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Reporting policies of ISPs: Do general terms and conditions (GTCs) match with the reality?

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Reporting Policies of ISPs: Do General Terms and Conditions (GTCs) Match with the Reality?

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Reporting Policies of ISPs: Do General Terms and Conditions (GTCs) Match with the Reality?

- ABSTRACT -

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Technological progress allows Internet Service Providers (ISPs) to carry out network management practices in a discriminatory fashion without being detected by their customers. This creates an opportunity that providers will exploit this information asymmetry in an opportunistic way by blocking and/or throttling certain services and applications without informing their customers in an adequate fashion that their Internet service is a restricted one.

The main objective of this paper is to investigate the extent to which reporting policies – as implemented through the General Terms and Conditions (GTCs) – of selected ISPs match with the display of discriminatory behavior by those ISPs as shown by Grove & Agic, (2012). Our analysis examines whether ISPs in Europe and the USA are informing their subscribers adequately about discriminatory traffic management. We, thus, analyze GTCs, signed between ISPs and their subscribers by applying a cross-country/provider approach, focusing on three main aspects of the contractual agreement: (1) availability of service, (2) obligations of the customers and (3) the contractual agreements concerning any intervention in services by ISPs.

First results show that no significant evidence of contractual transparency regarding the actual adverse deployment of *Deep Packet Inspection* (DPI) and similar traffic management tools by the ISPs could be found. This supports the general goal to promote transparency regarding ISPs' traf-

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fic management routines by suggesting compulsory rules that should oblige providers to make more accurate statements in terms of their general business practices.

For policy makers, this is yet another factor that needs to be taken into account regarding potential regulatory interventions in this field and an explicit network neutrality stipulation may be required in order to safeguard the openness of the Internet and protect consumers' basic rights of information and well-grounded choice.

KEYWORDS: Network Neutrality, General Terms and Conditions, Regulation, Telecommunications, User Discrimination.

JEL Codes: D22, D63, G13, I38, K23, L86

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1 Introduction

1.1 Background

In the last 20 years we have witnessed an unprecedented increase in the deployment of Internet services and data traffic via fixed and (especially in the last couple of years) mobile networks. According to Cisco (2012) this trend is expected to continue in this vein and even accelerate in the coming years providing grounds for the global IP traffic to surpass 1.3 zetta-bytes per year in 2016.⁴ As a consequence, Internet Service Providers (ISPs) fear that this increase in data traffic over their networks will produce severe bottlenecks jacking up costs of maintaining and expanding the infrastructure. In order to avoid this reputed trade-off between the increasing necessity for infrastructure investments – in order to enable smooth and steady network traffic – and the rising costs of financing and provisioning the required infrastructure, the ISPs are actively managing their networks. Furthermore, technical progress especially in light of Next Generation Networks (NGN) facilitated new mechanisms for traffic management, as for instance, Deep Packet Inspections (DPI), Quality of Service (QoS), or Packet Shaping. On the one hand, these tools are necessary in order to conduct reasonable network management (to avoid traffic congestions and secure a proper functioning of broadband networks). On the other hand, they – most of all DPI – enable ISPs to filter network traffic more precisely and in real time, hence, facilitating prioritisation between different data flows by introducing intelligence into so called *dumb*⁵ networks.⁶ As a result, these tools allow network operators to discriminate against certain applications and content or even to block them from their networks, thus, jeopardizing the principles of network neutrality.⁷

Moreover, the immense growth in the use of the Internet, the appearance of next generation converged services and applications (e.g. VoIP, eHealth, smart grids etc.) and the related increase in the volume of transferred data, as discussed before, render digital network processes more and more complex, intransparent and therefore generally hard to comprehend for techni-

⁴ See Cisco (2012), p. 1.

⁵ This term reference to the end-to-end principle meaning that the original architecture of the Internet facilitates direct communication between applications. For more details, see for instance Marucs et al. (2011) and Grove et al. (2012).

⁶ See Mueller & Asghari (2012), p. 1.

⁷ In short, network neutrality incorporates an Internet network that does not prioritise one data stream over the others. In general terms, that means that, for instance, VoIP services should not be favoured over, let's say, email or web surfing. For a more detailed discussion of the many definitions and concepts of net neutrality, see inter alia Wu (2003), van Schewick (2010a), van Schewick (2010b), Marcus et al. (2011), Null (2011) or Yoo (2006).

cally less minded Internet users. In addition, most of the Internet-users are unaware of the technical processes and functional dimensions regarding the different network management practices such as DPI. In other words: ISPs are enabled to carry out network management practices in a discriminatory fashion without being detected by their customers. This creates the risk that providers will exploit this information asymmetry in an opportunistic way by blocking and/or throttling certain services and applications without informing their customers in an adequate fashion that their Internet service is a restricted one.

1.2 Objectives

Against this background, empirical studies based on M-Lab data (Glasnost Test) provide evidence that some ISPs in the countries examined (Germany, France, Italy and USA) deployed DPI mechanisms for the given time period in order to discriminate P2P BitTorrent applications.⁸ The investigations showed that some large ISPs were deliberately restricting the speed of or in some cases completely blocking BitTorrent traffic (even at times of low network loads).⁹ Bearing this in mind and also the fact – as mentioned before – that an average Internet user is usually not aware of the common network management practices on the part of her/his ISP, the paper at hand examines the extent to which reporting policies – as implemented through the General Terms and Conditions (GTCs) – of selected European and US ISPs (both cable and telecom service providers) match with the display of discriminatory behaviour by the very same ISPs. Moreover, in order to analyse GTCs, signed between ISPs and their subscribers, we apply a cross-provider/cross-country approach. By conducting such an approach, we are seeking to find any similarities/differences in the reporting policies amongst ISPs in general but also between cable and DSL-based operators on a national or international level – especially between Europe and USA concerning their opposite regulatory situations in terms of net neutrality. Hence, we focus on the focal question: *Is there sufficient transparency regarding network management practices in Europe and USA?*

⁸ See Grove & Agic (2012). See also Mueller & Asghari (2012).

⁹ Due to the fact that the topic of network discrimination concerning all the possible economic and technical incentives an ISP might have for prioritizing some streams over others, has been widely discussed in the contemporary economic, computer science and legal literature, the scope of the paper does not cover this area. We suggest, however, to see for instance Frischmann & van Schewick (2007), van Schewick (2010a), van Schewick (2010b), Marcus et al. (2011), Mueller (2011) for more details on network discrimination in theory.

Due to the fact that GTCs represent a fundamental contractual agreement between an ISP and its subscribers by defining all the duties and obligations both parties have to adhere to, they are also an important factor upon which end-users can make an informed decision concerning a particular ISP. Hence, having a precise and accurate reporting system clearly stating all the bandwidth management activities a specific ISP conducts, will certainly improve both transparency and competition on the Internet access markets. This also aligns with the general EU and US approach towards net neutrality which stipulates a promotion of competition and transparency in the field of telecommunications.¹⁰

Following this, the overall goal of the paper at issue is to contribute to more transparency regarding ISPs' traffic management routines by suggesting compulsory rules that should oblige providers to make more accurate statements in terms of their general business practices. For policy makers, this is yet another factor that needs to be taken into account regarding potential regulatory interventions in this field and an explicit network neutrality stipulation may be required in order to safeguard the openness of the Internet and protect consumers' basic rights of information and well-grounded choice.

1.3 Scope

The paper is organised in the following fashion. In the section 2, we introduce the methodological framework used to investigate the focal research question whether European and US access providers inform their clients about (discriminatory) network operations. After presenting some important general assumptions and the underlying data, the main emphasis of this section lies on potential shortcomings of the analytical approach which need to be addressed in order to provide sustainable and valid results. Next section 3 deals with existing empirical findings in terms of discriminatory behaviour of European and US ISPs. In this section, we devote our focus on the results of our previous study conducted with the assistance of "The Network is Aware" project at the Syracuse University School of Information Studies and Delft University of Technology. Here we analysed whether ISPs in selected European countries engage in discriminatory behaviour towards BitTorrent traffic and discovered that some major

¹⁰ See BEREC (2011), p. 3. See also Crocioni (2011), pp. 5f.

operators deployed DPI in order to restrict or block P2P data flows. Mueller and Asghari (2012) conducted a similar analysis for US and Canadian fixed-line operators with profound results in terms of DPI deployment. Section 4 incorporates the main part of the analysis at hand presenting the results of our investigation of the General Terms and Conditions of the selected ISPs. Finally, section 5 contains conclusion and addresses some important issues that need to be considered in future research.

2 Methodology

This section focuses on the analytical framework and provides an overview of the applied methodological approach in order to address the focal research question: *Do European and US access providers inform their subscribers about the on-going (adverse) network management operations?* To answer this question, we apply a semi-quantitative research concept to the extent that we investigate the GTCs of the selected providers based on some general assumptions and parameters previously defined, and compare these findings with the results of the empirical results gathered from previous research projects (see section 3). This combination draws a clearer picture on the reporting policies of selected access operators especially those which have been engaged – according to empirical findings – in discriminatory conduct.

2.1 General Assumptions

In order to examine GTCs as agreed between the ISP and the Internet service user, we focus on the following three aspects of the contractual agreement: (1) availability of service, (2) obligations of the customers and (3) the contractual agreements concerning any intervention in services by ISPs. Availability of service refers to the actual failure-, loss- or delay rate of data as experienced by subscribers. The second aspect (obligations of the customers) contains all commitments of the service users, including the financial, contractual and behavioural duties, a discrete user has to adhere to in order to get the subscribed service. Finally, the third dimension (treatment of services by ISPs) considers any network management – reasonable or not – by an ISP that results in a service being blocked or throttled. Since our major emphasise lies on non-reasonable bandwidth management of ISPs, any discriminatory shaping or prioritising of data streams cited in GTCs of a specific ISP is explicitly stated in our framework. On the other hand, variables – in terms of both parameters (2) and (3) – that

refer to common legal, financial or technical obligations – stemming from national or international laws or any other societal norm – and apply to GTCs of an average ISP, are summarised within the framework using proxies as defined in Table 1 (see Appendix).

As mentioned above, the analysis considers ISPs from three European countries (Germany, France and Italy) and USA. The reason for focusing on these particular countries lies in the fact that the selected European states have not envisaged any affirmative legislative actions towards an explicit network neutrality order yet. On the other hand, we have USA where the debate over net neutrality commenced with the well-known Comcast-BitTorrent case¹¹ and where the Federal Communications Commission (FCC,) has employed a much more hands-on approach by introducing an *ex ante* non-discriminatory principle within its “Internet Policy Statement”.¹² This constellation provides the possibility to investigate reporting policies of ISPs coming from opposite regulatory regimes in terms of network neutrality and to examine whether these different governmental approaches have an impact on how/whether discrete network operators inform their subscribers about the undertaken network management activities. Consequently, we expect that – taking the aforementioned different regulatory approaches into consideration – US operators would make more accurate and precise statements considering traffic management than ISPs from Germany, Italy and France. Based on this assumption, we look into empirical findings on the discriminatory use of DPI and compare those results that display a clear adverse behaviour on behalf of a certain ISP with its GTC especially the part about network management practices (defined here as parameter (3)).

The second assumption of this paper relates to the correlations between the three analysed parameters of GTCs as stated above – most of all between aspect (1) availability of service and (3) the contractual agreements concerning any intervention in services by ISPs. The service availability refers to link failures that could eventually lead to packet losses, delays and outages and may result in generally worse quality of service experienced by the user.¹³ In

¹¹ See for more details, Mueller & Asghari (2012).

¹² The situation in USA is, however, still uncertain due to the fact that in 2010 the District of Columbia court of appeals ruled against FCC arguing that the regulator lacked a sufficient statutory basis for its order. See Crocioni (2011), pp. 5f.

¹³ See Bhattacharyya et al. (2003), p. 1.

today's high-traffic IP networks, data stream failures occur frequently and are often a result of traffic congestions and other unplanned circumstances beyond the direct control of the network operator. However, a high failure rate could theoretically also be an indicator that an ISP is restricting or blocking certain data flows. Hence, our second assumption is defined as follows: low service availability rate indicates possible blocking/restricting of a service by an ISP and, thus, should be stated in aspect (3) of the GTC. Since high failure rates are usually caused by overwhelming network loads, we mostly focus on those ISPs that display high rates in terms of DPI deployment as showed in empirical findings.

Especially notable, empirical studies reveal that a provider's infrastructure played an important role when making the decision whether to deploy DPI for network traffic management.¹⁴ In this juncture, data for US and German ISPs show that merely cable-modem operators restricted P2P traffic whereas DSL-based providers had far fewer positive DPI results in the same period.¹⁵ As a result it is to be expected that cable-modem ISPs would provide much more accurate information regarding bandwidth management practices to their subscribers than DSL providers.

Another important parameter that in our opinion would have to be controlled for is the usage cap policy which has gained momentum in USA in 2008 after Comcast – affected by regulatory proceedings and the ever-growing negative publicity resulted from its DPI deployment – has announced its new acceptable use policy (AUP) introducing a monthly data cap of 250 GB for each subscriber.¹⁶ Hereafter, many ISPs worldwide have pursued a similar strategy of targeting “heavy users” by throttling the access speeds when a certain threshold has been reached. In other words, those ISPs that have established a usage cap policy would inevitably have to deploy DPI or similar traffic management tools, in order to “punish” bandwidth-intensive subscribers, than those access operators which have not opt for a usage cap model.

The analysis at hand tends to prove these assumptions by examining data as described in the following section.

¹⁴ See Mueller & Asghari (2012). See also Grove & Agic (2012).

¹⁵ These strict differences in terms of underlying access technology could not be found for Italian and French ISPs though.

¹⁶ See Mueller & Asghari (2012), p. 7.

2.2 Data

As mentioned above, the paper at issue considers General Terms & Conditions (GTCs) of both cable and telecom providers from Germany, France, Italy and the United States. These documents can be downloaded from the website of each provider. Moreover, we focus on following three aspects of contractual agreements: (1) availability of service, (2) obligations of the customers and (3) the contractual agreements concerning any intervention in services by ISPs.

The empirical findings in section 3 are based on quantitative measures of the deployment of DPI in selected countries using data from the test called *Glasnost* and processing algorithms developed by “The Network is Aware” project at Syracuse University School of Information Studies and Delft University of Technology.¹⁷ Glasnost test can help end-users detect whether their ISP is blocking or throttling BitTorrent traffic and other protocols.¹⁸ The available data regarding the use of DPI provides test results for 2009, 2010, 2011 and the first quarter of 2012.

2.3 Constraints of the Analysis

In order to analyse GTCs correctly and to increase validity of the results, a number of constraints need to be overcome. First and foremost, a major obstacle in terms of analysing contractual agreements between ISPs and subscribers is the fact that those contracts are designed for national market participants and thus conceived in the national language. Hence, in order to achieve highly accurate results, we had to include students and peers from countries at stake (France and Italy) which provided linguistic assistance. Secondly, General Terms and Conditions are usually subject to constant change and revision, a fact that renders the entire analysis largely complicated. In order to control for this confounding factor, the study exam-

¹⁷ You can find more information about that project at <http://deeppacket.info>.

¹⁸ Glasnost test data are stored on an open-source platform known as Measurement Lab (MLab, <http://www.measurementlab.net>) and are globally available. For detailed workings of the Glasnost test, see Dischinger et al. (2010).

ines merely the latest version of the respective GTC at the time when the paper has been written.¹⁹

In terms of US network operators, we only examine those ISPs for which the Glasnost data provide a significant number of valid tests, since the test provides data for 34 US ISPs, most of which are small local access providers with a small number of customers. Analysing all of them would certainly require a great amount of time and efforts, whereas the impact on the final outcome would be minor. Hence, in our analysis we focus on those ISPs with more than 150 valid tests per quarter. Needless to say, the US cable and telecom providers taken into account (those that have more than 150 valid tests for each quarter) are at the same time those with the highest subscriber numbers, revenues and system significance regarding the US telecommunications market.

In terms of Glasnost data, the major limitation is certainly the fact that the algorithms behind the test exhibit a false positive of up to 10% prior to August 2009 and about 5% thereafter.²⁰ In other words, ISPs that exhibit a percentage of DPI lower than 10% over a period of several consecutive quarters are hardly deploying DPI in order to manipulate BitTorrent traffic. Thus, in order to avoid false accusations, one should focus on those ISPs with higher results in terms of DPI deployment (usually higher than 50%).

Another constraint that has to be considered in terms of Glasnost data is also the number of valid tests since the validity of test results increases with the number of deployed tests during one quarter. Hence, we do not consider ISPs with less than 10 tests per quarter.

3 Previous Empirical Findings

Even though DPI does not represent a novelty when discussing network management practices, only a handful of researchers have been dealing with empirical analysis of DPI deployments by ISPs. One of the main reasons for this lack of more empirical findings in this realm is the fact that such an analysis requires a very complex modelling structure since simply ask-

¹⁹ We examine only those versions of GTCs that have been effective until 9th August 2013.

²⁰ See Dischinger et al. (2010), pp. 8-9.

ing operators whether they use DPI to discriminate among applications, would not lead to viable research results. As an alternative and certainly more viable research method, one would have to run network tests to see what is really going on.²¹ And that is exactly what the aforementioned Glasnost test is offering.²²

We base this section mainly on two papers and their comprehensive analysis of DPI deployments in Europe and USA. Grove and Agic (2012) investigated whether German, Italian and French fixed-line providers are using DPI for discriminating BitTorrent traffic and obtained evidence that some ISPs adversely deployed DPI in great amounts for the given time period. Mueller and Asghari (2012), on the other hand, explored the use of DPI in USA and Canada to “throttle” BitTorrent streams and show that these implementations had major implications in terms of regulatory proceedings and general public dispute. Both papers supplement their analysis by quantitative data drawn from the Glasnost test and processing algorithms developed by “The Network is Aware” project at Syracuse University School of Information Studies and Delft University of Technology. For reasons of brevity, we focus here mainly on pure DPI deployment in Europe (Germany, France and Italy) and USA neglecting all the implications this had on regulation and Internet governance in countries at stake.

3.1 DPI Deployment in Europe

This section summarises results of our previous analysis regarding the discriminatory use of DPI by German, French and Italian fixed-line providers since 2009. The results can be seen in Tables 3, 4 and 5 (see Appendix) and are located in the column on the far right. This column shows the percentage of Glasnost tests (ran by Internet users) indicating that the ISP was intervening into BitTorrent traffic via DPI. As mentioned before, the column with the number of valid tests is of significant importance in order to gain reliable results due to false positives.

One of the most striking results of this study is certainly the case of Kabel Deutschland, the largest cable operator in Germany. This ISP exhibited positive and very high DPI results during the whole period at stake peaking in quarter 1 of 2011 at 69% of tests being manipulated by Kabel Deutschland. On average, Kabel Deutschland was discriminating against ca. 40% of

²¹ See Asghari et al. (2013), p. 3.

²² For more details about the workings of Glasnost test see Dischinger et al. (2010).

tests per quarter indicating a very high deployment of DPI during the observed period. However, a decreasing trend in shaped BitTorrent tests by the ISP can also be seen as the results exhibit only 8% of blocked/shaped BitTorrent streams in quarter 3 of 2011 (see Figure 1 in the Appendix). Generally, as far as other German ISPs are concerned, no significant results could be obtained from our analysis.

Similarly, in Italy some ISPs exhibited very high percentages of DPI deployment – mainly Opitel and FastWeb – whilst others obtained moderate or low results (see Table 4). Moreover, Opitel and FastWeb used DPI for blocking/throttling BitTorrent the most in the first half of 2009 – Opitel has shaped 65% of the P2P traffic in the first quarter of 2009 whilst for FastWeb this number was 42% in the quarter 2 of 2009 (see Table 4). As it was the case in Germany, Italian users also experienced a steady reduction in manipulated BitTorrent tests ever since.

Finally, no significant DPI results could be found for French ISPs. Here, the data show a relatively low and declining DPI deployment for the period at consideration for all ISPs (see Table 5).

As mentioned before, the analysis shows a decreasing trend in the deployment of DPI in all three countries at issue. In line with this, Figures 1, 2 and 3 (see Appendix) show, that Kabel Deutschland, FastWeb, Opitel and Iliad abruptly changed their DPI policies mostly during 2009. Since no explicit net neutrality rulings were passed nor were any attempts to regulate network management activities made in these countries (nor at EU-level) during that time, we assume that this development has been triggered by the Comcast case of 2008, when US cable operator's BitTorrent blocking policies were revealed to the public. Eventually, Comcast experienced massive critical media coverage and was also fined by the Federal Communications Commission (FCC) leading to severe financial and reputational implications for the ISP. European ISPs feared something similar could also happen in their court, hence the decreasing percentages of blocked/throttled BitTorrent applications in the countries at stake. Another important aspect of the resulting data is the differing DPI deployments among ISPs considering operators' infrastructure. So we have Kabel Deutschland, as the largest cable operator in Germany that was using DPI for bandwidth management far more than DSL providers (such as Deutsche Telekom, Vodafone Germany or Telefonica O2 Germany) that show almost negli-

gent results. Regarding Italian ISPs, Glasnost data covered merely DSL providers so that a difference among ISPs in terms of the underlying infrastructure and DPI deployment could not be observed. As seen before, French ISPs exhibit very low or moderate DPI values in general irrespective of the infrastructure in use.

3.2 DPI Deployment in USA

The study conducted by Mueller and Asghari (2012), analyses Glasnost data for US and Canadian ISPs covering last three quarters of 2008, all of 2009 and the first quarter of 2010. We supplement these findings with more recent Glasnost results till 2012. As mentioned before, our analysis focuses only on US ISPs with more than 150 valid tests for each quarter. Hence, we present recent results for 8 largest network operators in USA. Here we have to emphasise again one important constraint in terms of Glasnost data and that is the fact that the test algorithms produce a false positive of up to 10% prior to August 2009 and about 5% thereafter. This is also one of the main reasons the results display an abrupt reduction in DPI percentages around quarter 3 2009 (change from Glasnost v. 1 to Glasnost v. 2). Nevertheless, some very interesting events occur on the US Internet access market that led to a reduction in the adverse deployment of DPI in USA and that also had a great influence on the developments in Europe.

The fierce debate over the rationality of DPI as a bandwidth management tool was triggered in the USA, especially with Comcast's strategic decision to manipulate BitTorrent traffic. Comcast's massive use of DPI was mainly encouraged by U.S. Supreme Court's decision in 2005 to uphold FCC's classification of cable providers as deregulated "information service" providers. As a result, Comcast's management felt no obligation for seeking permission to use DPI, nor the necessity to inform its subscribers about the ongoing network management routines.²³ As could be seen in Figure 4 (see Appendix), Glasnost data exhibit very high values in terms of DPI deployment by Comcast in 2008 when over 50% of BitTorrent tests have been blocked/throttled by the cable ISP. Other ISPs, such as the wireless provider Clearwire and those that just like Comcast also rely on cable infrastructure (Cox and Charter), started shaping data traffic using DPI as well (see Table 6 in the Appendix). However, the DPI use in USA practically ceased in August 2008 due to FCC proceedings against Comcast following a mas-

²³ See Mueller & Asghari (2012), p. 4.

sive public discomfort with the ISP's bandwidth management routines (see Tables 6 and 7 in the Appendix).²⁴ As it was the case in Germany, it was mainly cable operators (Comcast, Charter and Cox) and a wireless ISP (Clearwire) that deployed DPI in greater amounts than DSL providers. Hence, the underlying infrastructure had in deed played a crucial role in the decision to conduct non-reasonable network management. Unlike in Europe, where the declining trend in the deployment of DPI was most probably linked to the developments in USA and not directly impacted by national regulation, in USA its was mainly the FCC intervention and a tremendous public exposure that hit Comcast in 2008 that forced US ISPs to refrain from their previous behavior.

4 Results & Applicability

The results of our in-depth analysis of the reporting policies of European (German, French and Italian) and US fixed-line ISPs can be obtained from Table 2 in the Appendix. As previously stated – due to reasons of brevity – we merely concentrate on blocking/shaping activities of ISPs that cannot be defined as reasonable bandwidth management routines nor are “forced” by non-compliant behaviour of the subscribers, but rather on those network management practices that aim at blocking/throttling certain applications/content based on merely economic reasons. In this sense, Table 1 (see Appendix) defines proxies for variables (2) *obligations of the customers* and (3) *the contractual agreements concerning any intervention in services by ISPs* that is to be regarded as reasonable network management. The proxies summarise all the common contractual obligations and rights, both parties have to comply to, which could be (more or less) found in the GTCs of an average ISP. Thus, we define following proxies: for variable (2) – *customer commitments and obligations* – we identify *financial, technical and legal obligations, property and intellectual rights* and *prohibited activities*; and for variable (3) – *blocking and restricting of services* – the proxies are *termination/suspension of services due to non-compliance of the user* and *reasonable network management*. As for *financial, technical and legal obligations*, we summarise all the commitments a user has to fulfil in order to get a service considering, inter alia, payment of monthly fees, different usage charges and fees, taxes (financial obligations), technical and systemic requirements for a proper functioning of the network (technical obligations) and compliance with all applicable laws, rules and

²⁴ See Mueller & Asghari (2012), pp. 6ff.

regulations (legal obligations). The proxy, *property and intellectual rights*, refers to the protection of a third party's legal right to a particular property and implies mostly a proscription of distributing/copying of unauthorized content (video, audio etc.) and software via the internet. Furthermore, the proxy, *prohibited activities*, defines certain rules of behaviour stipulating how a subscriber has to conduct himself when using a subscribed service and what activities he/she should refrain from in order to avoid a suspension/termination of the service. This proxy also corresponds widely with the proxy *termination/suspension of services due to non-compliance of the user* which defines contractual rights of the ISP to suspend/terminate the service if the user breaches certain rules as agreed in the contract. Last but not least, *reasonable network management* describes all the bandwidth management practices by an ISP that are necessary due to public security reasons, statutory provisions, reliability of network operation, maintenance of network integrity, data security or due to necessary operational or technical works.

4.1 Similarities and Differences amongst Providers/Countries

When examining our results in Table 2 (see Appendix), it is clear that ISPs provide very similar GTCs in many aspects (irrespective of the country the ISP is from). Based on the proxies defined in Table 1, we could not find any significant differences regarding *Customer Commitments & Obligations*. In terms of *Blocking/restricting of Services* based on either reasonable network management or due to non-compliance of the User, the examined ISPs also display very similar outcomes. They all block/suspend services if this is necessary due to public security reasons, statutory provisions, reliability of network operation, maintenance of network integrity, data security or due to non-compliance of the user in terms of appropriate conduct. One of the most remarkable similarities expressed in the results is the fact that DPI is not mentioned in any of the examined GTCs even though previous empirical findings delivered significant evidence in favour of DPI deployment in the countries at stake. Concerning the parameter *Service Availability*, European ISPs display very clear statements in terms of quality levels guaranteed by the contract (these values range between 90% at French ISP SFR and 98.5% guaranteed by Kabel Deutschland in Germany) whereas similar values could not be found in GTCs of any US provider at issue.

However, the most striking differences occurred within the parameter *Blocking/restricting of Services* regarded as specific network management activities (see Table 2). As assumed, US ISPs delivered much more precise and accurate information considering their network management policies than ISP from Germany, France or Italy. However, US providers fail to provide concrete details about the techniques used for addressing network congestions.

In terms of the underlying access technology, the results of the analysis could not display any significance as was the case in empirical studies described in the previous chapter. Although Kabel Deutschland, as the largest cable operator in Germany, provides much more information regarding its bandwidth management routines than German DSL ISPs, similar outcomes could not be found in other countries at consideration.

4.2 Comparing GTCs with Empirical Findings

When comparing ISPs' empirical findings in terms of DPI deployment and their statements (within the GTCs) regarding the very same implementation of DPI, some very interesting aspects could be drawn. As mentioned before, none of the examined ISPs (whether they actually used DPI according to Glasnost data or not) provides any information on DPI in the General Terms and Conditions. However, in some cases we do find more information considering non-reasonable bandwidth management routines on behalf of those ISPs that used DPI than the others that refrain from such behaviour. Following section gives a summary of the analysis of national GTCs keeping in mind the empirical findings on the adverse usage of DPI.

In case of Germany, it was Kabel Deutschland that – according to Glasnost data – used DPI in order to block/throttle BitTorrent and similar applications whilst other ISPs show very little or none discriminatory deployment of traffic management tools. In this juncture, Kabel Deutschland's GTC offer much more information in terms of specific network management activities (that we do not define as reasonable bandwidth routines). Even though the explicit use of DPI is in no fashion stated in Kabel Deutschland's GTC, most of the network management activities are addressing file-sharing applications (see Table 2 in the Appendix) by restricting their usage, however only if a risk of network overload exists. In this case, Kabel Deutschland has introduced a capping policy aiming directly at reducing P2P traffic via its networks allowing

the subscribers to download maximally 10 GB of data within one day. If this threshold is surpassed, the provider throttles transfer rates exclusively for file-sharing applications. As for other German ISPs, GTCs provide hardly any information regarding non-reasonable network management activities (see Table 2).

As showed in chapter 3.1, Glasnost data provide no significant evidence regarding French ISPs using DPI for manipulating P2P data streams. In line with this, we find almost none statements in terms of non-reasonable network traffic management whilst examining GTCs of French fixed-line providers. However, France Telecom (Orange) presents a very interesting solution how to deal with overwhelming network congestions caused by file-sharing platforms. The provider offers a service called “Control your download” for a monthly fee that blocks the usage of P2P applications on the subscriber’s end-device. In order to implement this service, France Telecom is using a tool named Security Software (see Table 2).

For Italian ISPs, Glasnost tests showed high percentages of manipulated P2P applications on behalf of some large providers (most of all Opitel, FastWeb and NGI, see Table 4). However, it was the very same ISPs that provide the least information regarding specific network management practices (see Table 2). Not only, these ISPs make no statements about the deployment of DPI, NGI goes even further by explicitly negating the usage or application of DPI (Glasnost data showed that NGI blocked/throttled 74% of BitTorrent tests in Q1 2010, see Table 4). In general, Italian ISPs aim their network management policies at suppressing P2P traffic in case of abnormal and excessive usage in order to optimise their networks and provide better quality of service (see Table 2).

According to empirical findings based on Glasnost data, the biggest BitTorrent “throttlers” in USA have been cable ISPs Comcast, Cox and Charter (see Table 6 in the Appendix). Since DPI deployment practically ceased in the second half of 2008 due to FCC proceedings against Comcast (see Table 7), we could not find any precise statements in the GTCs of US ISPs regarding the adverse use of DPI (or similar tools) for application-specific network management routines. Nevertheless, some ISPs (including previous “throttlers” Cox and Comcast) explicitly assure their subscribers that their network management techniques do not target P2P applications and that these tools work on an application-agnostic basis (see Table 2). As a result,

even though Glasnost data exhibit very clear and significant results in terms of an adverse use of DPI tools in the countries at stake, our in-depth analysis of the GTCs in the very same countries do not deliver promising and expected outcomes regarding transparency and accuracy of the applied network management techniques.

5 Conclusion & Outlook

The paper at hand tends to examine the extent to which reporting policies – as implemented through the General Terms and Conditions (GTCs) – of selected European and US ISPs (both cable and telecom service providers) match with empirical findings regarding the adverse use of DPI as proved using Glasnost data. To answer the question, whether these access providers inform their subscribers about the ongoing (adverse) network management operations, we applied a semi-quantitative research concept by investigating the GTCs of selected providers based on some general assumptions and parameters previously defined, and compared these findings with the results of the empirical results gathered from previous research projects. As a result, our in-depth analysis of the GTCs of German, French, Italian and US providers showed that none of the examined ISPs informs its subscribers adequately about deployed network management techniques (most of all DPI). On the other hand, we indeed find that US fixed-line providers deliver more information regarding network management than European ISPs as assumed keeping in mind the more progressive regulatory situation in USA in terms of network neutrality and the related transparency issues. However, there are still a number of related research questions that remain unanswered. Most of all the traffic shaping situation on mobile networks is still an uncharted territory given that mobile data traffic will increase exponentially in the years to come. Since Glasnost test does not deliver data for mobile connections, there is thus a wide scope for researchers to examine (and develop) similar tools for testing DPI deployment on mobile networks. This would inevitably generate a more precise picture on traffic shaping practices not only by fixed-line providers but also mobile Internet service operators.

Given the results of our study and the fact the inter-provider competition does not hinder network discrimination, the regulators should consider introducing compulsory rules in order to oblige ISPs to make more precise statements about their network management techniques.

Since an average Internet user is usually not aware of the common network management practices on the part of her/his ISP, these rules seem even more necessary in order to protect consumers' basic rights of information and well-grounded choice.

Appendix

Table 1: Categorization of Proxies for Customer Obligations and (Reasonable) Network Management Activities

<i>Customer Commitments & Obligations</i>					<i>Blocking/Restricting of Services</i>	
<i>Financial Obligations</i>	<i>Technical Obligations</i>	<i>Legal Obligations</i>	<i>Property & Intellectual Rights</i>	<i>Prohibited Activities</i>	<i>Termination/Suspension of Services due to non-compliance of the User</i>	<i>Reasonable Network Management</i>
<i>Payment of monthly fees</i>	<i>No violation of the security of the network in any way (Updating, Anti-virus etc.)</i>	<i>Age: eighteen (18) years or older/having legal authority</i>	<i>No infringement of property rights</i>	<i>No dissemination/posting of viruses, Trojan horses, worms, time bombs, zombies, cancelbots or any other computer or other programming routines that may damage, interfere with, secretly intercept or seize any system, program, data or personal information</i>	<i>Suspension in case of:</i> <ul style="list-style-type: none"> - <i>Violation of terms of policies</i> - <i>Threatening the complete network</i> - <i>Changing local telephone company</i> - <i>Failing to make the payment</i> 	<i>Right to remove or refuse the distribution of objectionable/illegal content that may disrupt proper functioning of the network/network integrity and security</i>
<i>Usage charges</i>	<i>Meet all requirements of a company-provided installation</i>	<i>Compliance with all applicable laws, rules and regulations regarding the use of the Service, e.g. usage only for lawful purposes</i>	<i>Copyright</i>	<i>No unsolicited advertisements</i>	<i>Right to block access to illegal material</i>	<i>Right to delete, without prior notice, files from any directory or mailbox if the associated storage limitations are exceeded</i>
<i>Equipment charges (incl. rental charges)</i>	<i>Configuration of LAN-Network</i>	<i>No posting/distribution of unlawful, libelous, defamatory, obscene, indecent,</i>	<i>Trademark</i>	<i>No solicitations</i>		<i>Preventing virus/spam delivery to customer accounts</i>

		<i>explicit, lewd, harassing, threatening, harmful, invasive of privacy or publicity rights, abusive, inflammation or otherwise objectionable content</i>				
<i>Software charges</i>	<i>Configuration of Equipment (PC, Printers, Routers)</i>	<i>No export violations</i>	<i>Patent</i>	<i>No commercial e-mail message or promotional message of any kind (commonly referred to as "spam")</i>		<i>Making decisions to place download limits on residential plans</i>
<i>Shipping fees</i>	<i>Responsibility for obtaining, maintaining and updating all equipment and software necessary to use the Service</i>	<i>No offering or disseminating fraudulent goods, services, schemes or promotions (e.g. make-money-fast schemes, chain letters and pyramid schemes)</i>	<i>Trade secret</i>	<i>No unsolicited informational announcements</i>		<i>IP Spoofing Prevention</i>
<i>Taxes</i>	<i>Responsibility for Backups</i>	<i>No unauthorized access to or use of data, systems or networks, including any attempt to probe, scan or test the vulnerability of a system or network or to breach secu-</i>	<i>No distribution/copying of unauthorized pictures, logos, software, articles, musical works and videos</i>	<i>No chain mail</i>		<i>DoS/Distributed DoS Monitoring and Mitigation</i>

		<i>rity or authentication measures without the express prior authorization of the owner of the system or network (hacking)</i>				
<i>Recovery fees</i>	<i>Permitting ISPs to access the computer and equipment and to monitor, adjust and record such data, profiles and settings for the purpose of providing service</i>	<i>No unauthorized monitoring of data or traffic on any network or system without the express prior authorization (interception)</i>		<i>No numerous copies of the same or substantially similar message</i>		<i>Right to temporarily suspend services, limit its duration or partially or completely block services as far as this is necessary due to public security reasons, statutory provisions, reliability of network operation, maintenance of network integrity, data security or due to necessary operational or technical works</i>
<i>Installation fees</i>				<i>No empty message</i>		
<i>Setup fees</i>				<i>No message which contain no substantive content</i>		
<i>Late fees</i>				<i>No very large message or files that disrupt a server, account, newsgroup or chat service</i>		

<i>Notify- ing ISP in case of bill- ing disputes</i>				<i>No participa- tion in collect- ing e-mail addresses, screen names, or other iden- tifiers of oth- ers (without Company's prior written consent</i>		
				<i>No spidering or harvesting</i>		
				<i>No participa- tion in using software (in- cluding "spy- ware") de- signed to facil- itate such activity</i>		
				<i>No collection of responses from unsolicit- ed messages</i>		
				<i>No reselling of the service</i>		
				<i>No usage for high volume purpose or engage in similar activi- ties that con- stitute such use (commer- cial or non- commercial)</i>		
				<i>No exceeding of the band- width usage limitations</i>		
				<i>Utilising a third party's mail server (relay) in or- der to send messages without the permission of the proprietor</i>		

				<i>Installing delivered software on devices other than the provided one and/or those intended by contractual agreements</i>		
				<i>Completely or partially modifying, adjusting, translating, leasing, distributing of software or using it as a basis for similar products</i>		
				<i>Gaining unauthorized third parties access to devices provided by ISP outside the own home or any other agreed accommodation</i>		

Source: Own illustration

Table 2:

ISP	Coun-try	Availability	Customer Commitments & Obligations	Blocking/Restricting of Services
<p>Kabel Deutschland General Terms and Conditions Internet and Telephone (Effective: May 2013)</p> <p>Downloaded: 09.08.2013</p>	DE	-> min. 98,5% (annual average)	<p>-> Financial, Technical and Legal Obligations according to Table 1</p> <p>-> Property and Intellectual Rights according to Table 1</p> <p>-> Prohibited Activities according to Table 1</p>	<p>-> Reasonable Network Management according to Table 1</p> <p>-> Termination/Suspension of Services due to Non-compliance of the User according to Table 1</p> <p><u>Specific network management activities:</u></p> <p>-> Generally, all kinds of traffic are conveyed equally -> if a risk of a network overload exists, Kabel Deutschland is entitled to prioritise between traffic in the affected network segment in order to secure the service quality -> prioritisation is carried out as follows:</p> <ul style="list-style-type: none"> • time-sensitive applications (for instance video-streaming, Internet-/video-telephony, online-gaming) gain priority over all the other applications • all the other applications (for instance web-surfing, social networks) have always priority over file-sharing applications (for instance peer-to-peer, one-click-hoster and net-news). For this reason, a reduction of transfer rates initially for the latter applications may occur in the affected network

				<p>segment. If the bottlenecks cannot be eliminated on this way, a reduction of transfer rates for prioritised applications may occur (only in a final step, also for time-sensitive applications possible)</p> <p>-> If a customer downloads more than 10 GB of overall data volume within a calendar day, Kabel Deutschland is entitled to reduce the provided transfer rates to 100 Kbit/s exclusively for filesharing-applications and till the end of the same day. All the other applications (web-surfing, social networks, emails, video-streaming, video on demand, chat, etc.) are not concerned at any time and can be used at unchanged conditions.</p>
<p>Deutsche Telekom General Terms and Conditions Landline and mobile connections (private customers) (Effective: 02.05.2013)</p> <p>Deutsche Telekom Terms of reference (Effective: 13.06.2013)</p> <p>Downloaded: 09.08.2013</p>	DE	average availability is 97% (annual average)	<p>-> Financial, Technical and Legal Obligations according to Table 1</p> <p>-> Property and Intellectual Rights according to Table 1</p> <p>-> Prohibited Activities according to Table 1</p>	<p>-> Termination/Suspension of Services due to Non-compliance of the User according to Table 1</p> <p>-> Reasonable Network Management according to Table 1</p> <p><u>Specific network management activities:</u></p> <p>-> envisaged data caps policy is planned to be introduced in 2016 and is not stated in current GTCs.</p>

<p>Telefonica O2 Germany General Terms and Conditions Fixed-line products (private customers) (Effective: 05.12.2012)</p> <p>Telefonica O2 Germany Terms of reference (Effective: 13.12.2012)</p> <p>Downloaded: 09.08.2013</p>	DE	98,5% per year	<p>-> Financial, Technical and Legal obligations according to Table 1</p> <p>-> Prohibited Activities according to Table 1</p> <p>-> Property and Intellectual Rights according to Table 1</p>	<p>-> Termination/Suspension of Services due to Non-compliance of the User according to Table 1</p>
<p>Unitymedia General Terms and Conditions (Effective: Feb. 2013)</p> <p>Unitymedia Special Terms and Conditions Internet and Telephony (Effective: Feb. 2013)</p> <p>Downloaded: 09.08.2013</p>	DE	average availability is 97,5% (annual average)	<p>-> Financial, Technical and Legal Obligations according to Table 1</p> <p>-> Prohibited Activities according to Table 1</p> <p>-> Property and Intellectual Rights according to Table 1</p>	<p>-> Reasonable Network Management according to Table 1</p> <p>-> Termination/Suspension of Services due to Non-compliance of the User according to Table 1</p>
<p>Vodafone Germany General Terms and Conditions (Effective: 01.02 2013)</p> <p>Vodafone Germany Price List DSL & landline</p>	DE	average availability is 97% (annual average)	<p>-> Financial, Technical and Legal Obligations according to Table 1</p> <p>-> Prohibited Activities according to Table 1</p> <p>-> Property and Intellectual Rights according to Table 1</p>	<p>-> Termination/Suspension of Services due to Non-compliance of the User according to Table 1</p> <p>-> Reasonable Network Management according to Table 1</p>

packages (Effective: June 2013) Downloaded: 09.08.2013				
Free (Iliad) General Terms and Conditions Broadband (Effective: 11.06.2013) Downloaded: 09.08.2013	FR	>=97% for telephone services >= 99% for e-mail (send- ing and re- ceiving) >= 98% for displaying and updating homepages >= 98% for displaying and updating a Manage- ment Console	-> Financial, Technical and Legal Obligations according to Table 1 -> Property and Intellectual Rights according to Table 1 -> Prohibited Activities ac- cording to Table 1	-> Reasonable Network Man- agement according to Table 1 -> Termination/Suspension of Services due to Non- Compliance of the User ac- cording to Table 1
France Telekom (Orange) General Terms and Conditions (Effective: 01.07 2013) France Telekom (Orange) Terms of broadband services (Effective: 01.07.2013) Downloaded: 09.08.2013	FR	97% for Ser- vice availa- bility; 99% for e-mail Service (sending and receiving messages); 98% for the display and update of personal pag- es; 98% for space for user management.	-> Financial, Technical and Legal Obligations according to Table 1 -> Property and Intellectual Rights according to Table 1 -> Prohibited Activities ac- cording to Table 1	-> Termination/Suspension of Services due to Non- Compliance of the User ac- cording to Table 1 -> Reasonable Network Man- agement according to Table 1 <u>Specific network manage- ment activities:</u> -> France Telecom and Or- ange France offering the op- tion “Control your down- loads” -> This Service allows the ISP to block the usage of “peer-to-peer” programs on the subscribers computer. This service requires a monthly payment. France Telecom and Orange France are using a tool named Secu- rity Software

<p>SFR General Terms and Conditions (Effective: June 2013)</p> <p>SFR Box SFR rates & terms and conditions of registration (Effective: 04.06.2013)</p> <p>Downloaded: 09.08.2013</p>	FR	90% each month	<p>-> Financial, Technical and Legal Obligations according to Table 1</p> <p>-> Property and Intellectual Rights according to Table 1</p> <p>-> Prohibited Activities according to Table 1</p>	<p>-> Termination/Suspension of Services due to Non-compliance of the User according to Table 1</p> <p>-> Reasonable Network Management according to Table 1</p> <p><u>Specific network management activities:</u></p> <p>-> According to Article 6-I-8, 21 June 2004, the operator may be required to suspend access to any site that would provide a download or, more generally, violate the rights of others.</p>
<p>Numericable (Completel) General Terms and Conditions (Effective: 01.02.2013)</p> <p>Downloaded: 09.08.2013</p>	FR	97% for Telephone; 97% for Internet Service; 99% for e-mail Service (sending and receiving messages); 98% for the display and update of personal pages; 99% for space for user management.	<p>-> Financial, Technical and Legal Obligations according to Table 1</p> <p>-> Prohibited Activities according to Table 1</p> <p>-> Property and Intellectual Rights according to Table 1</p>	<p>-> Termination/Suspension of Services due to Non-compliance of the User according to Table 1</p> <p>-> Reasonable Network Management according to Table 1</p> <p><u>Specific network management activities:</u></p> <p>-> The Company provides to the Customer on its website, information about tools used to restrict access to certain services and content</p>
<p>Vodafone General Terms and Conditions Fibre, ADSL, Wireless (Effective: June 12, 2013)</p>	ITA	(see Teletu)	<p>-> Financial, technical and legal obligations according to table 1</p> <p>-> Prohibited activities according to table 1</p>	<p>-> Termination/suspension of services due to non-compliance of the user according to table 1</p> <p>-> Reasonable network management according to table 1</p>

<p>Downloaded: 09.08.2013</p>				<p><u>Specific network management activities:</u></p> <p>-> In case of network congestion (only in times of peak traffic): Limitation of connection speed, primarily on applications that determine a higher-bandwidth (e.g. peer-to-peer file sharing)</p> <p>-> If customers exceed the threshold of 10 GB of traffic per month, Vodafone will be able to apply for the following 30 days, the same limitations on speed also to other types of applications / internet traffic</p> <p>-> Limitation of the connection speed of ADSL, only in times of peak traffic, right down to a maximum of 400 kbps in reception (download) to those customers who make an improper use of peer-to-peer file sharing</p> <p>-> The limitation will be applied exclusively to the active lines of fixed non-Vodafone network (technological Bitstream) and only for those applications that allow the exchange of large files and thus can congest the network (e.g., and peer-to-peer file sharing)</p> <p>-> For all other types of applications (e.g. Browsing internet, e-mail, streaming video) the speed will not be limited in any way by allowing customers to use them with a better quality of service</p> <p>-> No action will be per-</p>
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<p>Telecom Italia GTC ADSL (Effective: not reported)</p> <p>Downloaded: 09.08.2013</p> <p>Telecom Italia GTC Fiber (Effective: not reported)</p> <p>Downloaded: 09.08.2013</p> <p>Telecom Italia Carta dei Servizi (Effective: not reported)</p> <p>Downloaded: 09.08.2013</p>	ITA	Un-availability of Internet access via dial-up: 2%	<p>-> Financial, technical and legal obligations according to table 1</p> <p>-> Prohibited activities according to table 1</p> <p>-> Property and intellectual rights according to table 1</p>	<p>-> Termination/suspension of Services due to non-compliance of the user according to Table 1</p> <p>-> Reasonable network management according to Table 1</p> <p><u>Specific network management activities:</u></p> <p>-> Termination of the service in the case of abnormal consumption</p> <p>-> In times of high data traffic, Telecom reserves the right to introduce temporary mechanisms and non-discriminatory restrictions of the use of available network resources for all offers and / or profiles that provide commercial data traffic on ADSL technology, while respecting the principle of equal treatment</p> <p>-> Telecom will be able to limit the speed of internet connection, acting on applications that determine a higher bandwidth usage (e.g., peer-to-peer, file sharing, etc.)</p> <p>-> Limitation of the bandwidth allocated to these applications to a maximum value, proportional to the total bandwidth available on a single DSLAM</p>
<p>Opitel Teletu GTC Telephone and ADSL (Effective: not reported)</p>	ITA	Failure rate in the transmission of data uploading and downloading (all	<p>-> Financial, technical and legal obligations according to table 1</p> <p>-> Prohibited activities according to table 1</p>	<p>-> Termination/suspension of services due to non-compliance of the user according to table 1</p> <p>-> Reasonable network man-</p>

<p>reported)</p> <p>Downloaded: 09.08.2013</p> <p>Opitel Teletu Service Report ADSL (Effective: not reported)</p> <p>Downloaded: 09.08.2013</p> <p>Opitel Teletu Carta dei Servizi (Effective: not reported)</p> <p>Downloaded: 09.08.2013</p>		<p>offers): 2%</p> <p>Rate of packet loss (all offers): 0.5%</p> <p>Malfunction rate:</p> <p>- Service created with its own facilities or unbundling): 1.12%</p> <p>- Service created using wholesale services): 1.38%</p>	<p>-> Property and intellectual rights according to Table 1</p>	<p>agement according to table 1</p> <p><u>Specific network management activities:</u></p> <p>-> In order to provide its customers an homogeneous ADSL service and quality, the Company may make adjustments (congestion control, optimization of use and stability)</p>
<p>NGI GTC ADSL, HDSL, F5, F6 (Effective: not reported)</p> <p>Downloaded: 09.08.2013</p> <p>NGI Charta Servizi (Effective: not reported)</p> <p>Downloaded: 09.08.2013</p> <p>NGI Approccio Neutrale (Effective: not reported)</p>	ITA	<p>Target value of availability: 99,7%</p> <p>Unavailability of the access to services via dial-up: <0,8%</p> <p>Objectives: - latency less than 100 ms: 99%</p> <p>- failure rate data transmission (packet loss): < 5%</p>	<p>-> Financial, technical and legal obligations according to table 1</p> <p>-> Prohibited Activities according to table 1</p> <p>-> Property Rights according to table 1</p>	<p>-> Termination/suspension of services due to non-compliance of the user according to table 1</p> <p>-> Reasonable network management according to table 1</p> <p><u>Specific network management activities:</u></p> <p>-> Communications will not be checked, controlled or censored by NGI nor any other party, except for the Judicial Authority in the form and manner prescribed by law</p> <p>-> To ensure the best possible quality in xDSL services, NGI applies QoS policies, highlighted with transparency in service cards</p>

Downloaded: 09.08.2013				-> NGI negates the usage or application of DPI
Fastweb GTC Offerta Fissa (Effective: not reported) Downloaded: 09.08.2013 Fastweb Internet Speed (Effective: not reported) Downloaded: 09.08.2013	ITA	Failure rate in transmission & packet loss: (ADSL / Fiber) 0,5%	-> Financial, technical and legal obligations according to table 1 -> Prohibited activities according to table 1 -> Property and intellectual rights according to table 1	-> Termination/suspension of services due to non-compliance of the user according to table 1 -> Reasonable network management according to table 1 <u>Specific network management activities:</u> -> Suspension of services (in whole or in part) in the event of network failures, abnormal traffic or consumption
H3G -> Tre.it No GTC for fixed line services available	ITA	--	--	--
AT&T Broadband Information (Effective: March 29, 2012) Downloaded: 01.08.2013 AT&T Terms of Service / att.net Terms of Use (Effective: March 29, 2012) Downloaded: 01.08.2013	US	--	-> Financial, technical and legal obligations according to table 1 -> Prohibited activities according to table 1 -> Property and intellectual rights according to table 1	-> Termination/suspension of services due to non-compliance of the user according to table 1 -> Reasonable network management according to table 1 <u>Specific network management activities:</u> -> To address potential network congestion, AT&T has been investing billions of dollars to add more capacity to broadband networks -> AT&T provides usage calculators and other tools for wired services to assist consumers in estimating their anticipated usage levels

<p>AT&T Acceptable Use Policy (Effective: October 15, 2008)</p> <p>Downloaded: 01.08.2013</p>				<p>-> AT&T send notices to customers when they are approaching the applicable usage thresholds</p> <p>-> AT&T may occasionally need to limit the flow of traffic from certain locations or take other appropriate actions</p> <p>-> AT&T prevents the use of certain ports to avoid malicious activity</p> <p>-> To provide the U-verse customers with a consistently high-quality video service, the speed of AT&T U-verse broadband Internet access service may be temporarily reduced when a customer is using his or her U-verse video service in a manner that requires high bandwidth</p> <p>-> AT&T may adopt include, but are not limited to, the following:</p> <ul style="list-style-type: none"> • a cap on data usage • a modification of a customer's serving facility or service technology • a modification of or a limitation on a customer's data throughput speed or data consumption to protect the network <p>-> AT&T may terminate Services in response to a court order or government notice that certain conduct must be stopped or when AT&T reasonably determines, that the conduct may:</p>
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				<ul style="list-style-type: none"> • expose AT&T to sanctions, prosecution, civil action or any other liability • cause harm to or interfere with the integrity or normal operations of AT&T's network or networks with which AT&T is interconnected
<p>Cablevision Optimum Residential Terms of Use (Effective: July 15, 2013)</p> <p>Downloaded: 01.08.2013</p> <p>Cablevision Optimum Acceptable Use Policy (Effective: August 10, 2012)</p> <p>Downloaded: 01.08.2013</p> <p>Cablevision Optimum GTC of Service (Effective: November 15, 2011)</p> <p>Downloaded: 01.08.2013</p> <p>Cablevision's Open Internet Disclosure</p>	US	--	<p>-> Financial, technical and legal obligations according to table 1</p> <p>-> Prohibited activities according to table 1</p> <p>-> Property and intellectual rights according to table 1</p>	<p>-> Termination/suspension of Services due to non-compliance of the user according to table 1</p> <p>-> Reasonable network management according to table 1</p> <p><u>Specific network management activities:</u></p> <p>-> Subscriber consents to Cablevision's monitoring, adjustment and recording for the purpose of providing the Optimum Online Services</p> <p>-> Cablevision has the right to monitor all content transmitted through the service from time to time and to disclose any information as necessary to satisfy any law, regulation or other governmental request, to operate optimum online service properly</p> <p>-> Cablevision reserves the right to protect the integrity of its network:</p> <ul style="list-style-type: none"> • monitoring traffic • port blocking • e-mail virus scanning • denying e-mail from

<p>Statement (Effective: July 16, 2013)</p> <p>Downloaded: 01.08.2013</p>				<p>certain domains and</p> <ul style="list-style-type: none"> • putting limits on bandwidth and e-mail <p>-> Cablevision reserves the right to use a changing variety of network management techniques including</p> <ul style="list-style-type: none"> • allocating a fixed maximum amount of bandwidth to non-subscribers seeking to upload peer-to-peer files during peak periods only • utilizing industry-standard Subscriber Traffic Management (STM) technology to temporarily manage upstream and downstream traffic during times of peak congestion in a protocol-agnostic manner • implementing filtering and spam detection techniques to manage reliable email sources and mitigate spam • in limited instances, these techniques may affect the throughput rate at which subscribers may send and receive data, non-subscribers' ability to establish session connections within the network (such as peer-to-peer sessions), or result in the delay of certain traffic during times of peak congestion
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				<p>-> Cablevision also employs certain automated processes to more evenly distribute the available bandwidth to users</p> <p>-> Cablevision reserves the right to modify these network management practices in its discretion and in accordance with law</p> <p>-> Cablevision maintains an excessive use policy to address data consumption by Subscribers that is wholly uncharacteristic of a typical user of the Service as determined by the company in its sole discretion</p> <p>-> Common activities include numerous or continuous bulk transfers of files and other high capacity traffic using file transfer protocol ("FTP"), peer-to-peer applications, and newsgroups which result in excessive data consumption</p>
<p>Charter Acceptable Use Policy – Residential Customers Broadband Information (Effective: not reported)</p> <p>Downloaded: 02.08.2013</p> <p>Charter Communica- tions Network Management Practices (Effective: not</p>	US	--	<p>-> Financial, technical and legal obligations according to table 1</p> <p>-> Prohibited activities according to table 1</p> <p>-> Property and intellectual rights according to table 1</p>	<p>-> Termination/suspension of services due to non-compliance of the user according to table 1</p> <p>-> Reasonable network management according to table 1</p> <p><u>Specific network management activities:</u></p> <p>-> In the case of significantly high bandwidth usage causing congestion (regardless of the usage type or format), Charter may temporarily reduce the available bandwidth to those customers identified as using such high amounts of bandwidth as necessary to reduce band-</p>

<p>reported)</p> <p>Downloaded: 02.08.2013</p> <p>Charter Internet Residential Customer Agreement (Effective: April 2008)</p> <p>Downloaded: 02.08.2013)</p>				<p>width congestion</p> <p>-> Customers should not exceed the amount of transferred data per month as listed in the contract. If the customer violates this policy, Charter may terminate the service</p> <p>-> Charter reserves the right to revise or implement additional usage limits at any time</p> <p>-> Charter has the right to monitor transmissions and postings from time to time for violations of this policy, including for purposes of network management and implementing limitation of bandwidth use and to disclose, block, or remove them in accordance with the subscriber agreement and any other applicable agreements and policies</p> <p>-> When congestion occurs Charter will temporarily manage usage activity to maintain quality of service</p> <p>-> Charter does not target specific protocols</p> <p>-> If the software determines that one or subscribers have been the source of high volumes of network traffic over a particular time interval, traffic originating from those subscribers will be assigned a lower priority status temporarily</p> <p>-> If such network segment becomes congested, lower priority traffic could be delayed compared to higher priority traffic</p>
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				<p>-> Charter generally designates traffic as either “priority best effort” traffic or “best effort” traffic. Most modern cable modems attached to Charter’s network include a “bootfile” which includes information about the subscriber’s service account to ensure that the service functions properly</p> <p>-> This bootfile contains information that supports these different priorities for Internet traffic going to and from the cable modem. Priority best effort is the normal priority. If congestion management has been triggered and traffic to a particular modem has been designated best effort, traffic could be delayed compared to higher priority traffic</p> <p>-> CMTS ports have what is commonly called a “scheduler” that puts all the packets coming from or going to cable modems on that particular port in a queue and then handles them in turn. A certain number of packets can be processed by the scheduler in any given moment; for each time slot, priority best effort traffic will be given priority access to the available capacity, and best effort traffic will be processed on a space-available basis</p> <p>-> Congestion can occur in any IP network, and, when it does, packets can be affected, delayed, lost, or dropped. Because of this, IP applications and protocols have been designed to deal with delayed or dropped packets</p>
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				<p>-> Charter blocks the usage of certain ports that are associated with known vulnerabilities</p> <p>-> In situations where Charter believes, in its sole discretion, that Customer may harm the Charter network or disrupt the performance of the service for other users or where Customer is transmitting or is otherwise connected with what Charter considers in its sole discretion to be spam, Charter may take actions, in its sole discretion, to manage or protect its network or to benefit the greatest number of its subscribers, including, but not limited to, traffic prioritization and protocol filtering, and in some instances, suspend or terminate access by customer to the network</p>
<p>Comcast Agreement for Residential Services (Effective: April 2013)</p> <p>Downloaded: 02.08.2013</p> <p>Comcast Acceptable Use Policy for XFINITY® Internet (Effective: May 24, 2013)</p> <p>Downloaded: 02.08.2013</p>	US	--	<p>-> Financial, technical and legal obligations according to table 1</p> <p>-> Prohibited activities according to table 1</p> <p>-> Property and intellectual rights according to table 1</p>	<p>-> Termination/suspension of services due to non-compliance of the user according to table 1</p> <p>-> Reasonable network management according to table 1</p> <p><u>Specific network management activities:</u></p> <p>-> Examples of network management activities:</p> <ul style="list-style-type: none"> identifying spam and preventing its delivery to customer email accounts detecting malicious Internet traffic and preventing the distribution of such traffic

<p>Comcast Frequently Asked Questions about Network Management</p> <p>Downloaded: 02.08.2013</p>				<p>bution of viruses or other harmful code or content</p> <ul style="list-style-type: none"> temporarily lowering the priority of traffic for users who are the top contributors to current network congestion using other tools and techniques that Comcast may be required to implement in order to meet its goal of delivering the best possible broadband Internet experience to all of its customers <p>-> Comcast is not currently applying a monthly data consumption threshold. However, in certain locations Comcast is providing versions of the service with different speed and data consumption thresholds, among other characteristics, subject to applicable Service plans</p> <p>-> The Copyright Alert System: Copyright owners routinely participate in online peer-to-peer file sharing programs to see if their content is being improperly used or shared. If the copyright owner believes its content was uploaded or downloaded improperly, it can record the Internet Protocol or IP address that was used to access the content over these services</p> <p>-> Congestion management technique:</p> <ul style="list-style-type: none"> all customers should have a fair share of access to the network
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				<ul style="list-style-type: none"> • identification which customer accounts are using the greatest amounts of bandwidth and their Internet traffic will be temporarily managed until the period of congestion passes • the technique does not manage congestion based on the online activities, protocols or applications a customer uses • this technique is temporary and it has nothing to do with a customer's aggregate monthly data usage • Comcast's network management tools will evolve and keep pace so that we can deliver an excellent, reliable, and safe online experience to all of our customers • the congestion management technique does not target peer-to-peer ("P2P") or other applications, or make decisions about the content of the traffic • the technique is "protocol-agnostic," which means that the system does not manage congestion based on the applications being used by customers • it is also content neutral, so it does not depend on the type of content that is generating traffic congestion
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				<ul style="list-style-type: none"> • on average less than one percent of our High-Speed Internet customers are affected by the approach • Comcast does not block P2P traffic or applications like BitTorrent, Gnutella, or others as part of its current network congestion management technique • Comcast employs network security practices in addition to the congestion management technique (e.g. limits the number of login, SMTP, DNS, and DHCP transactions per second (at levels far above 'normal' rates) that customers can send to Comcast's servers in order to protect them against Denial of Service (DoS) attacks)
<p>Cox High Speed Internet Acceptable Use Policy (Effective: November 18, 2011)</p> <p>Downloaded: 02.08.2013</p> <p>Cox High Speed Internet Subscriber Agreement</p>	US	--	<p>-> Financial, technical and legal obligations according to table 1</p> <p>-> Prohibited activities according to table 1</p> <p>-> Property and intellectual rights according to table 1</p>	<p>-> Termination/suspension of Services due to non-compliance of the user according to table 1</p> <p>-> Reasonable network management according to table 1</p> <p><u>Specific network management activities:</u></p> <p>-> If bandwidth usage exceeds the amount included in Internet package, Cox may suspend the Service or require the customer to upgrade the Service to a higher pack-</p>

<p>(Effective: December 20, 2011)</p> <p>Downloaded: 02.08.2013</p> <p>Cox Terms and Conditions (Effective: July 10, 2009)</p> <p>Downloaded: 02.08.2013</p> <p>Cox Tech Solutions (Effective: March 11, 2013)</p> <p>Downloaded: 02.08.2013</p>				<p>age and/or pay additional fees</p> <p>-> Cox reserves the right at all times and without notice to remove, restrict access to, or make unavailable, any content on its servers that it considers, in its sole discretion, obscene, lewd, lascivious, filthy, excessively violent, harassing, or otherwise objectionable, and to monitor, review, retain and/or disclose any content or other information in Cox's possession about or related to the customer</p> <p>-> Cox does not shape or throttle Internet traffic based on the particular online content, protocols or applications a customer uses</p> <p>-> Cox uses other measures to ensure the best Internet experience, without limitation:</p> <ul style="list-style-type: none"> • Cox may take any appropriate measures, whether or not they are described above, in response to extraordinary levels of usage, denial of service attacks, or other exigent circumstances that have a significant effect on our subscribers' ability to obtain service or Cox's ability to provide service <p>-> Speed and usage information of services depend on the location of the user</p>
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<p>CenturyLink Acceptable Use Policy (Effective: June 7, 2009)</p> <p>Downloaded: 02.08.2013</p> <p>CenturyLink High-Speed Internet and Internet Access Services Residential Terms and Conditions (Effective: January 1, 2012)</p> <p>Downloaded: 02.08.2013</p> <p>CenturyLink High-Speed Internet Service Management (Effective: February, 2012)</p> <p>Downloaded: 02.08.2013</p> <p>Notice: (Qwest began doing business as CenturyLink in August 2011)</p>	US	--	<p>-> Financial, technical and legal obligations according to table 1</p> <p>-> Prohibited activities ac- cording to table 1</p> <p>-> Property and intellectual rights according to table 1</p>	<p>-> Termination/suspension of Services due to non- compliance of the user ac- cording to table 1</p> <p>-> Reasonable network man- agement according to table 1</p> <p><u>Specific network manage- ment activities:</u></p> <p>-> CenturyLink reserves the right to monitor or exercise any editorial control over any material stored, copied, or communicated using Centu- ryLink's services or Network</p> <p>-> CenturyLink will not deny common carrier transport service (such as long distance and wireless service) to a customer based on the type of content the customer is transmitting</p> <p>-> CenturyLink reserves the right to delete, without prior notice, files from any directo- ry or mailbox if the associat- ed storage limitations are exceeded</p> <p>-> CenturyLink may take any action deemed to be appro- priate without notice to pro- tect the services and its facili- ties for provision of the ser- vices</p> <p>-> CenturyLink automatically measures and monitors net- work performance and the performance of its Internet connection and its network</p>

				<p>-> CenturyLink also will access and record information about user's computer and equipment's profile and settings and the installation of software CenturyLink provides</p> <p>-> CenturyLink gathers information about user's Internet usage such as the sites visited, session lengths, bit rates, and number of messages and bytes passed</p> <p>-> CenturyLink aggregates this information with similar information from other customers and may share such aggregated information with other, trusted third parties from time to time</p> <p>-> When network congestion is identified, CenturyLink engineers employ various techniques to ensure a positive customer experience</p> <p>-> In some cases, CenturyLink may limit the number of customers that may be served on a particular network node until additional capacity can be added</p> <p>-> CenturyLink has made the decision to place download limits (application neutral) on residential plans. This policy only impacts residential customer plan download usage; upload usage is not impacted. It does not impact business class High-Speed Internet plans</p> <p>-> CenturyLink does not block, prioritize, or degrade any Internet sourced or destined traffic based on applica-</p>
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				tion, source, destination, protocol, or port unless it does so in connection with a security practice described in the security policy section
<p>Time Warner Cable Residential Services Subscriber Agreement (Effective: not reported) Downloaded: 02.08.2013</p> <p>Time Warner Terms of Services (Effective: not reported) Downloaded: 02.08.2013</p> <p>Time Warner Internet Acceptable Use Policy (Effective: not reported) Downloaded: 02.08.2013</p> <p>Time Warner Internet Description of Network Management Practices, Performance, and Commercial Terms</p>	US	--	<p>-> Financial, technical and legal obligations according to table 1</p> <p>-> Prohibited activities according to table 1</p> <p>-> Property and intellectual rights according to table 1</p>	<p>-> Termination/suspension of services due to non-compliance of the user according to table 1</p> <p>-> Reasonable network management according to table 1</p> <p><u>Specific network management activities:</u></p> <p>-> TWC may use network management tools to make the services operate efficiently</p> <p>-> TWC can set or change the maximum throughput rate, bandwidth limit or other characteristics of any High Speed Data (HSD) service level (and notifies customers)</p> <p>-> TWC may monitor bandwidth usage patterns and the compliance with their customer agreements</p> <p>-> The throughput rate for residential users also depends on and the priority TWC gives to business subscribers' data traffic</p> <p>-> TWC does not block specific applications or traffic that may tend to increase congestion. Instead, it focuses on anticipating and avoiding congestion by monitoring network usage and augmenting capacity in a targeted manner</p>

<p>(Effective: November 20, 2011)</p> <p>Downloaded: 02.08.2013</p>				<p>-> TWC will continue to evaluate their practices in this respect and will revise their approach as needed to deliver a quality online experience</p> <p>-> TWC does not impair or degrade particular content, applications, services, or non-harmful devices</p>
<p>Verizon Online Terms of Service (Effective: February 27, 2013)</p> <p>Downloaded: 02.08.2013</p> <p>Verizon Acceptable Use Policy (Effective: February 27, 2013)</p> <p>Downloaded: 02.08.2013</p> <p>Verizon Additional Service Terms (Effective: February 27, 2013)</p> <p>Downloaded: 02.08.2013</p> <p>Verizon Network Management Guide</p>	US	--	<p>-> Financial, technical and legal obligations according to table 1</p> <p>-> Prohibited activities according to table 1</p> <p>-> Property and intellectual rights according to table 1</p>	<p>-> Termination/suspension of Services due to non-compliance of the user according to table 1</p> <p>-> Reasonable network management according to table 1</p> <p><u>Specific network management activities:</u></p> <p>-> A termination of the service is also possible, if the customer generates excessive amounts of email or other Internet traffic</p> <p>-> Verizon Online does not affirmatively manage congestion on the network through mechanisms such as real-time throttling, blocking, or dropping of specific end user traffic</p> <p>-> There are no usage caps applicable to Verizon Online's Internet access services</p> <p>-> Except as noted with respect to blocking outbound traffic on port 25, Verizon Online does not block or rate-control specific protocols or protocol ports, modify proto-</p>

(Effective: not reported) Downloaded: 02.08.2013				col fields in ways not prescribed by the protocol standard, or otherwise inhibit or favor certain applications or classes of applications of traffic on our Internet access service
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Source: Own illustration based on General Terms and Conditions of the analyzed ISPs:

AT&T (2008), (2012a), (2012b); **Cablevision/Optimum** (2011), (2012), (2013a), (2013b); **Charter** (2008), (2013a), (2013b); **CenturyLink/Qwest** (2009), (2012a), (2012b); **Comcast** (2013a), (2013b), (2013c); **Cox** (2009), (2011a), (2011b), (2013); **Deutsche Telekom** (2013a), (2013b); **FastWeb** (2013a), (2013b), (2013c); **France Telekom** (2013a), (2013b); **Free/Iliad** (2013); **Kabel Deutschland** (2013); **NGI** (2013a), (2013b), (2013c), (2013d); **Numericable/Completel** (2013); **Opitel/Teletu** (2013a), (2013b), (2013c); **SFR** (2013a), (2013b); **Telecom Italia** (2013a), (2013b), (2013c), (2013d); **Telefonica O2 Germany** (2012a), (2012b); **Tiscali** (2013a), (2013b); **Time Warner Cable** (2011), (2013a), (2013b), (2013c); **Unitymedia** (2013a), (2013b), (2013c), (2013d); **Verizon** (2013a), (2013b), (2013c), (2013d); **Vodafone Germany** (2013a), (2013b); **Vodafone Italia** (2013); **Wind/Infostrada** (2012), (2013).

Table 3: BitTorrent Throttling by ISPs, Germany, Glasnost data, Q1 2009 – Q1 2012

Operator Name	Quarter	Number Of Valid Tests	Range of Valid Tests	Pct of Tests Showing DPI
Deutsche Telekom	2009Q1	163	151-450	4%
Kabel Deutschland	2009Q1	106	91-150	59%
Telefonica O2 Germany	2009Q1	103	91-150	1%
Unitymedia	2009Q1	16	11-30	0%
Vodafone Germany	2009Q1	59	31-60	2%
Deutsche Telekom	2009Q2	174	151-450	5%
Kabel Deutschland	2009Q2	268	151-450	58%
Telefonica O2 Germany	2009Q2	136	91-150	4%
Unitymedia	2009Q2	18	11-30	11%
Vodafone Germany	2009Q2	68	61-90	7%
Deutsche Telekom	2009Q3	171	151-450	4%
Kabel Deutschland	2009Q3	489	>450	50%
Telefonica O2 Germany	2009Q3	113	91-150	4%
Unitymedia	2009Q3	55	31-60	2%
Vodafone Germany	2009Q3	65	61-90	2%
Deutsche Telekom	2009Q4	204	151-450	4%
Kabel Deutschland	2009Q4	242	151-450	40%
Telefonica O2 Germany	2009Q4	146	91-150	6%
Unitymedia	2009Q4	26	11-30	8%
Vodafone Germany	2009Q4	108	91-150	6%
Deutsche Telekom	2010Q1	174	151-450	6%
Kabel Deutschland	2010Q1	164	151-450	35%
Telefonica O2 Germany	2010Q1	117	91-150	8%
Unitymedia	2010Q1	31	31-60	3%
Vodafone Germany	2010Q1	91	91-150	7%
Deutsche Telekom	2010Q2	94	91-150	6%
Kabel Deutschland	2010Q2	179	151-450	40%
Telefonica O2 Germany	2010Q2	75	61-90	4%
Unitymedia	2010Q2	14	11-30	7%
Vodafone Germany	2010Q2	56	31-60	5%
Deutsche Telekom	2010Q3	32	31-60	3%
Kabel Deutschland	2010Q3	111	91-150	32%
Telefonica O2 Germany	2010Q3	11	11-30	0%
Vodafone Germany	2010Q3	12	11-30	0%
Deutsche Telekom	2010Q4	21	11-30	10%
Kabel Deutschland	2010Q4	40	31-60	33%
Telefonica O2 Germany	2010Q4	17	11-30	0%
Deutsche Telekom	2011Q1	14	11-30	0%
Kabel Deutschland	2011Q1	32	31-60	69%
Telefonica O2 Germany	2011Q1	13	11-30	0%
Vodafone Germany	2011Q1	15	11-30	0%
Deutsche Telekom	2011Q2	11	11-30	0%
Kabel Deutschland	2011Q2	11	11-30	45%
Kabel Deutschland	2011Q3	12	11-30	8%
Telefonica O2 Germany	2011Q3	10	11-30	0%
Deutsche Telekom	2011Q4	10	11-30	0%
Kabel Deutschland	2011Q4	26	11-30	15%
Telefonica O2 Germany	2011Q4	20	11-30	0%
Deutsche Telekom	2012Q1	19	11-30	5%
Kabel Deutschland	2012Q1	38	31-60	37%
Telefonica O2 Germany	2012Q1	39	31-60	8%

Source: Own illustration based on M-Lab Data (<http://deeppacket.info>).

Table 4: BitTorrent Throttling by ISPs, Italy, Glasnost data, Q1 2009 – Q1 2012

Operator Name	Quarter	Number Of Valid Tests	Range of Valid Tests	Pct of Tests Showing DPI
FastWeb	2009Q1	252	151-450	32%
H3G	2009Q1	45	31-60	7%
NGI	2009Q1	52	31-60	33%
Opitel	2009Q1	332	151-450	65%
Telecom Italia	2009Q1	1045	>450	4%
Tiscali	2009Q1	254	151-450	17%
Vodafone	2009Q1	93	91-150	10%
Wind	2009Q1	442	151-450	5%
FastWeb	2009Q2	226	151-450	42%
H3G	2009Q2	53	31-60	13%
NGI	2009Q2	136	91-150	25%
Opitel	2009Q2	326	151-450	60%
Telecom Italia	2009Q2	990	>450	5%
Tiscali	2009Q2	200	151-450	9%
Vodafone	2009Q2	101	91-150	5%
Wind	2009Q2	360	151-450	3%
FastWeb	2009Q3	101	91-150	31%
H3G	2009Q3	64	61-90	8%
NGI	2009Q3	34	31-60	12%
Opitel	2009Q3	193	151-450	46%
Telecom Italia	2009Q3	519	>450	5%
Tiscali	2009Q3	95	91-150	6%
Vodafone	2009Q3	45	31-60	9%
Wind	2009Q3	222	151-450	4%
FastWeb	2009Q4	188	151-450	9%
H3G	2009Q4	91	91-150	16%
NGI	2009Q4	73	61-90	68%
Opitel	2009Q4	325	151-450	50%
Telecom Italia	2009Q4	829	>450	8%
Tiscali	2009Q4	185	151-450	25%
Vodafone	2009Q4	107	91-150	15%
Wind	2009Q4	347	151-450	10%
FastWeb	2010Q1	142	91-150	10%
H3G	2010Q1	96	91-150	9%
NGI	2010Q1	31	31-60	74%
Opitel	2010Q1	263	151-450	51%
Telecom Italia	2010Q1	854	>450	8%
Tiscali	2010Q1	169	151-450	22%
Vodafone	2010Q1	107	91-150	17%
Wind	2010Q1	413	151-450	14%
FastWeb	2010Q2	53	31-60	8%
H3G	2010Q2	17	11-30	6%
Opitel	2010Q2	50	31-60	40%
Telecom Italia	2010Q2	352	151-450	7%
Tiscali	2010Q2	42	31-60	14%
Vodafone	2010Q2	56	31-60	16%
Wind	2010Q2	138	91-150	8%
FastWeb	2010Q3	11	11-30	9%
H3G	2010Q3	20	11-30	0%
Opitel	2010Q3	22	11-30	27%
Telecom Italia	2010Q3	108	91-150	5%
Tiscali	2010Q3	19	11-30	5%
Vodafone	2010Q3	12	11-30	0%
Wind	2010Q3	57	31-60	4%
FastWeb	2010Q4	26	11-30	19%
H3G	2010Q4	13	11-30	15%
Opitel	2010Q4	31	31-60	35%
Telecom Italia	2010Q4	136	91-150	4%
Tiscali	2010Q4	38	31-60	21%
Vodafone	2010Q4	18	11-30	6%
Wind	2010Q4	66	61-90	5%
FastWeb	2011Q1	38	31-60	3%
Opitel	2011Q1	20	11-30	25%
Telecom Italia	2011Q1	149	91-150	10%
Tiscali	2011Q1	49	31-60	12%
Vodafone	2011Q1	15	11-30	0%
Wind	2011Q1	74	61-90	7%
FastWeb	2011Q2	11	11-30	0%
Telecom Italia	2011Q2	67	61-90	3%
Tiscali	2011Q2	15	11-30	33%
Wind	2011Q2	25	11-30	4%
Telecom Italia	2011Q3	22	11-30	5%
Tiscali	2011Q3	13	11-30	8%
Wind	2011Q3	16	11-30	0%
Telecom Italia	2011Q4	12	11-30	8%
Wind	2011Q4	11	11-30	18%
Telecom Italia	2012Q1	42	31-60	10%
Tiscali	2012Q1	13	11-30	8%
Wind	2012Q1	29	11-30	0%

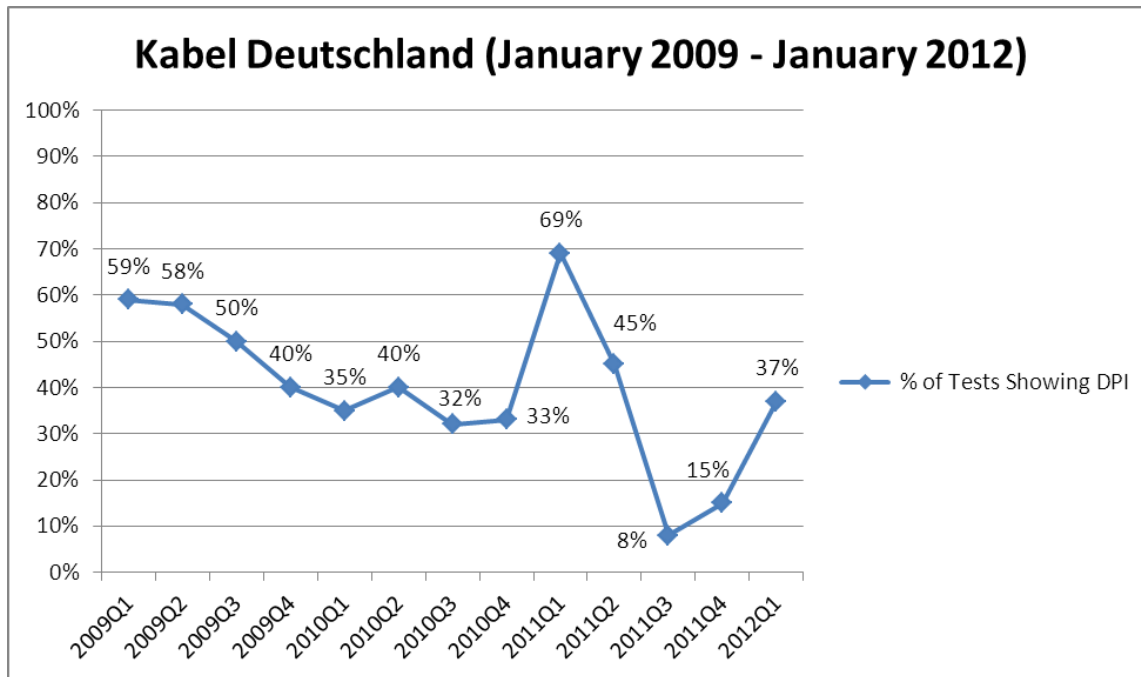
Source: Own illustration based on M-Lab Data (<http://deppacket.info>).

Table 5: BitTorrent Throttling by ISPs, France, Glasnost data, Q1 2009 – Q1 2012

Operator Name	Quarter	Number Of Valid Tests	Range of Valid Tests	Pct of Tests Showing DPI
France Telecom	2009Q1	142	91-150	3%
Iliad	2009Q1	227	151-450	8%
Numericable-Comptel	2009Q1	48	31-60	2%
SFR	2009Q1	69	61-90	6%
France Telecom	2009Q2	300	151-450	4%
Iliad	2009Q2	306	151-450	11%
Numericable-Comptel	2009Q2	76	61-90	4%
SFR	2009Q2	187	151-450	3%
France Telecom	2009Q3	173	151-450	5%
Iliad	2009Q3	136	91-150	9%
Numericable-Comptel	2009Q3	34	31-60	3%
SFR	2009Q3	77	61-90	1%
France Telecom	2009Q4	188	151-450	12%
Iliad	2009Q4	210	151-450	13%
Numericable-Comptel	2009Q4	67	61-90	4%
SFR	2009Q4	88	61-90	8%
France Telecom	2010Q1	171	151-450	8%
Iliad	2010Q1	149	91-150	4%
Numericable-Comptel	2010Q1	46	31-60	7%
SFR	2010Q1	102	91-150	7%
France Telecom	2010Q2	71	61-90	3%
Iliad	2010Q2	75	61-90	11%
Numericable-Comptel	2010Q2	26	11-30	4%
SFR	2010Q2	50	31-60	12%
France Telecom	2010Q3	42	31-60	5%
Iliad	2010Q3	41	31-60	7%
Numericable-Comptel	2010Q3	10	11-30	10%
SFR	2010Q3	27	11-30	7%
France Telecom	2010Q4	18	11-30	6%
Iliad	2010Q4	19	11-30	0%
France Telecom	2011Q2	10	11-30	0%
Iliad	2011Q2	38	31-60	3%
Numericable-Comptel	2011Q2	10	11-30	0%
SFR	2011Q2	12	11-30	8%
France Telecom	2011Q3	11	11-30	0%
SFR	2011Q3	10	11-30	10%
France Telecom	2011Q4	17	11-30	0%
Iliad	2011Q4	34	31-60	6%
France Telecom	2012Q1	25	11-30	0%
Iliad	2012Q1	35	31-60	3%

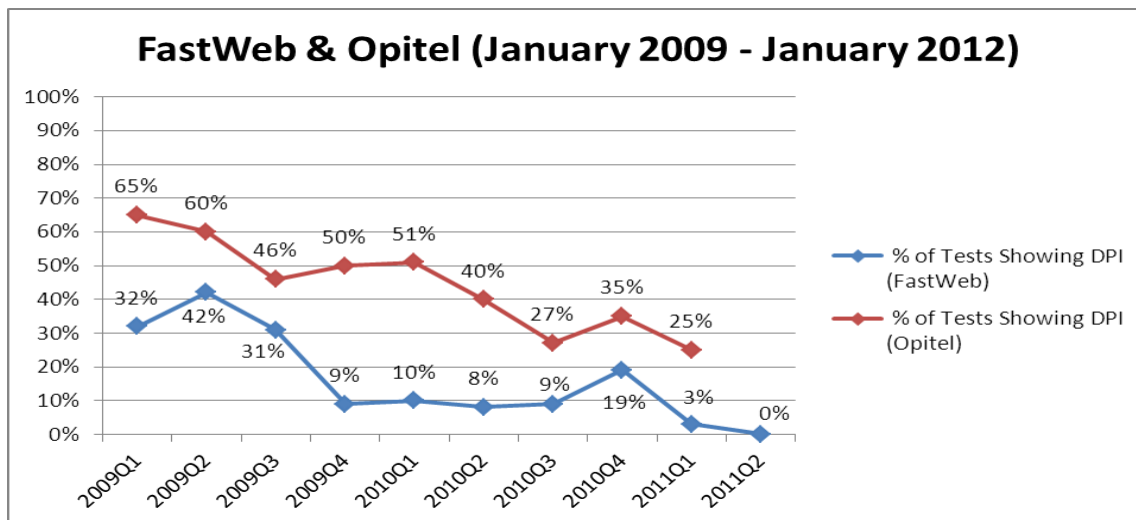
Source: Own illustration based on M-Lab Data (<http://deppacket.info>).

Figure 1: Percentage of blocked BitTorrent connections changed between January 2009 and January 2012, Kabel Deutschland, Germany



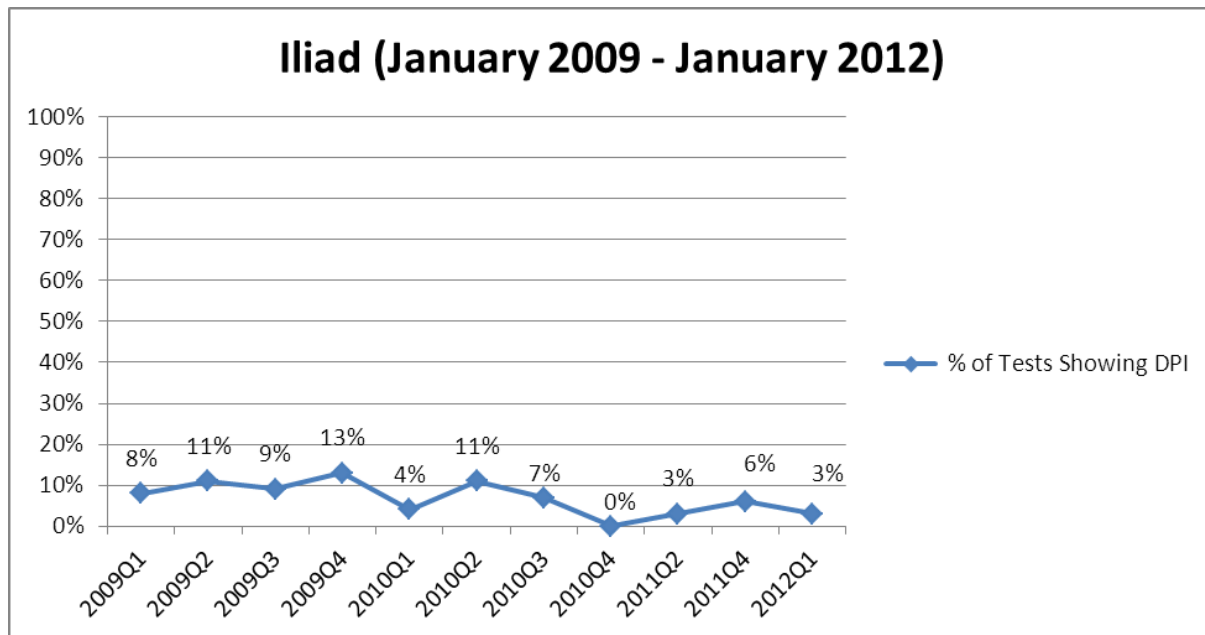
Source: Own illustration based on results from table 3.

Figure 2: Percentage of blocked BitTorrent connections changed between January 2009 and January 2012, FastWeb and Opitel, Italy



Source: Own illustration based on results from table 4.

Figure 3: Percentage of blocked BitTorrent connections changed between January 2009 and January 2012, Iliad, France



Source: Own illustration based on results from table 5.

Table 6: BitTorrent Throttling by ISPs, USA, Glasnost data, H1 2008 – H1 2010

Operator	2008H1	2008H2	2009H1	2009H2	2010H1
Comcast	49%	23%	8%	5%	3%
Charter Communications	14%	19%	14%	8%	5%
Cox Communications	52%	30%	8%	4%	3%
Insight Communications	13%	9%	9%	4%	6%
Time Warner Cable	10%	10%	8%	5%	4%
Cablevision Systems	12%	10%	10%	8%	*7%
Clearwire	*27%	*57%	66%	28%	17%
Covad Communications	5%	3%	2%	3%	*7%
Verizon Communications	*7%	*5%	5%	4%	*2%
Windstream Communications	*8%	*2%	6%	6%	*5%
Qwest Communications	*9%	*9%	7%	4%	*7%
AT&T Inc.	9%	10%	8%	5%	4%
CenturyLink	8%	9%	8%	5%	4%

* - Total number of test results is less than .02% of the number of subscribers

Source: Mueller & Asghari (2012).

Table 7: BitTorrent Throttling by ISPs, USA, Glasnost data, Q1 2009 – Q1 2012

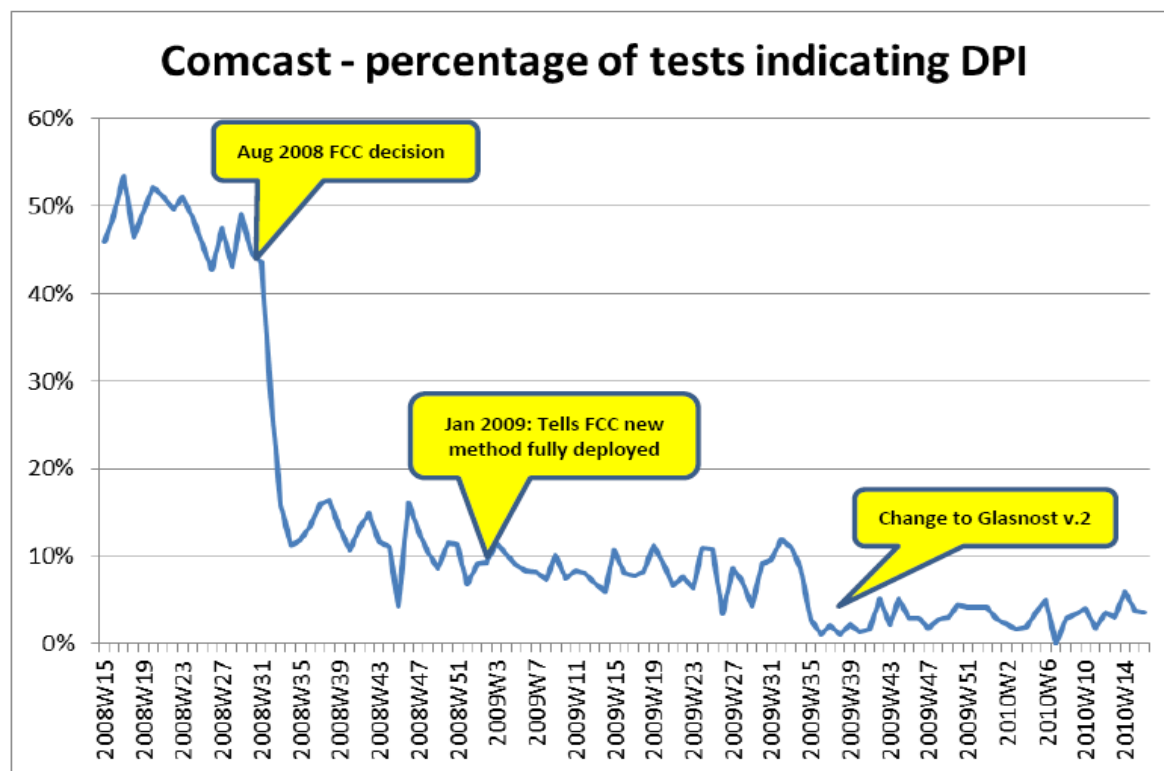
Operator Name	Quarter	Number of Valid Tests	Range of Valid Tests	Pct of Tests Showing DPI
Verizon	2009Q1	893	>450	2%
Cablevision	2009Q1	261	151-450	3%
Comcast	2009Q1	3228	>450	2%
AT&T	2009Q1	1926	>450	6%
Charter	2009Q1	562	>450	8%
TWC	2009Q1	1788	>450	4%
Cox	2009Q1	574	>450	3%
CenturyLink	2009Q1	125	91-150	2%
TWC	2009Q2	1947	>450	3%
Comcast	2009Q2	2923	>450	3%
AT&T	2009Q2	1792	>450	5%
Charter	2009Q2	576	>450	13%
Verizon	2009Q2	836	>450	2%
Cablevision	2009Q2	283	151-450	2%
Cox	2009Q2	613	>450	4%
CenturyLink	2009Q2	114	91-150	4%
AT&T	2009Q3	1409	>450	5%
Comcast	2009Q3	2006	>450	3%
TWC	2009Q3	1358	>450	3%
Cox	2009Q3	507	>450	3%
Cablevision	2009Q3	205	151-450	5%
Verizon	2009Q3	681	>450	2%
CenturyLink	2009Q3	96	91-150	3%
Charter	2009Q3	460	>450	13%
Cablevision	2009Q4	331	151-450	9%
Comcast	2009Q4	3634	>450	4%
TWC	2009Q4	2226	>450	5%
AT&T	2009Q4	2000	>450	5%
Charter	2009Q4	748	>450	11%
Cox	2009Q4	819	>450	5%
CenturyLink	2009Q4	141	91-150	6%
Verizon	2009Q4	993	>450	4%
Cox	2010Q1	580	>450	4%
TWC	2010Q1	1598	>450	6%
AT&T	2010Q1	1514	>450	5%
Verizon	2010Q1	721	>450	3%
Comcast	2010Q1	2489	>450	4%
Cablevision	2010Q1	232	151-450	8%
Charter	2010Q1	449	151-450	10%
CenturyLink	2010Q1	116	91-150	4%

Operator Name	Quarter	Number of Valid Tests	Range of Valid Tests	Pct of Tests Showing DPI
Comcast	2010Q2	1481	>450	4%
Verizon	2010Q2	447	151-450	2%
TWC	2010Q2	898	>450	7%
Cablevision	2010Q2	128	91-150	5%
AT&T	2010Q2	794	>450	5%
Charter	2010Q2	321	151-450	6%
Cox	2010Q2	313	151-450	6%
CenturyLink	2010Q2	54	31-60	4%
Comcast	2010Q3	557	>450	4%
Verizon	2010Q3	202	151-450	2%
TWC	2010Q3	399	151-450	4%
AT&T	2010Q3	367	151-450	5%
Cox	2010Q3	106	91-150	10%
Charter	2010Q3	106	91-150	9%
CenturyLink	2010Q3	18	11-30	6%
Cablevision	2010Q3	38	31-60	3%
TWC	2010Q4	382	151-450	6%
Charter	2010Q4	145	91-150	7%
Cox	2010Q4	156	151-450	6%
AT&T	2010Q4	366	151-450	4%
Comcast	2010Q4	630	>450	5%
Verizon	2010Q4	206	151-450	6%
Cablevision	2010Q4	70	61-90	3%
CenturyLink	2010Q4	11	11-30	0%
AT&T	2011Q1	271	151-450	6%
TWC	2011Q1	334	151-450	7%
Comcast	2011Q1	496	>450	5%
Verizon	2011Q1	162	151-450	2%
Charter	2011Q1	92	91-150	11%
Cablevision	2011Q1	59	31-60	7%
Cox	2011Q1	107	91-150	4%
CenturyLink	2011Q1	14	11-30	0%
AT&T	2011Q2	391	151-450	6%
Cox	2011Q2	163	151-450	4%
TWC	2011Q2	482	>450	6%
Comcast	2011Q2	740	>450	4%
Charter	2011Q2	153	151-450	3%
Cablevision	2011Q2	76	61-90	7%
Verizon	2011Q2	227	151-450	3%
CenturyLink	2011Q2	17	11-30	0%
TWC	2011Q3	468	>450	4%
Comcast	2011Q3	705	>450	4%
Cox	2011Q3	178	151-450	7%
Verizon	2011Q3	225	151-450	4%
Cablevision	2011Q3	78	61-90	5%
AT&T	2011Q3	340	151-450	4%
Charter	2011Q3	177	151-450	3%
CenturyLink	2011Q3	15	11-30	7%

Operator Name	Quarter	Number of Valid Tests	Range of Valid Tests	Pct of Tests Showing DPI
AT&T	2011Q4	372	151-450	4%
Cox	2011Q4	173	151-450	4%
Charter	2011Q4	181	151-450	9%
Comcast	2011Q4	770	>450	3%
Cablevision	2011Q4	103	91-150	4%
Verizon	2011Q4	313	151-450	4%
TWC	2011Q4	524	>450	5%
CenturyLink	2011Q4	15	11-30	7%
Verizon	2012Q1	274	151-450	3%
TWC	2012Q1	485	>450	5%
Charter	2012Q1	150	91-150	4%
Comcast	2012Q1	619	>450	3%
Cablevision	2012Q1	101	91-150	4%
AT&T	2012Q1	330	151-450	3%
Cox	2012Q1	193	151-450	6%
CenturyLink	2012Q1	-	-	-

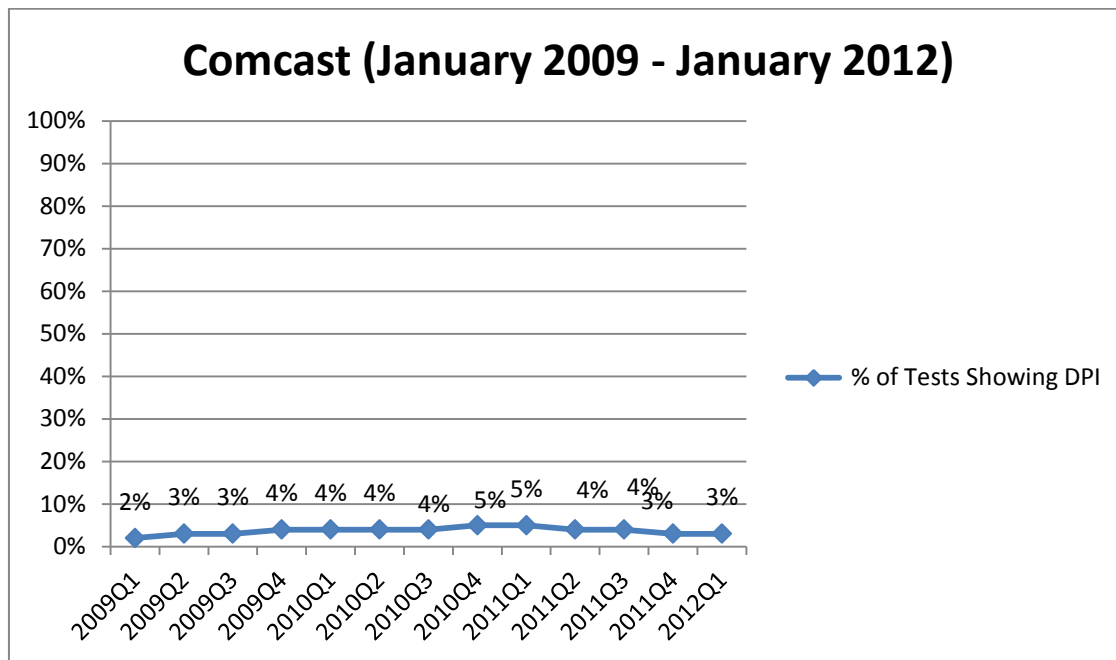
Source: Own illustration based on M-Lab Data (<http://deeppacket.info>).

Figure 4: Percentage of blocked BitTorrent connections changed between Q1 2008 and Q1 2010, Comcast, USA



Source: Mueller & Asghari (2012).

Figure 5: Percentage of blocked BitTorrent connections changed between January 2009 and January 2012, Comcast, USA



Source: Own illustration based on M-Lab Data (<http://deeppacket.info>).

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