** The Communications Act 2003.

**Adaptive bitrate (ABR):** A method to improve the quality of video streaming. It adjusts the quality of the stream to better suit the user's bandwidth and device capacity.

**Backhaul network:** The aggregation layer of a network, which connects a service provider's access network to its core network.

**BEREC:** The Body of European Regulators for Electronic Communications.

**Busy hour:** The 60-minute period during which a communications network is at its busiest.

**Content and application provider (CAP):** A company that produces content and/or applications and distributes it to users via the internet.

**Content distribution network (CDN):** A geographically distributed network of servers, which is used to distribute content and applications produced by CAPs.

**Core network:** The central part of a network where users' traffic is routed/switched.

**Datacentre:** Premises whose main purpose is to house computing, data and application hosting, and communications equipment.

**Geoblocking:** A technology that restricts access to internet content based on a user's location.

**GC:** A General Condition imposed by Ofcom under section 45 of the Communications Act 2003.

**Internet protocol (IP):** Packet data protocol used for routing and carriage of messages across the internet and other modern communications networks.

**IP Interconnection:** The physical and logical link between two IP networks.

**IP transit:** A wholesale connectivity service that provides indirect access to the global network of networks which form the internet. IP transit services are typically purchased by retail ISPs from major tier 1 ISPs to provide connectivity to networks which do not warrant direct interconnections.

**Internet of things (IoT):** The interconnection via the internet of computing devices embedded in devices used by consumers and businesses.

**Internet service provider (ISP):** A company that provides end-users with access to the internet.

**Net neutrality framework:** The net neutrality rules and the relevant guidance issued by BEREC and Ofcom.

**Net neutrality rules:** The Open Internet Access Regulation (also referred to in this document as 'the Regulation').

**The Open Internet Access Regulation:** Regulation (EU) 2015/2120 of the European Parliament and of the Council of 25 November 2015 laying down measures concerning open internet access.

**Peak throughput:** The highest throughput of traffic carried by a network in a given period, measured in bits per second.

**Peering:** The direct exchange of traffic between two ISPs' networks (rather than via an intermediate transit network). Traffic may be exchanged via a direct interconnection between the networks (private peering) or at an internet exchange point (IXP) (public peering). Peering is typically settlement-free.

**The Regulation:** The Open Internet Access Regulation.

**Specialised services:** Services other than internet access services, optimised for specific content and provided in accordance with the specialised services provisions in Article 3(5) of the Regulation.

**Tethering:** Sharing the internet connection of a phone or tablet with other devices such as laptops.

**Traffic throughput:** The volume of traffic carried by a network at a given point in time, reported in bits per second.

**Traffic volume:** The amount of data carried by a network in a given period, reported in bytes.

**Voice over IP (VoIP):** A technology that supports the transmission of voice communications over IP networks. Used in modern IP based telephone systems and internet based communications applications.

**Voice over Long-Term Evolution (VoLTE):** The communications standard for voice calls in 4G Long Term Evolution mobile networks.

**Zero-rating:** A commercial practice whereby an ISP gives favourable access to specified content by not deducting usage relating to the content from a user's data allowance. Zero rating may be applied to a particular application or website (e.g. Facebook, Netflix) or category of applications or websites (e.g. social media, video streaming).

**5G:** 5th generation mobile network.