Body of European Regulators for Electronic Communications

BEREC

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A view of traffic management and other practices resulting in restrictions to the open Internet in Europe

Findings from BEREC's and the European Commission's joint investigation

29 May 2012

Table of Contents

1 Introduction 3
1.1 A joint investigation by BEREC and the European Commission 3
1.2 An investigation with a large scope 4
1.3 Stakeholder participation 4
2 Qualitative overview of restrictions 5
2.1 Caveats 5
2.2 Categories of restrictions 6
2.3 Specific restrictions ("differentiated") 8
2.3.1 Restrictions on P2P or VoIP traffic 8
2.3.2 Other specific restrictions 8
2.4 Network protection 9
2.4.1 Security and integrity 9
2.4.2 Congestion management 9
2.5 Implementation of business models 10
2.5.1 Data caps 10
2.5.2 Specialized services 11
3 Quantification of restrictions 11
3.1 Variety of the reported measures 12
3.2 Quantification based on numbers of operators 13
A closer look at how restrictions are enforced 15
3.3 Quantification based on operators weighted according to their total number of subscribers 17
3.4 Quantification based on numbers of Internet access subscribers 19
3.5 Aggregated statistics per types of national markets 23
Annex 1 - General statistics 29
Annex 2 - List of respondents 31
Annex 3 – Questionnaire sent to operators 36
Annex 4 - Glossary 39

1 Introduction

1.1 A joint investigation by BEREC and the European Commission

This investigation on traffic management practices by providers of electronic communications services (also called "operators" or "ISPs" in this document) was initiated in 2011 following requests from the European Commission addressed to BEREC, seeking information regarding several aspects closely related to the debate on net neutrality[1]. The Commission was interested in having more specific information on market situations regarding blocking or hindering of applications, and throttling or degrading of traffic.

In the conclusions of its *Communication on the open internet and net neutrality in Europe* issued on the 19th of April 2011[2], the Commission indicated that the evidence found by BEREC would serve as a basis for assessing the potential need for additional guidance on net neutrality[3].

In December 2011 the BEREC member NRAs addressed a questionnaire on traffic management practices to their main providers of electronic communication services[4] in their respective fixed and mobile markets. The questionnaire was published in parallel on the website of the Commission[5].

The stakeholders were invited to submit their answers by 20th of January 2012. On 6th of March, BEREC submitted its preliminary findings to the Commission and published a corresponding press release on 9th of March[6].

This "snapshot of results" intends to deliver a more thorough qualitative and quantitative overview of the results gathered by BEREC and the Commission.

It should be noted that the quantitative results throughout this report represent average figures for Europe. The results for individual countries may substantially differ from these average European figures. This aspect is specifically highlighted in section 3.5.

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[1] European Commission, *Communication on the open internet and net neutrality in Europe* (COM (2011) 222 final, April 2012: http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=COM:2011:0222:FIN:EN:PDF.

[2] Ibid, pages 8 to 10.

[3] For more information regarding the European Commission's public consultation on the open internet and net neutrality in Europe see:
http://ec.europa.eu/information_society/policy/ecomm/library/public_consult/net_neutrality/index_en.htm.

[4] The NRAs were asked to define a scope encompassing a reasonable number of operators with the suggestion that they consider, *at least*, the operators which together represent 90% of end users on both fixed and mobile markets.

[5] For more information regarding the questionnaire and the specific questions asked see Annex 3 and also:
http://ec.europa.eu/information_society/policy/ecomm/index_en.htm.
Questionnaire: http://ec.europa.eu/information_society/policy/ecomm/doc/current/ec_berec_tm_questionnaire.xls.
Instructions to respondents:
http://ec.europa.eu/information_society/policy/ecomm/doc/current/ec_berec_tm_instructionstorespondents.pdf.

[6] See the BEREC press release: http://erg.eu.int/doc/2012/TMI_press_release.pdf.

1.2 An investigation with a large scope

The objective of this wide-ranging European-level inquiry, jointly undertaken by BEREC and the Commission, is to get a view of traffic management and potential restrictions to access, content or applications, in particular to gain some insights into their variety and relative importance. Indeed, they are done for a variety of purposes, and at the same time take different forms, e.g. remain purely contractual or are technically enforced.

The scope of the inquiry was, in this respect, deliberately wide. The questionnaire sent to the operators throughout Europe particularly intended to understand the variety in terms of objectives of measures, for instance by including practices aimed at preserving network security and integrity and measures required by legal order. It also covered the setting of data caps, and the potential impact of some specialized services implemented alongside the Internet access service. All these situations stem from very different business objectives or constraints. For instance, in many cases, traffic management practices serve as an effective mean to provide quality services to end users.

In this respect, the term “traffic management” was used with a broad meaning in the explanatory documents of the questionnaire. Instructions to respondents typically referred to traffic management practices, which are commonly understood as all technical means used to process through the network traffic sent or received by end users, including both application-specific and application-agnostic traffic management. These instructions also specified that the investigation covered all measures pursuing similar objectives, including through contractual terms that are not necessarily enforced technically.

This “results snapshot” will attempt to represent this variety, for instance by summarising the results on “differentiation practices” (i.e. deviations from the “best effort” approach), which are the most relevant with respect to the net neutrality debate.

1.3 Stakeholder participation

The findings are largely based on the data submitted by 32 NRAs[7] - out of a total of 35 BEREC members and observers - which consisted of questionnaire responses by the main national operators they had identified[8].

A total of 414 operators responded - 266 fixed and 148 mobile operators. Among those 148 mobile operators were 33 MVNOs. As MVNOs referred to practices put in place by their MNO in most of their answers, often without being able to precisely confirm or detail them, it was considered preferable not to count their responses in the snapshot statistics. Therefore, the total number of operators considered within the scope of the exercise is **381 - 266 fixed and 115 mobile operators**[9]. The customer base of the respondent operators covers a total

[7] These 32 NRAs are: Austria, Belgium, Bulgaria, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, FYRoM, Germany, Greece, Hungary, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Norway, Poland, Portugal, Romania, Slovak Republic, Slovenia, Spain, Sweden, Switzerland, The Netherlands, Turkey and United Kingdom.

[8] The NRAs were asked to define a scope encompassing a reasonable number of operators with the suggestion that they consider, *at least*, the operators which together represent 90% of the end users in both fixed and mobile markets.

[9] For further details, see Annex 1 (overall statistical data) and Annex 2 (list of respondents).

of about **140 million fixed broadband subscribers and 200 million mobile active Internet subscribers**.

In addition, a number of providers of content and applications, consumer organisations, industry associations and 18 private individuals responded to the questionnaire on the Commission's website, on a voluntary basis, which provided an additional dimension and some extra reference for crosschecking national situations. This report does not cover those responses.

Although the level of details varied significantly, the overall operator participation was excellent and a lot of information was collected. BEREC is very pleased with this comprehensive feedback and would like to thank all the respondents for their efforts and submissions.

2 Qualitative overview of restrictions

This section provides some elements of description and understanding of the different sorts of restrictions reported by operators, whether or not they are a common practice in the markets. Indeed, as the quantitative analysis in chapter 3 will show, only a minority of providers apply some of the categories of practice described below.

Among the measures reported by respondents, BEREC found across Europe a wide array of traffic management practices resulting in restrictions, and an equally wide range of implementation methods and policy justifications for them (sections 3.2 to 3.4 provide a graphical representation of the frequency of the practices covered by the inquiry).

2.1 Caveats

When studying the details of the results, it is important to bear in mind the following limitations and caveats:

- This is the first time that such a wide-ranging and comprehensive exercise of this type has been jointly carried out by BEREC and the Commission. It was thus decided, as far as possible, to simplify some aspects regarding traffic management characteristics, in order to limit the complexity associated with the use of new concepts, or unusual questions that may be understood differently by European operators (also foreseeing possible language issues, as the text of the traffic management questionnaire is in English). This is an important constraint of the exercise, which explains some inevitable "imprecisions" in the subsequent analysis. For example, it was not systematically demanded to specify the duration of a measure, or the place in the network (e.g. access or backhaul) where it is implemented. As a result, the categories presented in this document regroup situations that are broadly similar, but which in fact may impact end users in quite different manners.
- The level of information provided varies significantly among the different operators. While some operators provided brief answers, others explained their actions in detail and a few even gave additional reasons and arguments in separate attached documents.

- The categories of measures in the questionnaire were built, of course, before knowing which ones were the most representative in the European Union. When preparing this snapshot, it seemed useful to distribute the information according to a modified categorization, better adapted to the responses. This resulted in the creation of two categories ("*Measures related to network security and integrity*" and "*Measures upon legal order*"), whereas the category "*Restriction on the type of terminal allowed, or tiered pricing depending on the terminal used*" disappeared (the corresponding answers were included in "*restrictions of other kind of traffic*").
- The reliability of quantitative information is, to a certain extent, limited - mainly due to a lack of up-to-date information regarding the number of Internet access subscribers per operator. This derives from the fact that a significant number of operators did not provide this information, sometimes on the basis of commercial confidentiality. Drawing on information and estimations provided by NRAs helped to fill some gaps in this information. With this approach, it was possible to propose a quantification of practices in reference to the number of Internet users, but any absolute figure should be considered with extreme caution.

2.2 Categories of restrictions

The first overview of results proposed in the next section presents the frequency, as reported by operator, of the different types of restrictions, distinguishing the following main categories: differentiation (of traffic, or providers…) in section 2.3; technical network protection (congestion, security) in section 2.4; implementation of business models (data caps, specialized services) in section 2.5; and legal obligations. Hereafter is a general description of these categories.

The first part in this overview (section 2.3) considers the occurrences of restrictions (contractual and/or technical "blocking/throttling"[10]) of specific traffic contained in the operator responses:

1) P2P/VoIP traffic: operators were specifically required to reference any restriction (contractual and/or technical) to the transportation of such kind of P2P/VoIP traffic within the Internet access packages they offer.
2) Other contents/applications (e.g. file sharing, FTP, etc.) or specific providers

These "differentiation" practices, which result in restrictions to access content or applications, are the most relevant in terms of net neutrality. It can be emphasized here that restrictions indicated in the offers, and possibly enforced technically, will not necessarily impact all end users at all times.

The second part (section 2.4) consists of measures reported by operators as allowing a more efficient protection and management of networks. These include:

3) Congestion management and
4) Security and integrity:

[10] As labelled in the questionnaire.

30% of the fixed and 20% of the mobile operators reported certain traffic management practices which have been categorised under this umbrella (such as controlling "spam" traffic). In addition, some of the traffic management measures justified by the operators as being based on these "security and integrity" concerns are best described as congestion management techniques, and have therefore been categorized accordingly. This distinction is further explored in other BEREC work streams (particularly in relation to minimum quality of service requirements).

The third part (section 2.5) corresponds to measures put in place by operators in order to implement specific business models, either concerning the bundling of specialized services with Internet access, or with respect to data volume pricing.

5) Specialised services in fixed networks:
   35% of the fixed operators manage their networks in order to offer specialised services (for the provision of facility–based applications, e.g. telephony or TV) in a way which could potentially affect the (public and best efforts) Internet access service being delivered through the same access network.

6) Data caps:
   A wide variety of data caps and "fair use" policies, used to implement specific business models, were found (especially in mobile networks, where 83% of ISPs apply data caps). However, it should be noted that these were not the main focus of this investigation, since (with some exceptions) in general they do not imply differentiated treatment of traffic. While data caps are a technical measure in the sense that traffic volume needs to be measured and throttled once the data cap has been reached or charging for extra volume implemented, these practices are common business models since the early days of narrowband Internet access. Data caps provide a price signal to end users related to the cost of bandwidth consumption. As pointed out by BEREC in its *Response to the Communication on the open internet and net neutrality in Europe*, limiting the data volume or throughput rate independent of data type does not constitute a departure from the principle of net neutrality[11]. Offers implemented through such measures are frequent and of interest to end users, which is why they are also detailed here.

The last category covers any form of restriction that is not at the operators' initiative, but is required by public authorities:

7) Measures upon legal order:
   These measures are undertaken under "legal obligation" purposes (e.g. anti-bill shock in roaming, court orders, etc.) and have also been included in a separate category. Not being the focus of this investigation, they are not further detailed in the subsequent description.

[11] See BEREC, *Response to the European Commission's consultation on the open internet and net neutrality in Europe* BoR (10)42, September 2010, page 15 (question 10): http://www.irg.eu/streaming/BoR%20(10)%2042%20BEREC%20response_ECconsultation_Net%20neutrality_final.pdf?contentId=546969&field=ATTACHED_FILE.

2.3 Specific restrictions ("differentiated")

2.3.1 Restrictions on P2P or VoIP traffic

Among the restrictions related to specific types of traffic, the most frequently reported restrictions are the blocking and/or throttling of peer-to-peer (P2P) traffic, on both fixed and mobile networks, and the blocking of Voice over IP (VoIP) traffic, mostly on mobile networks.

As regards P2P, some level of restriction is reported by 49 operators (out of 266) on fixed networks and by 41 operators (out of 115) on mobile networks. As regards VoIP, some level of restriction is reported by 28 operators (out of 115) on mobile networks. Each of these types of restrictions affects at least 20% of subscribers.

However, it should be noted that the level of restriction applied and the corresponding impact on end users vary significantly among operators: some apply it to all their users, others to some of their users only; some apply permanent restrictions, others apply limited period restrictions (e.g. peak time), etc.

Various approaches are proposed in chapter 3 to further quantify these practices and the resulting restrictions at European level (see sections 3.2 to 3.4 for further details).

Furthermore some interesting descriptive information can be noted. These restrictions are usually reflected in specific contractual terms (such information is now compulsory according to EU directives), so that in most cases the end users are supposed to be aware that the package they have chosen contractually excludes VoIP and/or P2P. In a certain number of cases, these contractual terms are not followed by an effective technical enforcement of the restriction[12] (the distinction between "contractual only" and "technically enforced" is further elaborated in section 3.2).

2.3.2 Other specific restrictions

As reflected in the graphs in chapter 3, other, less common, examples of specific restrictions (including traffic degradation, i.e. blocking/throttling) are reported. These include restrictions on access to other specific applications (such as gaming, streaming, e-mail or instant messaging service) and, to a much lesser extent, on access to specific content and application providers.

A number of cases of operators giving preferential treatment to specific types of over-the-top traffic were also found (e.g. prioritising streaming and other real-time applications, HTTP, etc.) and are presented separately in the figures of chapter 3.

Some examples of special treatment for over-the-top traffic reported by fixed operators are prioritisation of certain kind of traffic or applications at peak times (such as HTTP, DNS, VoIP, gaming, instant messaging, etc.), and assigning lower priority to applications such as

[12] Conversely, some network management techniques may have an indirect impact on VoIP or P2P traffic, without this being directly reflected in the terms of contracts. Such situations are not easy to quantify.

file downloading, P2P, etc. In mobile networks, it is worth to mention some cases of applications or websites which are excluded from the monthly data cap (HTTP traffic, customer care portals or applications such as Facebook).

These restrictions, usually detailed in the contractual terms to various extents, are (here also) not always technically enforced. When they are accompanied by technical measures in the network, these are sometimes not completely covering the restriction. Often the restrictions evolve over time, for instance to target new providers of similar applications.

2.4 Network protection

This category includes network security and integrity related measures, as well as congestion management, which are further detailed hereafter.

2.4.1 Security and integrity

As stated above, a significant number of operators reported practices that can be classified as “based on network security and integrity reasons”. The most frequent measure in this category is the hindering of end users’ access to protect from spam, blocking port 25 (SMTP). This measure can be deactivated by the end user in some cases. Other ports are sometimes blocked as well (e.g. NetBios), and some respondents reported using measures aimed at security enforcement in case of an attack (e.g. DoS attack).

Measures resulting from legal obligations are considered in a different category (e.g. anti-bill shock in roaming, court orders, blocking of child pornography sites, etc.). These are intended to be measures of general application by all operators, within a country, although they were not always reported in responses.

2.4.2 Congestion management

On the Internet, temporary traffic peaks are buffered in routers, and congestion occurs when buffers overflow and IP packets get dropped. Traditional best effort networks, like the Internet, limit congestion through so-called “congestion control” at the *edge* of the network where traffic sources (such as computers connected to the Internet) slow down the transmission rate when packet loss is observed.

A significant proportion of the operators explain that they implement dedicated traffic management measures in order to manage congestion. Providers of modern IP networks often perform congestion management *within* their own networks. These techniques vary from application-agnostic functions treating all traffic types equally (often referred to as “fair sharing” and similar methods) to application-specific functions performing throttling and/or blocking of specific applications (typically using deep packet inspection technologies). When these practices were clearly reported (or verified by NRAs) as application-specific, they were included in the categories of the previous section “other specific restrictions” (2.3).

2.5 Implementation of business models

2.5.1 Data caps

Data caps are not the focus of this net neutrality-related inquiry. Indeed, caps are generally application-agnostic, i.e. applied indistinctively from specific types of traffic. In general, they reflect a strategy from the operator with respect to the pricing of data traffic, according to volume. In other words, data caps are technical measures, in the sense that traffic volume needs to be measured and throttled once the data cap has been reached or charging for extra volume implemented. Nevertheless, when they are application-agnostic, they represent common business models implemented since the early days of narrowband Internet access. Data caps indeed provide a price signal to end users related to the cost of bandwidth consumption.

However, in a few instances, mobile operators do not include the usage of a specific application in the consumption of the contracted data volume (e.g. in the case of a partnership with a content website, or to promote a specific social networking application).

In its response to the *Commission's Communication on the open internet and net neutrality in Europe*, BEREC stated that: "*Limiting the data volume or throughput rate may either be independent of data type (data volume caps or bandwidth limits) or dependent of data type (e.g. throttling of P2P file sharing). The first method does not constitute a departure from the principle of net neutrality; while the second method presumably does as specific data types receive a different treatment than other traffic.*"[13]

Regarding application-agnostic data caps (or data user "volume limits"), two kinds of implementation have been observed in the responses, mainly on mobile access services:

- segmented tariff models, with various levels of data cap per month;
- fair use policies, to prevent "excessive" consumption.

Several measures can be applied to the end user access after the data cap is reached: a speed limit can be activated (e.g. restricting transmission data down to 64 kbps), access service can be temporarily stopped or, in several cases, end users are given the opportunity to buy extra data volume.

Data caps are often the subject of transparency improvement efforts by public authorities and the sector (also in relation to content and application providers); this question is further explored in other net neutrality related work streams from BEREC[14].

[13] See BEREC, *Response to the European Commission's consultation on the open internet and net neutrality in Europe* BoR (10)42, September 2010, page 15 (question 10): http://www.irg.eu/streaming/BoR%20(10)%2042%20BEREC%20response_ECconsultation_Net%20neutrality_final.pdf?contentId=546969&field=ATTACHED_FILE.

[14] See in particular BEREC, *Guidelines on Transparency in the scope of net neutrality: Best practices and recommended approaches,* BoR (11) 67, December 2011: http://berec.europa.eu/doc/berec/bor/bor11_67_transparencyguide.pdf.

2.5.2 Specialized services

Some providers of electronic communication services offer specialized services, which differ from (public and best effort) Internet access service in that they provide a generally guaranteed quality of service and a strict admission control. There are quite different national situations, varying from none to all operators offering specialized services in parallel to offering Internet best-effort access service.

The most frequent applications offered are VoIP, IPTV, VoD. The use of these specialized services might affect the Internet access service in some cases, due to the sharing of access resources:

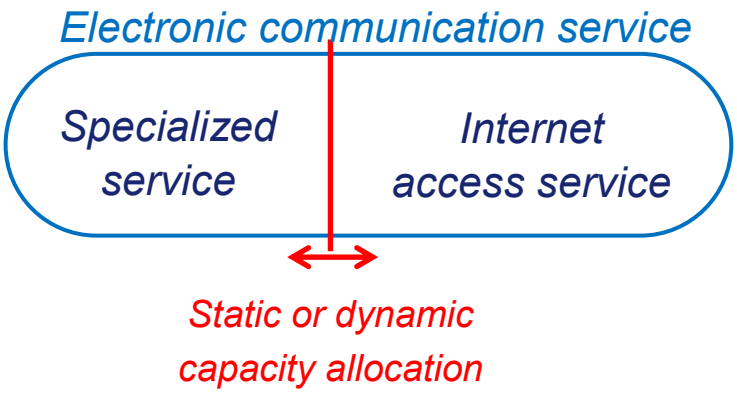


Figure 1

About one third of the fixed operators indicate in their responses that specialized services are affecting, to some extent, the Internet best-effort service of customers using the same access network[15] (see graphs in chapter 3). Potential degradation of the Internet access service in this context is particularly examined within other net neutrality related BEREC work streams, particularly in relation to quality of service minimum requirements.

3 Quantification of restrictions

This chapter first shows the variety of practices reported, and presents the relative importance of the different types of restrictions considered in the questionnaire (section 3.1).

Sections 3.2 to 3.5 provide a detailed quantification, using four different approaches:

1) Number of operators applying each kind of restriction (section 3.2).

[15] There are two possible relevant cases here: either a customer using specialised services has his bundled Internet access service (IAS) affected, or the IAS of one customer affected by the specialised service of other customers.

2) Operators applying each kind of restriction weighted according to their total number of subscribers (section 3.3).
3) Number of Internet access subscribers affected by restrictions (section 3.4).
4) Cross-country aggregated statistics for the most frequent restrictions (section 3.5), in order to represent the relatively contrasting situation across Europe.

Quantification based on the number of operators is helpful to provide a first general picture. However, it suffers from the fact that the number of operators applying a specific restriction does not necessarily reflect the situation on the market as a whole. It is not possible to draw any inference from the number of operators to the number of subscribers actually affected. Moreover the number of operators per country having reported data, during the data collection procedure, does not relate to the size of the country. Countries with many operators compared to the overall subscriber base are overrepresented in the snapshot data, when it is based on operator's numbers information.

To allow more meaningful statements about the overall frequency of particular measures, it was therefore also tried to calculate and present data in relation to the number of subscribers affected. However subscriber data provided by operators were not complete. Some operators did not supply any subscriber data. Those operators were excluded from the subscriber-based calculation (which implies an underestimation, in those graphs, for the practices that these operators reported).

Moreover, precise data was not always provided, in the cases where measures were only applied to part of the subscriber base. Therefore the data reported allow stating a minimum number of subscribers that are surely affected, and a minimum number of subscribers that are surely not affected by a specific measure. For those operators responding that a particular measure was applied to some users only, a range of uncertainty may remain in some cases, with respect to how many users are affected by the measure.

This range is clearly marked hereafter.

3.1 Variety of the reported measures

The following graph (Figure 2) provides a general overview of the measures reported, by representing the proportion of operators applying each type of practice considered to their Internet access customers. The percentages regroup both practices applicable to all, and to only a part of the client base, regardless of whether they are implemented technically and/or contractually, and of how the information is conveyed to customers.

These charts include all types of measures described previously, including those that do not, in most cases, represent a concern in terms of net neutrality – in particular data caps (volume limits), which represent an important portion of responses, particularly in the mobile environment, where they are a very common practice.

Some restrictions which were asked for are nearly never reported, neither in fixed nor mobile networks, such as restrictions on instant messaging, or restrictions on a specific content or application provider.

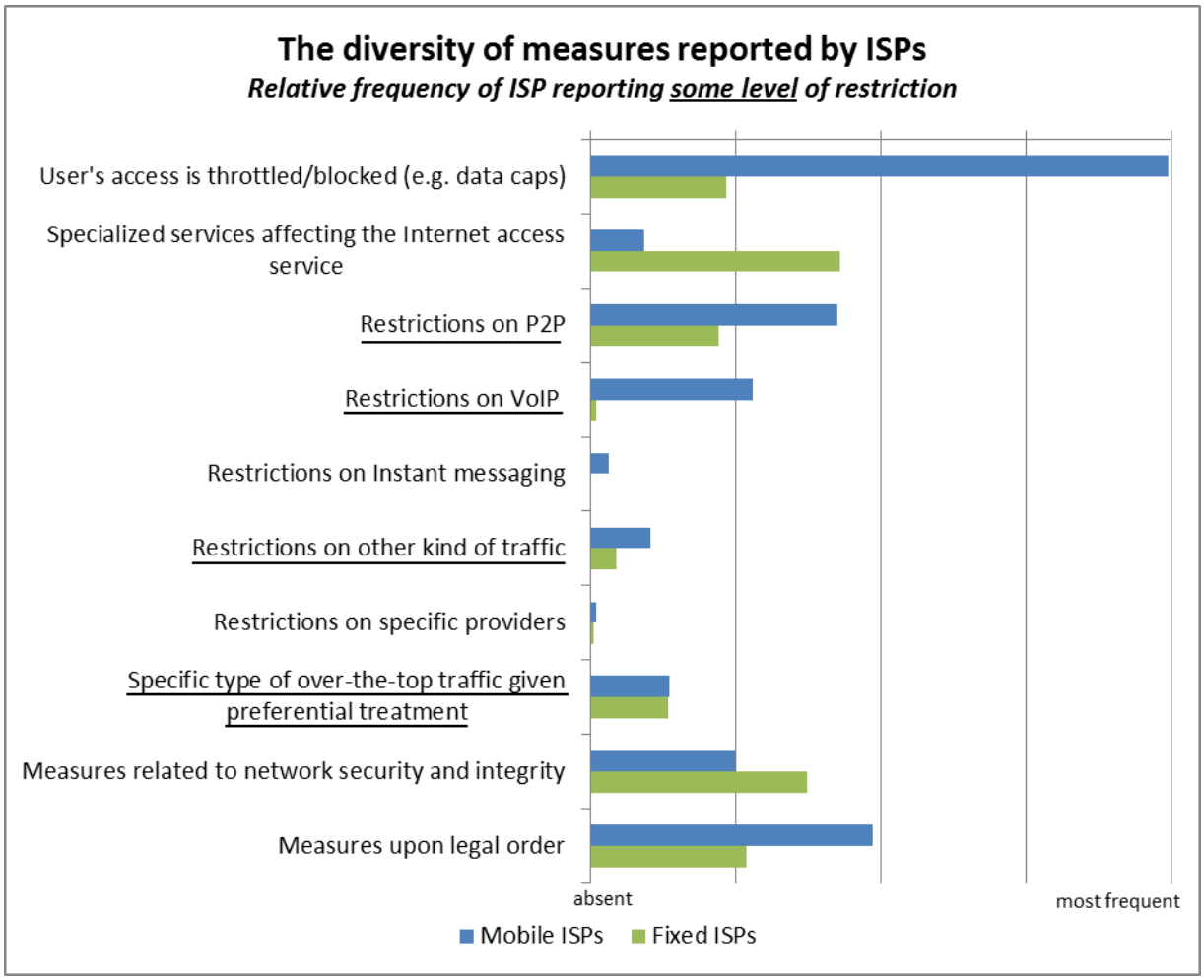


Figure 2

When reading this chart, it is important to keep in mind that the frequency of ISPs reporting some level of restriction does not quantify the numbers of users affected (which depends on the size of the ISP, on whether the restriction is applied to all users or to some users only, etc). It does not represent either the quantitative importance of the restriction in the daily experience of users. The measure may indeed, for example, only be applied for a limited period of time.

Subsequent sections will look more in details at the quantification of practices which are both net neutrality related and not insignificant. These are the practices underlined in Figure 2: "restrictions on P2P", "restrictions on VoIP", "restrictions on other kind of traffic" and "specific type of over-the-top traffic given preferential treatment".

3.2 Quantification based on numbers of operators

This section presents the aggregated results in terms of number of operators, for some of the restrictions sought after in the questionnaire, in particular those in the questionnaire section labelled *"Different priority levels within Internet access traffic"*:

- *"P2P file sharing is blocked/throttled"*

- *"VoIP is blocked/throttled"*
- Other practices of "negative differentiation" of specific traffic: *"Other specific kind of traffic (port, protocol, application, usage, etc.) is blocked/throttled"*
- Practices of "positive differentiation" of specific traffic: *"Specific type of over-the-top traffic given preferential treatment (e.g. specific content/application and/or specific application/content provider)"*

For each type of restriction, the figures presented below display the number of operators reporting the practice. As mentioned before, it should be noted that these figures should not be understood as a quantification of the impact on end users, as the level of restriction applied varies significantly among operators (in particular, some apply it to all their users, others to some of their users only).

In the figures presented below, a distinction is made depending on whether an ISP declaring a practice applies this practice to all its subscribers, or only to some of its subscribers (e.g restriction applied only in certain offers, and not in others).

As stated above, the total number of operators considered within the results of the exercise is 381 - 266 fixed and 115 mobile network operators[16].

A first version below (Figure 3) presents a general view of restrictions set up by operators. The colours in the graphs vary, depending on whether the operator is applying the restriction to all its customers (orange), only to a part of its customer base (yellow), or to none (green).

The second version (Figure 5) is more detailed, since it reflects the distinction between technically-enforced restrictions and contractual-only restrictions – which is explained further in an intermediate section.

[16] The 33 respondent MVNOs were not included in the statistics, as in most cases they referred to practices put in place by their MNOs operator, often not being able to guarantee their observations. However, in a number of cases, the level of restrictions (frequently imposed by the host MNO) appears higher than for the MNO's offers.

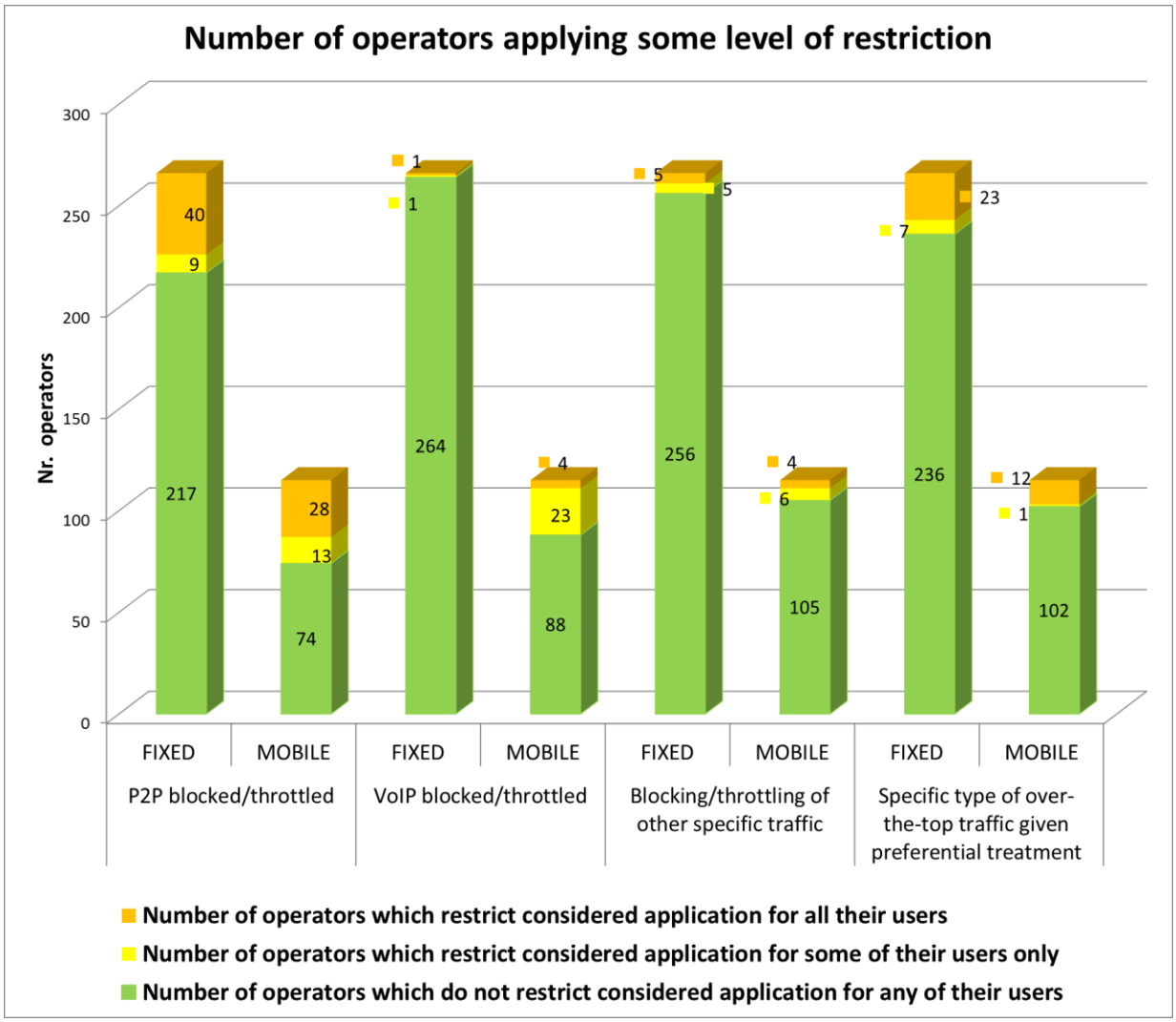


Figure 3

A closer look at how restrictions are enforced

An important distinction in the forms of implementation of the reported restrictions is the method of enforcement. There are two main types of situations with regards to how the end users are confronted with a restriction in practice. Either the contractual provision is accompanied by technical measures, which guarantee that the provision is respected – this is described here as "technically enforced". Or there are no technical means put in place by the operator to control that matter – this situation is described as "contractual only". In the latter case, end users would technically be able to "violate" the contractual terms and access some contents or applications that are restricted in their offer, even though they are obviously not supposed to do so.

In this regard, the global figures presented in Figure 3 above should not be regarded as quantifying specifically the technical measures in place, but rather the intended restriction.

For the most frequent restrictions, BEREC has calculated the proportion that is not actually technically enforced (according to the answers to the questionnaire). The results are the following: **"contractual only" restrictions represent 4% of the cases reported for P2P in**

fixed networks, 12% for P2P in mobile networks, 44% for VoIP in mobile networks. This percentage is in reference to the number of operators which report to apply such restrictions. For example, in the case of P2P in fixed networks, 48 out of 266 operators (4% here corresponds to 2 operators).

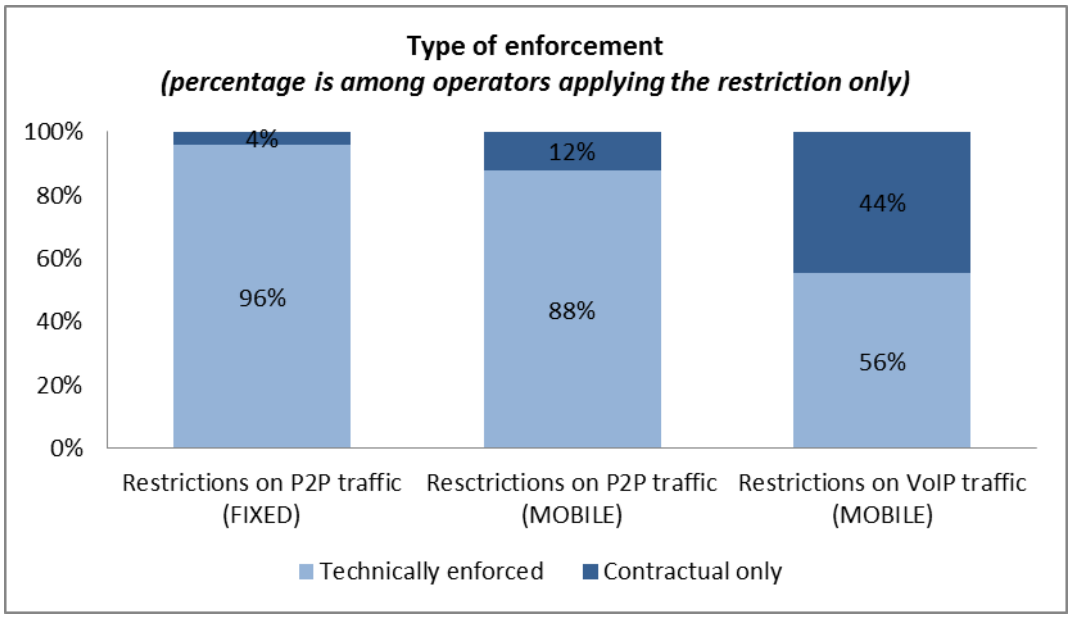


Figure 4

One last piece of descriptive information relates to the effectiveness of the measure. Even when a restriction is technically enforced, it may be done incompletely (e.g. not all the producers of a type of traffic are identified by the system). It may also be ineffective when the end users use certain configurations. This consideration is useful to better understand to what extent an end user is effectively prevented from accessing or using some content or application. Nevertheless, this is not the only element to be appreciated in the context of net neutrality: the ability to exercise choice, in particular, is a criteria emphasized in other work streams of BEREC.

Applying this distinction between “technically enforced” and “conctractual only” to all the categories of measures, the data collected is classified and presented in Figure 5. The colours in the graphs vary, depending on whether the operator is applying the restriction to all its customers (orange, solid or dashed), only to a part of its customer base (yellow, solid or dashed), or to none (green).

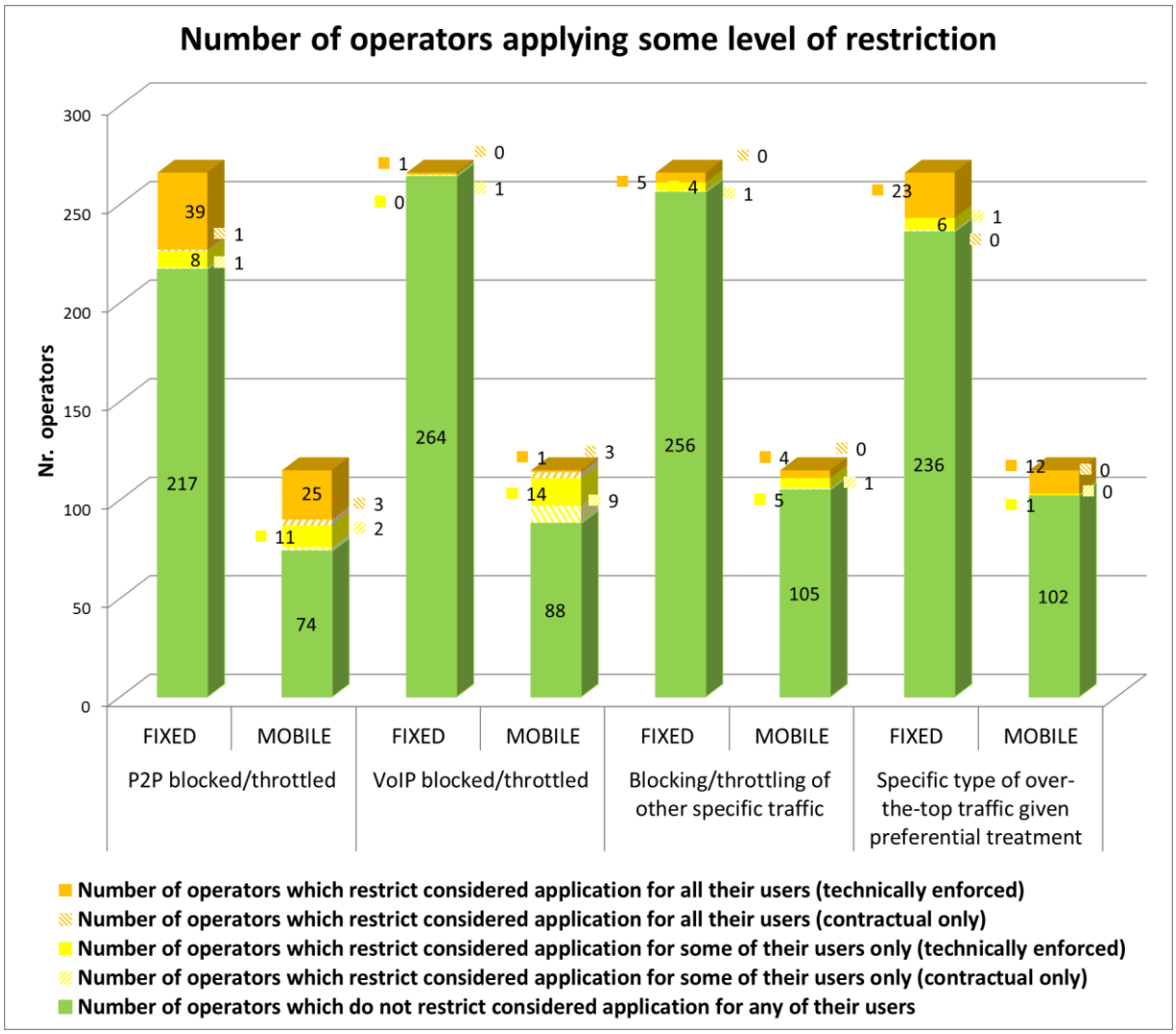


Figure 5

3.3 Quantification based on operators weighted according to their total number of subscribers

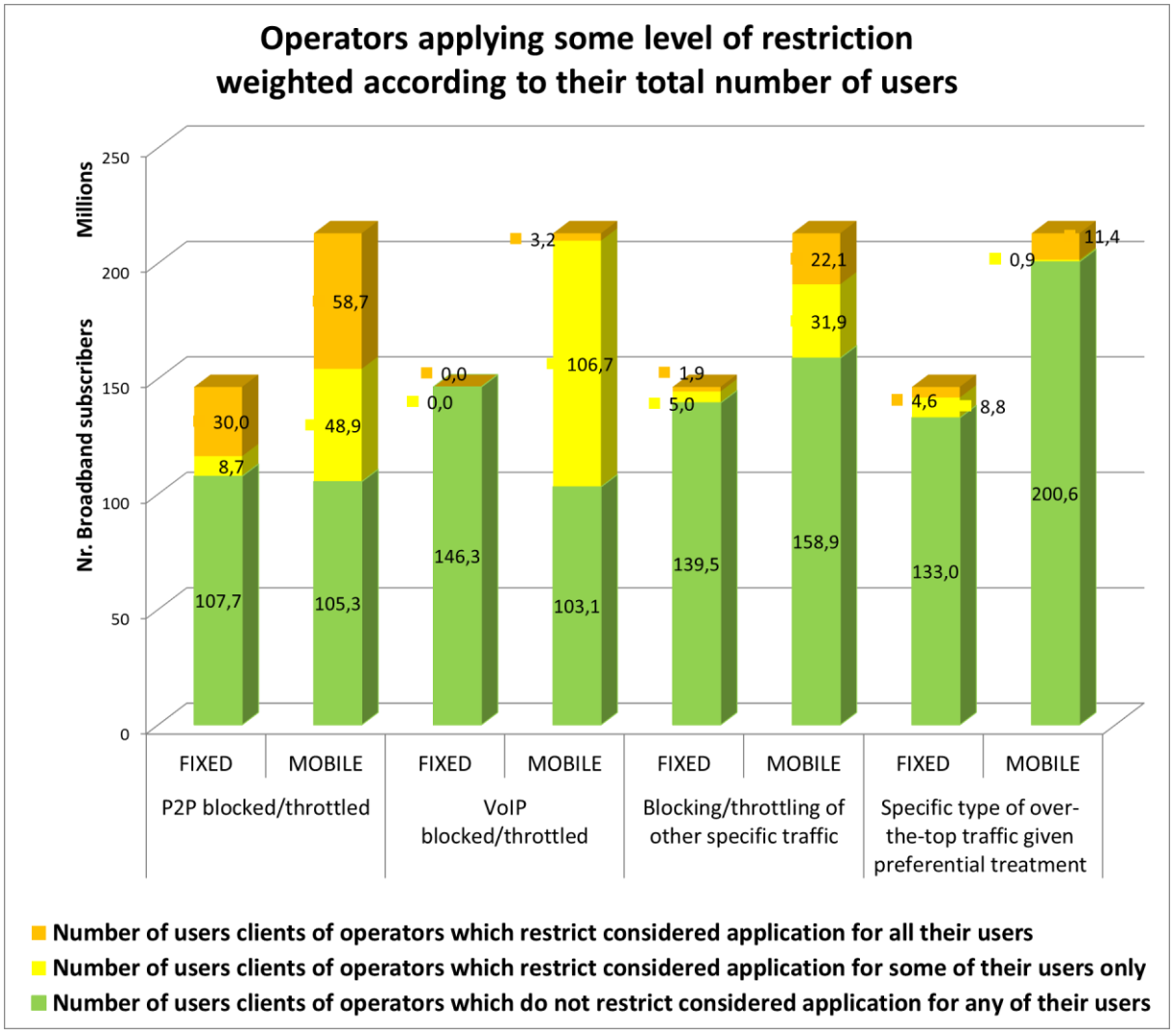
The objective here is, starting from previous figures, to weight each operator according to its number of subscribers. In the resulting graphics, it should be underlined that the weight affected to the category of operators which “restrict considered application for some of their users only” does not correspond to the number of users affected by the restriction, but rather to the total number of users of these operators. So that the graphics do not tell exactly how widespread the restrictions are (which will be the aim of next section), but rather how important (in terms of customers) are the categories of operators that apply restrictions to all, some and none of their users.

It is important to note that, when users are counted within categories with some level of restriction, the measure implemented on their Internet access does not necessarily have continuous effect at all times (e.g. throttling P2P only at peak hours). Furthermore, both the yellow and orange categories include restrictions that are implemented technically, as well as restrictions that are implemented contractually only.

Lastly, it should be kept in mind that these figures are estimations, given that up-to-date data on the number of Internet access subscribers was not provided by every operator.

A first version below (Figure 6) presents a general view of the weighting of operators' behaviour, depending on whether they apply restrictions to all, some or none of their users. The colours in the graphs vary, depending on whether the operator is applying the restriction to all its customers (orange), only to a part of its customer base (yellow), or to none (green).

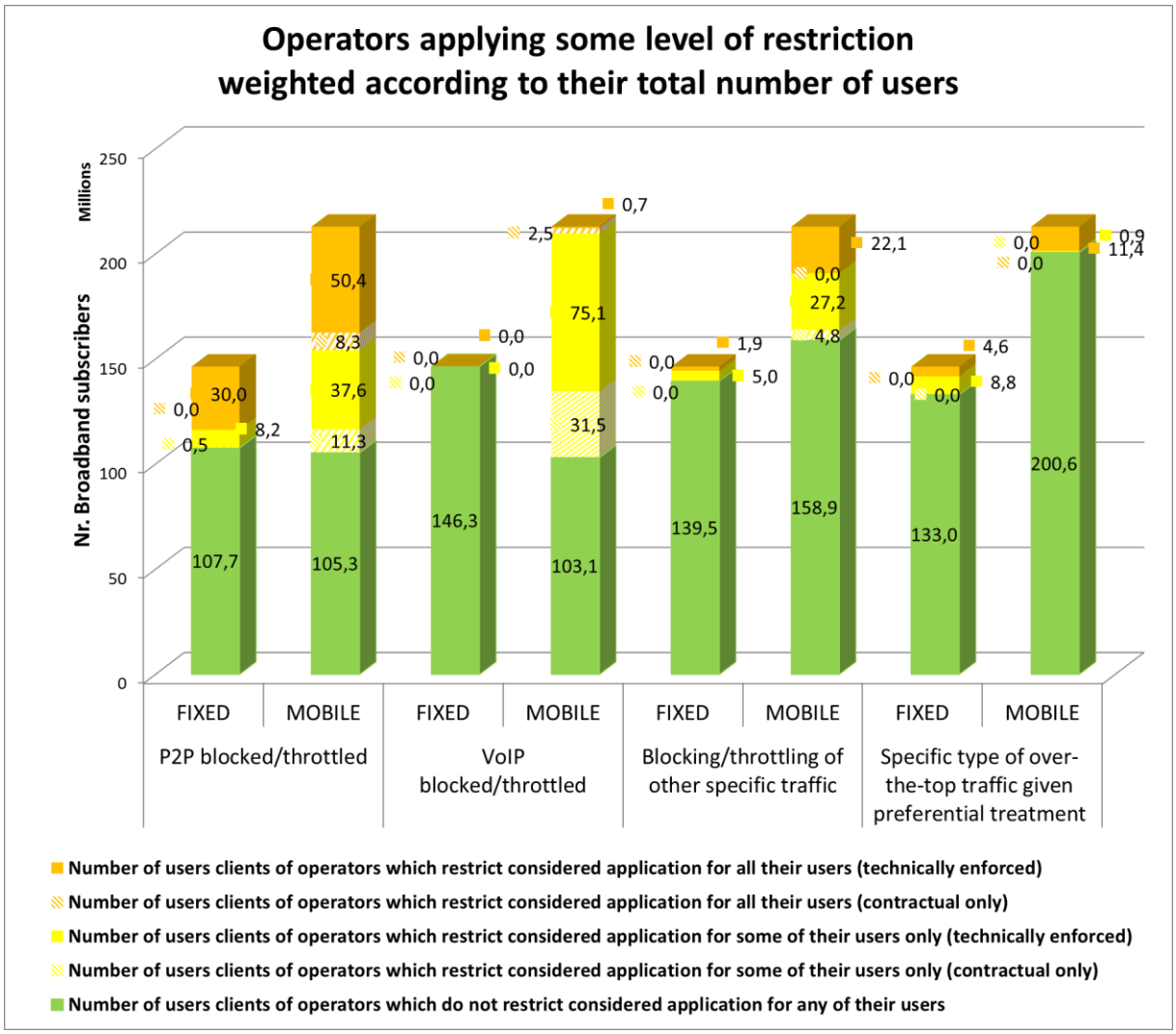
The second version (Figure 7) is more detailed, since it reflects the distinction between technically enforced restrictions and contractual only restrictions.



Note: Those operators were not taken into account which did not provide any data as regards their total number of subscribers. Therefore this graph reflects less than the total numbers of 266 (fixed operators) and 115 (mobile operators) of Figures 3 and 5.

Figure 6

An alternative view in Figure 7 allows reflecting also the absence, in a number of cases, of technical enforcement of a restriction stated in a contract.



Note: Those operators were not taken into account which did not provide any data as regards their total number of subscribers. Therefore this graph reflects less than the total numbers of 266 (fixed operators) and 115 (mobile operators) of Figures 3 and 5.

Figure 7

3.4 Quantification based on numbers of Internet access subscribers

The same restrictions as in the previous sections are presented here, this time showing the results in terms of number of Internet access subscribers, in order to present a first high-level assessment of the impact of the operators' practices on the end users in Europe.

It is indeed useful to further quantify the number of users "affected" by restrictions to a considered application, and at the same time the number of users preserved from such restrictions.

This is done easily for operators which reported not to apply a restriction (all their subscribers were put in category "users not affected") and for those which reported to apply a restriction to all their users (all their subscribers were put in category "users affected"). However, a difficulty arises for operators which reported to apply a restriction to some of

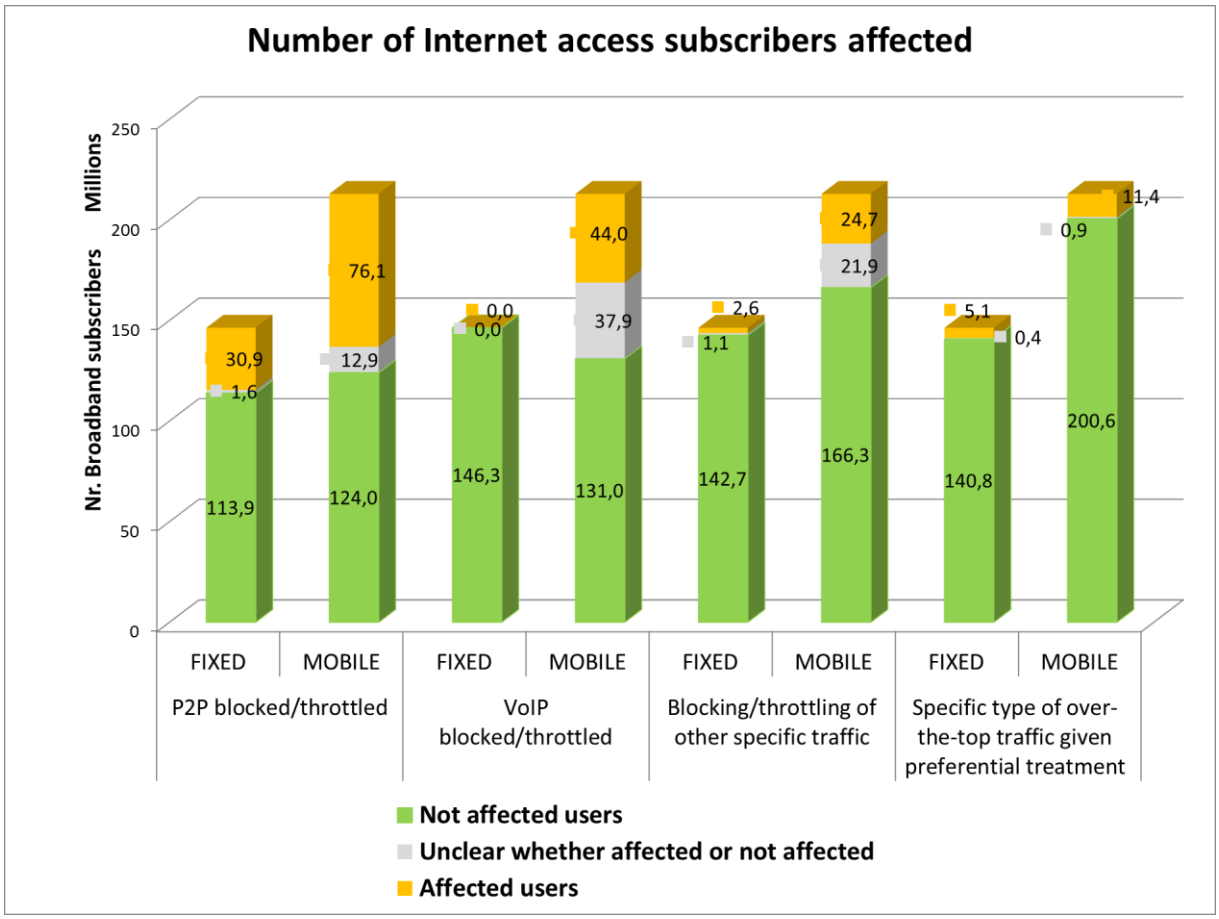
their users only, and not all: figures as regards the number of users affected were not always provided by the operators. In case figures were provided, the operator's subscribers were split between the first two categories ("users affected" and "users not affected"). Absent such figures, all its subscribers were put in a third category "unclear whether affected or not affected".

In the end, when reading the figures quantifying the impact on end users, it should be understood that the "unclear whether affected or affected" category (grey) is in reality a compound, of unknown proportion, between "users affected" (that would have to be painted orange) and "users not affected" (that would have to be painted green). This implies that the dividing line between "affected" and "not affected" stands somewhere in the grey block. Or, said differently, the number of users effectively affected is in the range between "users affected" (orange) and "users affected" and "unclear whether affected or affected" (orange + grey).

Furthermore, similarly as above, both the grey and orange categories include restrictions that are implemented technically, as well as restrictions that are implemented contractually only.

A first version below (Figure 8) presents a general view of resulting restrictions faced by end users. The colours in the graphs vary, depending on whether the user faces restrictions (orange) or not (green), or whether the data does not allow to tell (grey).

The second version (Figure 9) is more detailed, since it reflects the distinction between technically enforced restrictions and contractual only restrictions.



Note: Those operators were not taken into account which did not provide any data as regards their total number of subscribers. Therefore this graph reflects less than the total numbers of 266 (fixed operators) and 115 (mobile operators) of Figures 3 and 5.

Figure 8

Figure 8 can be read accordingly:

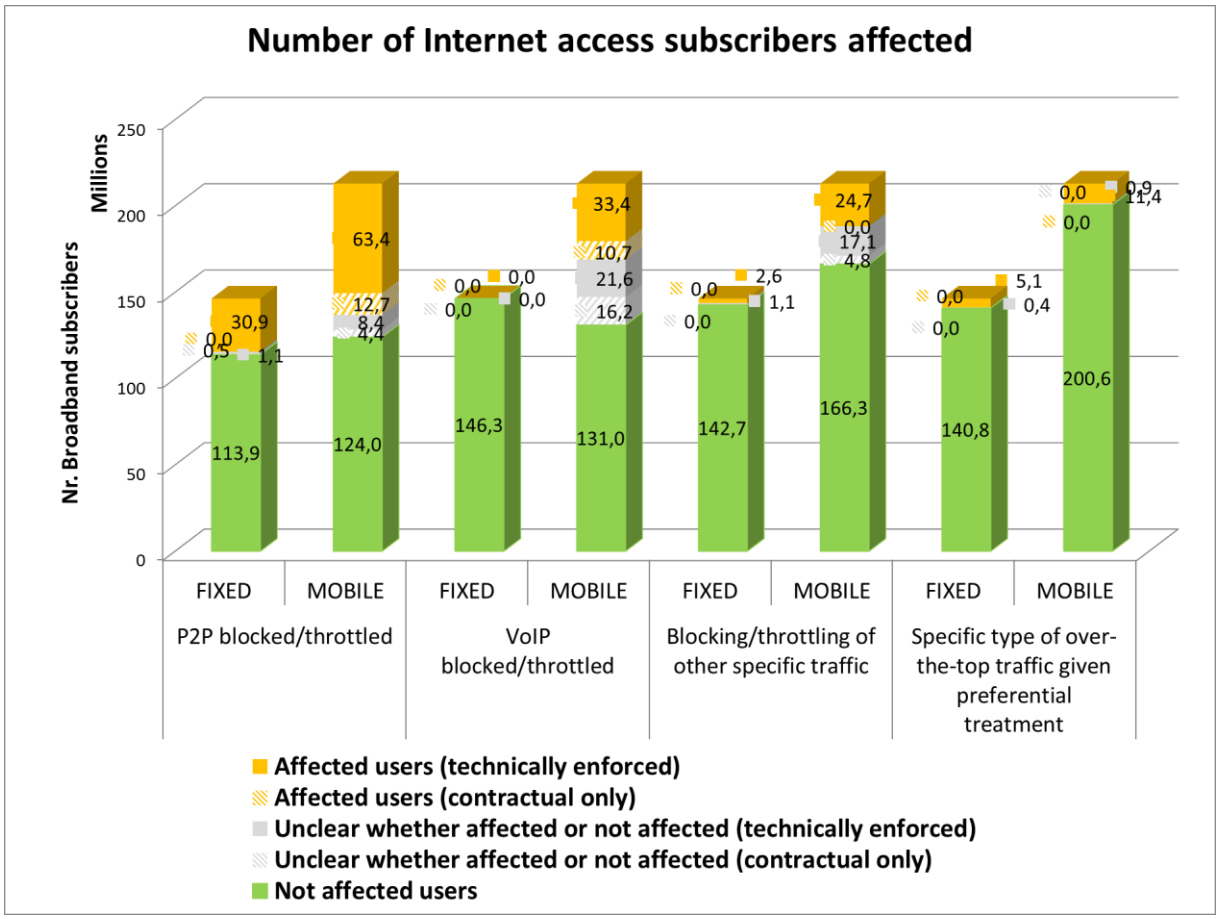
- In the fixed market, while at least 78% are not affected by those restrictions, at least 21 % of broadband users are affected by P2P related restrictions, either technically or contractually. The data is not clear enough to enable reliable conclusions to be drawn about the remaining 1% of users who might or might not face such restrictions.
- In the mobile market, while at least 58% are not affected by those restrictions, at least 36 % of broadband users are affected by P2P related restrictions, either technically or contractually. The data is not clear enough to enable reliable conclusions to be drawn about the remaining 6% of users who might or might not face such restrictions.
- In the mobile market while at least 61% are not affected by those restrictions, at least 21 % of broadband users are affected by VoIP related restrictions, either technically or contractually. The data is not clear enough to enable reliable conclusions to be drawn about the remaining 18% of users who might or might not face such restrictions.

To correctly interpret the meaning of Figure 8 and the preceding figures, it is important to recall the many different ways in which the reported restrictions are implemented, and thus the fact that affected end users will be impacted in very different ways.

One important aspect relates to the type of technical management associated with a certain type of restriction. For instance, *when* blocking/throttling is implemented in the network, it is typically done through deep packet inspection (DPI). But various other techniques are reported as well – in fact, there does not seem to be any "standard" methodology today in Europe, or even within a country. A central element is the type of traffic that is concerned. Indeed, quite often management related to P2P will be targeted essentially at peak hours, in cases of congestion. So in reality, the experience of end users will be concretely affected to a much smaller extent than the figure may suggest.

One last important factor is the absence, in a number of cases, of technical enforcement of a restriction stated in a contract. This has been further examined in the previous section, and is represented in Figure 9 below.

As previously, an alternative view in Figure 9 allows reflecting also the absence, in a number of cases, of technical enforcement of a restriction stated in a contract. The colours in the graphs vary, depending on whether the user faces restrictions (orange, solid or dashed) or not (green), or whether the data does not allow to tell (grey, solid or dashed).



Note: Those operators were not taken into account which did not provide any data as regards their total number of subscribers. Therefore this graph reflects less than the total numbers of 266 (fixed operators) and 115 (mobile operators) of Figures 3 and 5.

Figure 9

It may be noted that the divergence between restrictions that are implemented both technically and contractually as opposed to those that are only implemented contractually is more significant for mobile subscribers than for fixed subscribers.

3.5 Aggregated statistics per types of national markets

This approach helps to understand the difficulty in drawing conclusions from the EU-level statistics above, for any specific market, since there are truly different national situations. Light is shed below on the availability of unrestricted offers at national market levels, because it is the relevant level for an end user to exercise choice (if this choice is possible), as highlighted in other BEREC work streams related to net neutrality. The contrasted results confirm that any analysis of the “net neutrality status” would need to be performed at each national market level, in order to assess appropriately the situation of its users with respect to restrictions on the access to content/applications/services.

The following figures reflect the statistical distribution of unrestricted offers for the most frequently restricted traffic, i.e.:

- For the fixed broadband markets: unrestricted offers in relation to P2P traffic (Figure 11);
- For the mobile Internet markets: unrestricted offers for P2P (Figure12) and for VoIP traffic (Figure 13).

It is important to note that any (contractual and/or technical) measure in place, which could restrict access to content, application, services of the customers of an offer, results in this offer being classified here as "restricted", thus naturally overstating the restricted nature of a market – indeed, as mentioned previously, a measure implemented on an end user's access does not necessarily have a continuous effect at all times (e.g. throttling P2P only at peak hours).

The data is aggregated according to three different categories of countries - low, medium and high proportions of unrestricted offers within a national market - depending on the percentage of end users that are clients of operators which provide unrestricted offers for all their users in those countries. The graphs display the total number of countries in each category, and the aggregated number of European Internet users in the countries included in each category, in percentages[17].

The categorisation of national markets follows the criteria below:

- *Frequent restrictions (type 1 in the graphs)*: Markets with a low proportion of unrestricted offers. A national market falls under this category when the ISPs that are restricting P2P (respectively VoIP) for all their end users have a cumulated market share over 50%.
- *Unfrequent restrictions (type 3 in the graphs)*: Markets with a high proportion of unrestricted offers. A national market falls under this category when the ISPs that are *not* restricting P2P (respectively VoIP) for any of their end users have a cumulated market share over 50%.
- *Intermediate markets (type 2 in the graphs)*: the rest of the situations (neither of the two previous criteria fits that national market).

The following chart (Figure 10), based on fictional data in order to keep it simple, further explains how Figures 11 to 13 are built, from top to bottom:

- national markets are sorted on the basis of the share of users clients of operators who restrict the considered application for all / some / none of their users;
- three groups of markets are formed, on the basis of categories described before ("all">50%, "none">50%, others);
- the size of each group (number of countries) leads to the distribution (in percentages) of types of markets in term of number of countries; this forms the inner circle of the "pies" of Figures 9 to 11;
- weighting each national market by its number of subscribers, this leads to the distribution (in percentages) of types of markets in terms of number of subscribers; this forms the outer circle of the "pies" of Figures 11 to 13.

[17] The percentages in the graph are related to the total number of subscribers covered by the respondent ISPs.

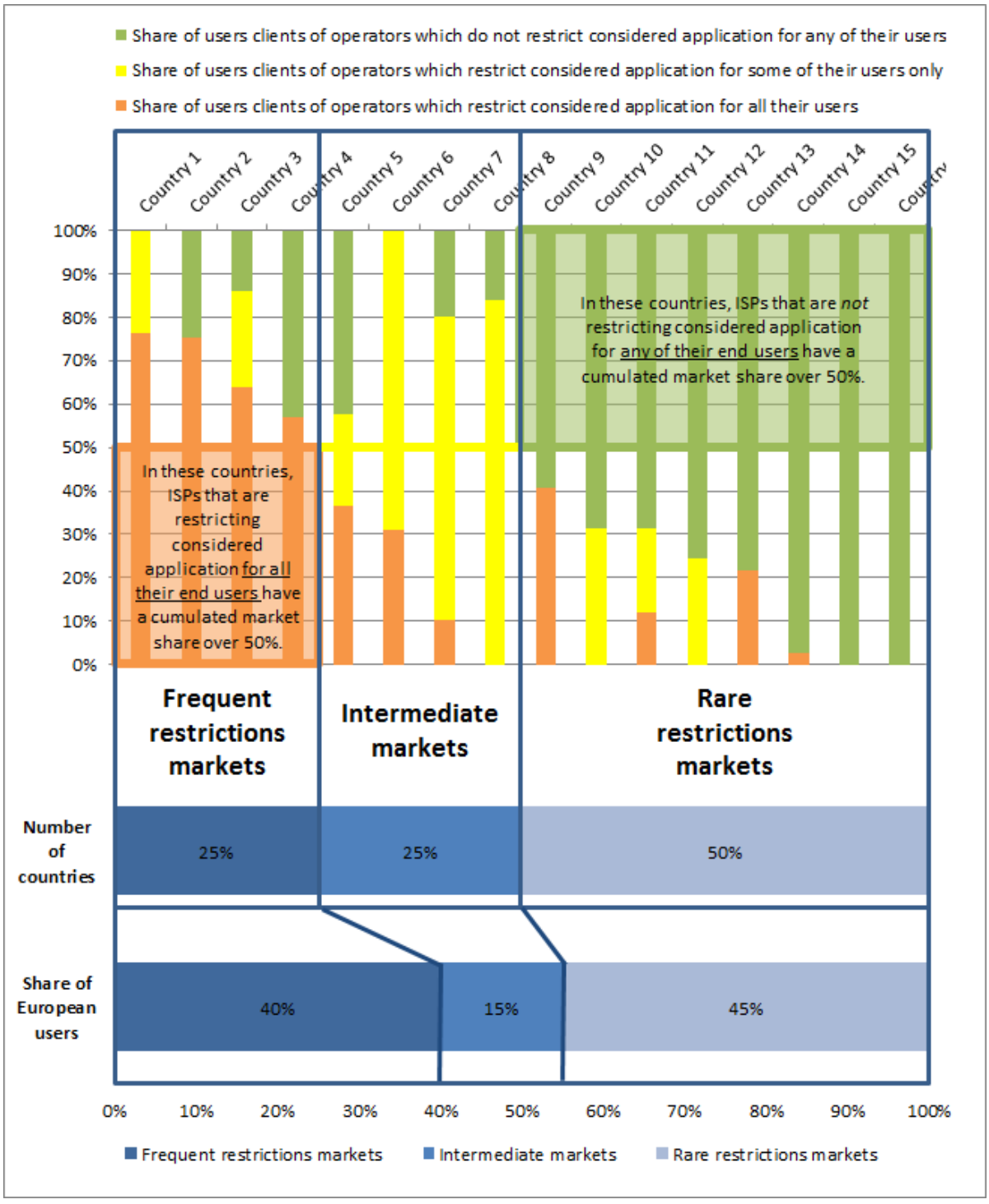


Figure 10

The resulting graphs are displayed below.

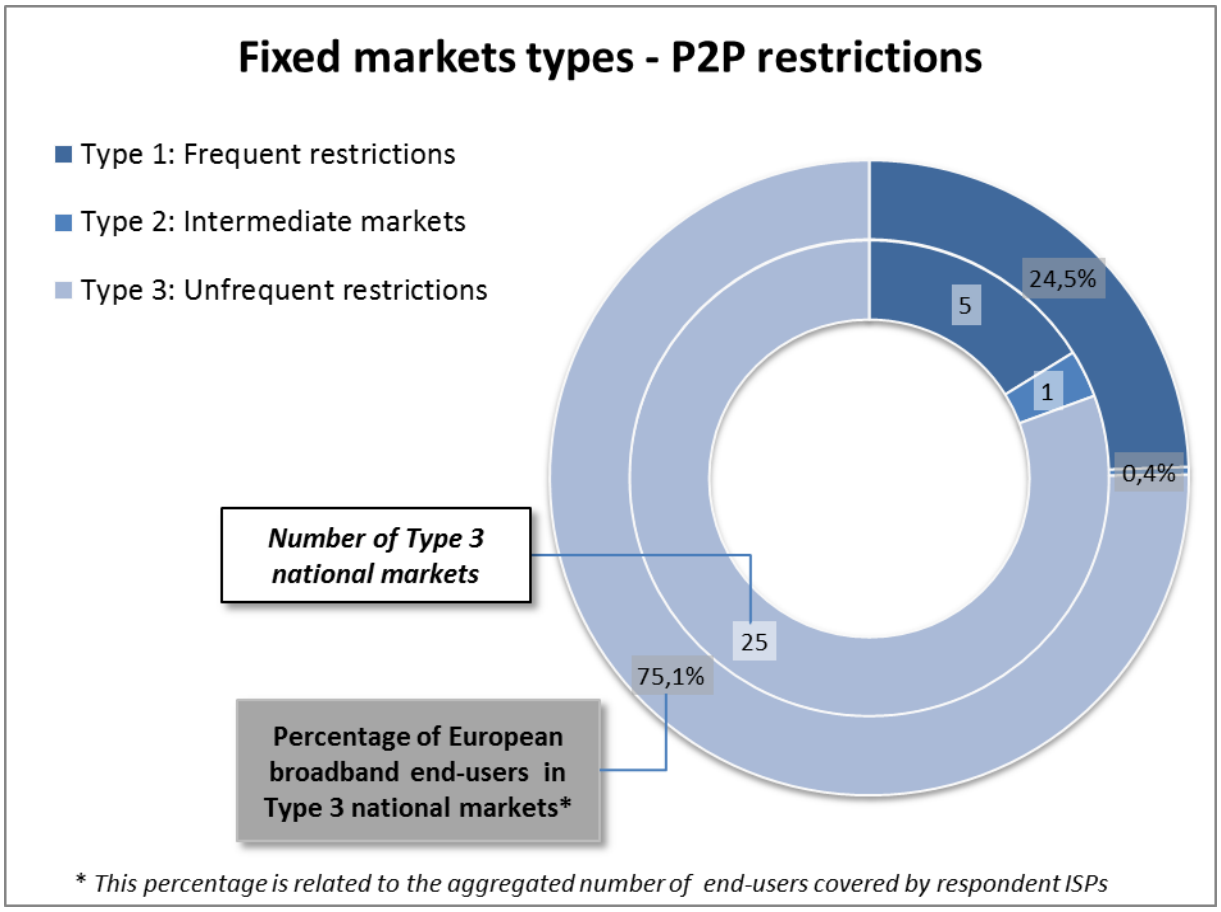


Figure 11

Example of information displayed in Figure 11: 25 countries (representing 75% of European fixed Internet subscribers covered by this inquiry) have “type 3” national markets, i.e. more than 50% of fixed broadband end users currently subscribe to offers where P2P traffic is not restricted in any form.

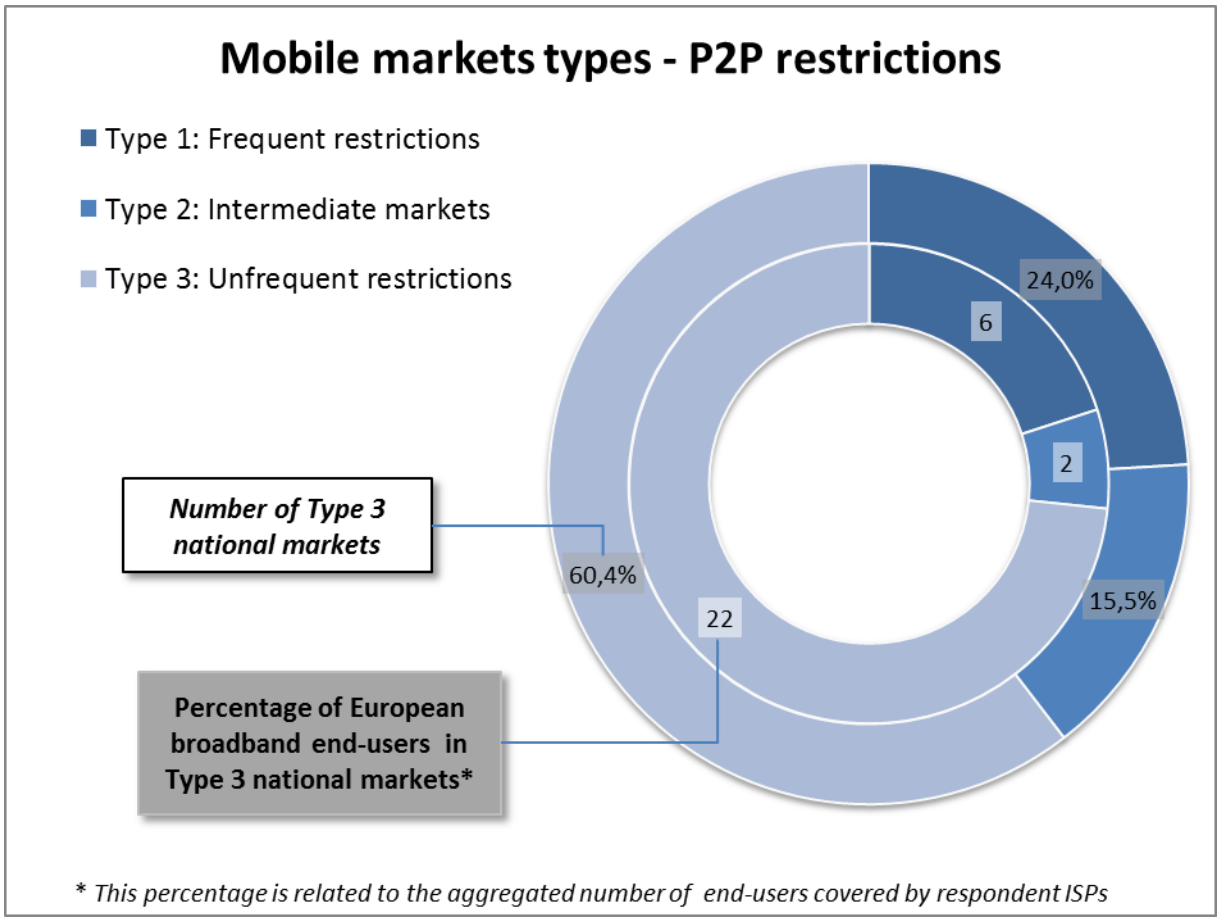

Mobile markets types - P2P restrictions
Type 1: Frequent restrictions
Type 2: Intermediate markets
Type 3: Unfrequent restrictions
24,0%
6
2
15,5%
60,4%
22
Number of Type 3 national markets
Percentage of European broadband end-users in Type 3 national markets*
* This percentage is related to the aggregated number of end-users covered by respondent ISPs

Figure 12

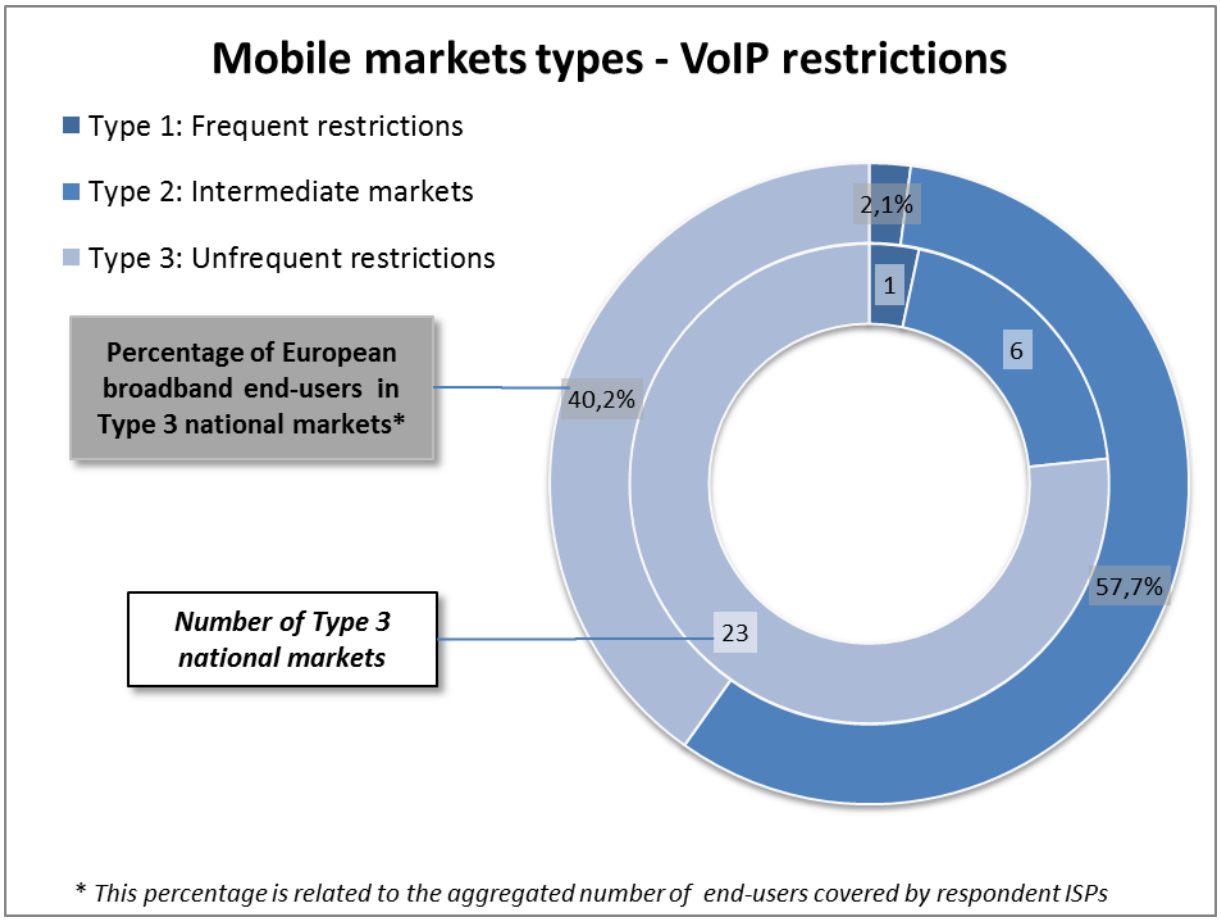

Mobile markets types - VoIP restrictions
Type 1: Frequent restrictions
Type 2: Intermediate markets
Type 3: Unfrequent restrictions
Percentage of European broadband end-users in Type 3 national markets*
Number of Type 3 national markets
2,1%
1
6
40,2%
57,7%
23
* This percentage is related to the aggregated number of end-users covered by respondent ISPs

Figure 13

Annex 1 - General statistics

The following tables display the general statistics of respondent operators which were taken into account in the figures of the document. This amounts to a total of 381 operators: 266 fixed and 115 mobile operators (excluding MVNOs, as explained in section 1.3).

FIXED

Member State	Number of respondent operators	Total number of lines for access to Internet, for the respondent operators (aggregated per country)
Austria	3	1 799 000
Belgium	7	3 212 949
Bulgaria	10	810 071
Croatia	9	776 003
Cyprus	3	198 916
Czech Republic	22	1 611 216
Denmark	9	1 951 942
Estonia	4	272 100
Finland	10	1 415 500
France	6	22 301 000
FYRoM	3	71 324
Germany	11	26 187 516
Greece	5	2 035 500
Hungary	12	1 838 664
Ireland	9	826 932
Italy	7	13 151 787
Latvia	9	335 774
Lithuania	9	578 394
Luxembourg	7	0
Malta	3	126 959
Norway	6	1 573 227
Poland	13	4 971 528
Portugal	5	2 179 628
Romania	21	3 014 485
Slovak Republic	20	580 919
Slovenia	7	449 040
Spain	5	10 723 236
Sweden	8	2 722 100
Switzerland	4	2 565 667
The Netherlands	8	5 264 910
Turkey	5	14 038 527
United Kingdom	6	18 778 857
Total	**266**	**146 363 671**

MOBILE

Member State	Number of respondent operators	Total number of broadband subscriptions for access to Internet, for the, for respondent operators (aggregated per country)
Austria	4	4 371 548
Belgium	3	1 779 162
Bulgaria	3	1 643 121
Croatia	3	657 000
Cyprus	2	286 972
Czech Republic	4	1 904 923
Denmark	5	3 843 333
Estonia	3	207 000
Finland	3	4 435 000
France	4	19 100 000
FYRoM	3	0
Germany	4	29 350 000
Greece	3	5 962 421
Hungary	3	942 955
Ireland	3	2 702 168
Italy	4	19 006 051
Latvia	5	1 055 951
Lithuania	3	219 992
Luxembourg	4	0
Malta	3	135 453
Norway	3	2 384 758
Poland	4	15 404 044
Portugal	3	3 870 002
Romania	6	3 020 004
Slovak Republic	3	1 223 672
Slovenia	4	556 163
Spain	4	15 179 292
Sweden	5	8 512 500
Switzerland	3	5 524 905
The Netherlands	3	10 474 096
Turkey	4	2 932 070
United Kingdom	4	46 223 987
Total	**115**	**212 908 543**

Annex 2 - List of respondents

The following tables display the names of all respondents to the questionnaire. As regards to operators, this amounts to a total of 414 operators: 266 fixed and 148 mobile operators. Among those 148 mobile operators were 33 MVNOs.

Fixed operators
Austria
A1 Telekom Austria
Tele2
UPC Austria
Belgium
Belgacom
Brutélé (VOO)
Clearwire Belgium
Mobistar
Scarlet Belgium
TECTEO (VOO)
Telenet
Bulgaria
BBC Cable
Blizoo
BTC (Vivacom)
Bulsatcom
Cable Sat Zapad
Megalan Network JSC
Mobiltel
Net 1
Network Bulgaria
Croatia
Amis Telekom
AT&T Hrvatska
B.Net Hrvatska
H1 Telekom
Hrvatski Telekom
Iskon Internet
Novi-Net
OT - Optima Telekom
VIPNET
Cyprus
Cablenet
Cyta
Primetel
Czech Republic
AVONET
COMA
Dial Telecom
Dragon
Erkor
Fortech
GRAPE SC
GTS Czech

Fixed operators
Internethome
Kabelova TV CZ
MobilKom
Nej TV
PODA
RIO Media
SELF Servis
Sky Net
Smart Comp
Telefónica
T-mobile
T-Systems
UPC
Vodafone
Denmark
ComX Networks
ELRO Skyline
EnergiMidt
SE
Stofa
TDC
Telenor
Telia
Waoo!
Estonia
Elion
Elisa
Starman
Uus Programm
Finland
AinaCom
Anvia
CSC (non profit)
DNA
Elisa
Kaisanet
Kymen Puhelin KYMP
Nebula
Pohjanmaan PPO
TeliaSonera Finland
France
Bouygues Telecom
Darty
France Télécom – Orange
Free

Fixed operators
Numericable
SFR
FYRoM
Cabletel (Blizoo)
T Home (Macedonia Telekom)
Telekabel
Germany
Deutsche Telekom
EWE Tel
Kabel BW
Kabel Deutschland
Netcologne
QSC
Telefónica Germany
United Internet
Unitymedia
Versatel
Vodafone D2
Greece
Cyta Hellas
Forthnet
Hellas Online
OTE
WIND Hellas
Hungary
DIGI
DRÁVANET
EnterNet 2001
Externet
GTS Hungary
Invitel
Magyar Telekom
PR-TELECOM
RubiCom
Tarr Építő
UPC
ViDaNet
Ireland
BT
Cable and Wireless
Digiweb
Eircom
Imagine
O2 (Telefonica Ireland)
UPC
Verizon
Vodafone
Italy
BT Italia
Fastweb
Telecom Italia
TeleTu
Tiscali
Vodafone
Wind
Latvia
Baltcom

Fixed operators
Balticom
Dautkom TV
IZZI
Latnet Serviss
Lattelecom
LMT
MFL Serviss
Telia Latvija
Lithuania
5CI
Balticum TV
Baltneta
CGATES
Dokeda
Init
LRTC
Splius
TEO
Luxembourg
op1
op2
op3
op4
op5
op6
op7
Malta
GO plc
Melita plc
Vodafone Malta
Norway
Altibox
Eidsiva Bredbånd
Get
NextGenTel
Telenor
Ventelo
Poland
Aster
INEA
Internetia
Multimedia Polska
Netia
Polkomtel
PTC
PTK
Telefonia Dialog
Toya
TP
UPC Polska
Vectra
Portugal
Cabovisão
Optimus
PTC
Vodafone
ZON

Fixed operators
Romania
Ambra
BĂLEANU SERVCOM
CANAL S
CCC Blue Telecom
Cobalt IT
Dial Telecom
Diginet
Digital Cable Systems
Electrosim
Euro-Cable
Fastlink
GTS Telecom
Millenium IT
Nextgen Communications
Orange
Radiocom
RCS & RDS
Romtelecom
TV SAT 2002
UPC Romania
Vodafone
Slovak Republic
Antik Telecom
Axalnet
CondorNet
Dsi data
EHS
GAYA
GTS Slovakia
Imafex
Martico
O-NET
Orange Slovensko
RS NET
RUPKKI
Salamon Internet
Satro
Slovanet
SWAN
Telekom
TRNAVATEL
UPC BROADBAND
Slovenia
Amis
T-2
Telekom Slovenije
Telemach
Telemach Rotovž
Tušmobil
Telemach Tabor
Spain
Cableuropa
Jazztel
Orange
Telefonica
Vodafone

Fixed operators
Sweden
AllTele
Bahnhof Unipessoal LDA
Bredband2 AB
Com hem AB
Ownit Broadband AB
Tele2 Sverige AB
Telenor Sverige AB
TeliaSonera AB
Switzerland
op1
op2
op3
op4
The Netherlands
KPN
Lijbrandt
Tele2/BB Ned
T-Mobile/Online
UPC
Vodafone
XS4ALL
Ziggo
Turkey
Smile
Superonline
TTnet
TurkTelekom
Turksat
United Kingdom
BSkyB
BT
Everything Everyhwere - Orange
Telefonica
TalkTalk
Virgin Media

Mobile operators
Austria
A1 Telekom Austria
Hutchison 3G Austria
Orange Austria
T-Mobile Austria
Belgium
Belgacom
KPN Group Belgium
Mobistar
Scarlet Belgium
Bulgaria
BTC (Vivacom)
Cosmo (Globul)
Max Telecom
Mobiltel
Croatia
Hrvatski Telekom
Tele 2
VIPNET
Cyprus
Cyta
Primetel
Czech Republic
MobilKom
Telefónica
T-mobile
Vodafone
Denmark
ELRO Skyline
Hi3G
TDC
Telenor
Telia
Estonia
Elisa
EMT
Tele2
Finland
AinaCom
DNA
Elisa
TeliaSonera Finland
France
Bouygues Telecom
Darty
France Télécom – Orange
Free
NRJ Mobile
Numericable
Omea Telecom
SFR
FYRoM
ONE
T-Mobile Macedonia
VIP
Germany
Deutsche Telekom

Mobile operators
E-Plus
Kabel BW
Kabel Deutschland
mobilcom-debitel (Freenet)
Netcologne
Telefónica Germany
United Internet
Versatel
Vodafone D2
Greece
Cosmote
Vodafone Greece
WIND Hellas
Hungary
DIGI
EnterNet 2001
Externet
Invitel
Magyar Telekom
PR-TELECOM
Tarr Építő
Telenor Magyarország
ViDaNet
Vodafone
Ireland
Eircom
O2 (Telefonica Ireland)
Italy
BT Italia
Fastweb
H3G
Postemobile
Telecom Italia
Tiscali
Vodafone
Wind
Latvia
Bite
Latnet Serviss
LMT
Tele2
Telekom Baltija
Lithuania
BITE Lietuva
Omnitel
Tele2
Luxembourg
op1
op2
op3
op4
Malta
GO plc
Melita plc
Vodafone
Norway
Ice

Mobile operators
NetCom (TeliaSonera)
Tele2
Telenor
Ventelo
Poland
Aster
INEA
P4
Polkomtel
PTC
PTK
Telefonia Dialog
Toya
Vectra
Portugal
Optimus
TMN
Vodafone
Romania
Cosmote
Orange
RCS & RDS
Romtelecom
Telemobil
Vodafone
Slovak Republic
Orange Slovensko
Telefónica O2 Slovakia
Telekom
Slovenia
Si.mobil
T-2
Telekom Slovenije
Tušmobil
Spain
Cableuropa
Jazztel
Orange
Telefónica Móviles
Vodafone
Yoigo
Sweden
HI3G Access AB
Netett Sverige AB (Net1)
Tele2 Sverige AB
Telenor Sverige AB
TeliaSonera AB
Switzerland
op1
op2
op3
The Netherlands
KPN
Tele2/BB Ned
T-Mobile/Online
Vodafone
Turkey

Mobile operators
Avea
Turkcell
Turksat (satellite)
Vodafone
United Kingdom
Telefonica O2 UK Ltd
Three
Vodafone
Everything Everyhwere

Other stakeholders
Verizon
QSC (Germany)
BEUC
VON Europe
LQDN
Vzbv (Germany)
18 private individuals

Annex 3 – Questionnaire sent to operators

					ISP only	ISP only	ISP only			
Country	**Operator**	**Type of measure***		**Description of the measure**	**Objective**	**Method of implementation (if applicable)**	**Number of subscribers having a subscription where this measure is**	**How is the user informed?**	**Can the user activate/deactivate the measure? How?**	**Protection of business secret**
		User's access is blocked/throttled, e.g. after having downloaded/uploaded a certain amount of data.								
		If you offer specialized services (e. g. facilities-based telephony and television over broadband as opposed to "over the top" applications), how does this affect the Internet access traffic on the same access								
		Different priority levels within Internet access traffic	*Examples of measures that depend on the type of protocol or application (mail, video, web, etc.) accessed via internet:*							
			P2P file sharing is blocked/throttled							
			VoIP is blocked/throttled							
			Other specific kind of traffic (port, protocol, application, usage, etc) is blocked/throttled							
			Specific application/content provider (e.g. website or VoIP provider) is blocked/throttled							
			Specific type of over-the-top traffic given preferential treatment (e.g. specific content/application and/or specific application/content provider)							
		Restriction on the type of terminal allowed, or tiered pricing depending on the terminal used								
		Other relevant practice	To be completed with other types of measures - *add as many lines as extra practices*							
		* If several effective measures fall in the same category, add one line per measure	***Expected answer:***	*Description of the measure, in terms of impact for the users*	*Reason(s) for the implementation of the measure (e.g. congestion management, network security, law enforcement, commercial terms)*	*How the measure is implemented (technically) and, if applicable, which conditions trigger it (e.g. threshold of data consumption). If the measure is not technically enforced, state: "N/A".*	*Number of subscribers to the packages where this measure is implemented*	*Quotation of the relevant contractual terms, plus any other type of information given to the user.*	*Yes' or 'No' If Yes, specify how, technically (which actions have to be taken by the user) and commercially (free/paying option).*	*If some information in a specific row is considered confidential, please mention precisely which parts should not be individually disclosed, and why. Reminder: in any case, all information is subject to publication, at least in a form that will be anonymous (generally aggregate).*

		ISP only
Country	**Operator**	**Total number of subscribers to packages that include a fixed access to the Internet (mobile: see other tab)**

Country	**Operator**	**Open questions regarding traffic management**	**Response**
		What kind of application-agnostic traffic management techniques is used for e.g. congestion management?	
		What technologies (e.g. DPI) are used in the network to differentiate between packets?	
		Where are these techniques implemented in the network? (e.g. close to interconnection points)	
		Are there some plans for implementing additional traffic management practices in the future?	

Country		**Additional open questions**
		Any additional comment

Comments on any other conditions that may impact users' ability to access the content/application of their choice	

					ISP only	ISP only	ISP only			
Country	**Operator**	**Type of measure***		**Description of the measure**	**Objective**	**Method of implementation (if applicable)**	**Number of subscribers having a subscription where this measure is**	**How is the user informed?**	**Can the user activate/deactivate the measure? How?**	**Protection of business secret**
		User's access is blocked/throttled, e.g. after having downloaded/uploaded a certain amount of data.								
		If you offer specialized services, how does this affect the Internet access traffic on the same access								
		Different priority levels within Internet access traffic	*Examples of measures that depend on the type of protocol or application (mail, video, web, etc.) accessed via internet:*							
			P2P file sharing is blocked/throttled							
			VoIP is blocked/throttled							
			Instant Messaging services are blocked/throttled							
			Other specific kind of traffic (port, protocol, application, usage, etc) is blocked/throttled							
			Specific application/content provider (e.g. website or VoIP provider) is blocked/throttled							
			Specific type of over-the-top traffic given preferential treatment (e.g. specific content/application and/or specific application/content provider)							
		Restriction on the type of terminal allowed, or tiered pricing depending on the terminal used								
		Other relevant practice	To be completed with other types of measures - *add as many lines as extra practices*							
		* If several effective measures fall in the same category, add one line per measure	***Expected answer:***	*Description of the measure, in terms of impact for the users*	*Reason(s) for the implementation of the measure (e.g. congestion management, network security, law enforcement, commercial terms)*	*How the measure is implemented (technically) and, if applicable, which conditions trigger it (e.g. threshold of data consumption). If the measure is not technically enforced, state: "N/A".*	*Number of subscribers to the packages where this measure is implemented*	*Quotation of the relevant contractual terms, plus any other type of information given to the user.*	*Yes' or 'No' If Yes, specify how, technically (which actions have to be taken by the user) and commercially (free/paying option).*	*If some information in a specific row is considered confidential, please mention precisely which parts should not be individually disclosed, and why. Reminder: in any case, all information is subject to publication, at least in a form that will be anonymous (generally aggregate).*

		ISP only
Country	**Operator**	**Total number of subscribers to packages that include a mobile access to the Internet (fixed: see other tab)**

Country	**Operator**	**Open questions regarding traffic management**	**Response**
		What kind of application-agnostic traffic management techniques is used for e.g. congestion management?	
		What technologies (e.g. DPI) are used in the network to differentiate between packets?	
		Where are these techniques implemented in the network? (e.g. close to interconnection points)	
		Are there some plans for implementing additional traffic management practices in the future?	

Country		**Additional open questions**
		Any additional comment

				Comments on any other conditions that may impact users' ability to access the content/application of their choice						

Annex 4 - Glossary

BEREC	Body of European Regulators for Electronic Communications
BoR	Board of Regulators
COM	Communication
DOS	Disk Operating System
DPI	Deep Packet Inspection
EC	European Commission
EU	European Union
FTP	File Transfer Protocol
HTTP	Hypertext Transfer Protocol
IAS	Internet Access Service
IP	Internet Protocol
IPTV	Internet Protocol Television
ISP	Internet Service Provider
kbps	Kilo Bits Per Second
MNO	Mobile Network Operator
MS	Member State
MVNO	Mobile Virtual Network Operator
NetBios	Network Basic Input/Output System
NRA	National Regulatory Authority
P2P	Peer-to-Peer
SMTP	Simple Mail Transfer Protocol
TMI	Traffic Management Investigation
TV	Television
VoD	Video on Demand
VoIP	Voice over Internet Protocol