

Net Neutrality and Zero Rating. What are the requirements for content, application and service providers to deliver digital innovation and better consumer internet-based services ?

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Net Neutrality and Zero Rating
What are the requirements
for content, application and service providers
to deliver digital innovation
and better consumer internet-based services?

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Travail de fin d'études présenté par
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Terms

3G	Third generation of cellular mobile communications
4G	Fourth generation of cellular mobile communications
5G	Fifth generation of cellular mobile communications
BEREC ¹	Body of European Regulators for Electronic Communications
BIPT ²	Belgian Institute for Postal Services and Telecommunications
BoR	BEREC Board of Regulators
CAP	Content and Application Provider
CDN	Content Data Network
COE ³	Council of Europe
CP	Content Provider
CPC ⁴	Consumer Protection Cooperation
CSP	Content Service Provider
DTA	Dutch Telecommunications Act
DPI	Deep Packet Inspection
EEA	European Economic Area
EU	European Union
FCC	Federal Communications Commission
GB	Giga-Byte
HTTPS	Hyper Text Transfer Protocol
HTTPS	Hyper Text Transfer Protocol Secure
IETF ⁵	Internet Engineering Task Force
IoE	Internet of Everything
IoT	Internet of Things
IP	Internet Protocol
IPTV	IP base Television
ISP	Internet Service Provider

¹<https://berec.europa.eu/>

²<http://bipt.be/>

³<http://coe.int/>

⁴http://ec.europa.eu/internal_market/scoreboard/performance_by_governance_tool/consumer_protection_cooperation_network/index_en.htm

⁵<http://ietf.org/>

M2M	Machine-to-Machine
MINETAD	Ministry of Industry, trade and tourism (Spain)
Mbps	Megabyte per second
Net	Network
NRA ⁶	National Regulatory Authority
OSI ⁷	Open Systems Interconnection (model)
PSTN	Public Switched Telephone Network
QoS	Quality of Services
RFC ⁸	Request for Comments
SDN	Software Defined Networking
SME	Small and Medium Enterprises
T1	Tier 1 (Refers to ISP)
TCP	Transmission Control Protocol
TCP/IP	Refers to the Internet Protocol suite including TCP and IP
UDP	User Datagram Protocol
VoIP	Voice over IP
Wi-Fi	Technology for radio wireless local area networking of devices

⁶ <https://ec.europa.eu/energy/en/national-regulatory-authorities>

⁷ https://en.wikipedia.org/wiki/OSI_model

⁸ <https://www.ietf.org/standards/rfcs/>

1. Introduction

“By 30 August 2016, in order to contribute to the consistent application of this Regulation, BEREC shall, after consulting stakeholders and in close cooperation with the Commission, issue guidelines for the implementation of the obligations of national regulatory authorities under this article”⁹. This is the introduction of the new regulation.

“Providers of internet access services shall treat all traffic equally, when providing internet access services without discrimination, restriction or interference, and irrespective of the sender and receiver, the content accessed or distributed, the applications or services used or provided, or the terminal equipment used”¹⁰. “[...] Providers of internet access services, and providers of content, applications and services shall be free to offer services other than internet access services which are optimized for specific content, applications or services or a combination thereof, where the optimization is necessary in order to meet requirements of the content, applications or services for a specific level of quality”¹¹. “Providers of internet access services shall ensure that any contract which includes internet access services specifies at least [...] a clear and comprehensible explanation as to how any volume limitation, speed and other quality of service parameters may in practice have an impact on internet access services, and in particular on the use of content, applications and services”¹².

Internet service providers have worked out commercial agreements, including “Zero Rating”¹³, before this regulation was in place, to exclude part of the internet traffic from utilization based pricing. “Zero Rating” is more affecting mobile data than broadband internet traffic and is still in use for mobile data options. Vodafone Spain offers streaming access to television chains¹⁴, Proximus Belgium offers one application at user choice¹⁵, and T-Mobile Germany offers streaming for Gaming or

⁹ BEREC, Article 5, Paragraph 3

¹⁰ BEREC, Article 3, Paragraph 3

¹¹ BEREC, Article 3, Paragraph 5

¹² BEREC, Article 4, Paragraph 1

¹³ Erik Stallman & R. Stanley Adams, IV (2015), Center for Democracy and Technology, „Zero Rating: A Framework for Assessing Benefits and Harms”, www.cdt.org

¹⁴ www.vodafone.es/

¹⁵ www.proximus.be/

“Music & Video”¹⁶, in options for which traffic is not counted against monthly allowances.

“Zero Rating” poses a problem for national regulators as it is in contradiction with net neutrality. Dutch legislators, as example, opted for a strict net neutrality which does not permit “Zero Rating”¹⁷⁺¹⁸.

“Net neutrality provides a disincentive for ISPs to invest in high-speed broadband infrastructure because they are prohibited from maximizing the returns on their investment”¹⁹. Net Neutrality is blocking investments according ISPs²⁰ while BEREC and FCC have a different views on this²¹.

As Net Neutrality is (almost) in place, it would be beneficial to review the regulatory rules and internet service providers’ requirements to boost the digital innovation and improve and develop end-user internet-based services.

1.1 The design of the Internet

The internet is a globally interconnected set of networks which enables its end-users and end-points over the world to communicate, share, and access content using the Internet Protocol suite²². This suit includes the protocols TCP, UDP and IP which are used by different applications, including mail clients, web browsers, music listening applications, video viewing applications, messaging clients, phone applications with Voice over IP and much more, all referred to as “clients”, generally used by end-users. These clients connect to other devices on the internet, called “servers”, which deliver the content that the end users want to get²³. The connections use the TCP/IP protocols as well as connection rules and methods, as agreed by the internet community in the different standards, called RFCs²⁴.

¹⁶ www.t-mobile.de/

¹⁷ Authority for Consumers & Markets, „ACM to investigate T-Mobile’s new service’ (ACM, 11 October 2016) www.acm.nl/en/publications/publication/16467/ACT-to-investigate-T-Mobile-new-service/

¹⁸ T-Mobile, “T-Mobile zal recht van klanten bepleiten voor de rechter“, Newsroom T-Mobile, <http://newsroom.t-mobile.nl/t-mobile-zal-recht-van-klanten-bepleiten-voor-de-rechter/>, 11 October 2016

¹⁹ GlobalData, DTTMT-TR-S165, 13 December 2017, www.globaldata.com

²⁰ Jose Marino Garcia, World Bank Group, World Development Report 2016, Background Paper Digital Dividends

²¹ <https://www.wired.com/story/the-fcc-says-net-neutrality-cripples-investment-thats-not-true/>, 12 August 2018

²² Cisco, <https://www.cisco.com/c/en/us/support/docs/ip/routing-information-protocol-rip/13769-5.html>

²³ Wikipedia, https://en.wikipedia.org/wiki/Client%E2%80%93server_model

²⁴ IETF, <https://www.ietf.org/standards/rfcs/>

Internet connections can be filtered, blocked, modified using network firewalls and proxy servers²⁵, and even accelerated using network accelerators²⁶, as network flows are based on packets, protocols, and ports. This permits anybody with the adequate network hardware material placed on the network flow paths to alter specific traffic, and perform quality of service management²⁷.

1.2 The Actors of the Internet

The internet has gained in popularity because of the possibility for everyone connected on the internet to be able to share content and/or to retrieve content, and to exchange data over a meshed network that reaches nowadays almost each part of the world. Starting from science laboratories in the 1960s²⁸, networks were developed in different areas and finally joined in the 1970s. And moving from single networks to interconnected networks, alignments, agreements, and interfaces needed to be constructed among the participants. The main model that is nowadays in use comprises the following main group of actors:

- Content Providers (CP): entities that deliver content to end users, including, but not only, text documents, data files, music streaming, video streaming, chat messages, voice over the internet called Voice over IP (VoIP)
- Tier 1 Internet Service Providers (T1 ISP): organizations that deliver internet traffic with a global reach and high capacity, generally interconnecting smaller internet service providers (Tier 2, Tier 3, ...) and having free exchange of traffic and information with other internet service providers²⁹.
- Tier x (Tier 1, Tier 2, ...) Internet Service Providers (Tx ISP): organizations that deliver internet traffic without a global reach, interconnected with other internet service providers and purchasing internet traffic transit³⁰

²⁵ Cisco, <https://www.cisco.com/c/en/us/products/security/firewalls/what-is-a-firewall.html?dtdid=osscdc000283>

²⁶ TechnoPedia, <https://www.techopedia.com/definition/14184/wide-area-network-accelerator-wan-accelerator>

²⁷ BEREC, BoR (16) 127, BEREC Guidelines on the Implementation by National Regulators of European Net Neutrality Rules, https://berec.europa.eu/eng/document_register/subject_matter/berec/download/0/6160-berec-guidelines-on-the-implementation-b_0.pdf

²⁸ Wikipedia, https://en.wikipedia.org/wiki/History_of_the_Internet

²⁹ TechnoPedia, <https://www.techopedia.com/definition/23819/tier-1-internet-service-provider-tier-1-isp>

³⁰ Wikipedia, https://en.wikipedia.org/wiki/Tier_2_network

- Local and Regional Service Providers: Tier x internet service providers that have only a local or regional reach, many times only servicing customers within a city
- Business Customers: customers of internet service providers that are registered as businesses
- Private Customers: customers of internet service providers that are not registered as business, but generally individual people
- End-Users: individuals or entities that access content thru internet services, either as Business Customers or Private Customers
- Regulatory Authorities that regulate the internet
- Hardware Providers, including leading companies like Cisco, Juniper, NOKIA, AT&T, Arbor and Riverbed (with a much larger list available) are business organizations that are specialized in hardware components used to manage internet traffic

BEREC, as the main regulatory authority, does not differentiate business customers from private customers in regard to end-users, to ensure that the net neutrality rules apply to everyone without distinction. End-users reflect the entity that has requested access to an internet service or content.

Some entities, like restaurants or bars, that provide free Wi-Fi to their have are not bound to the regulation of net neutrality, as the services offered are typically limited to a predetermined group of end-users and are only provided in private³¹.

1.3 The principles of Net Neutrality

The term “Net Neutrality” was coined in 2003 by Tim Wu, American lawyer and professor at the Columbia Law School, in his paper “Net Neutrality, Broadband Discrimination”³² and was popularized right after³³. No common definition exists among the various internet actors. However the policy commonly used refers to the fact that all internet traffic should be treated the same way by the internet access providers.

³¹ BEREC, “BEREC Guidelines on the implementation by National Regulators of European Net Neutrality Rules” (2016) BoR (16) 94, p. 5

³² Wu, Time (2003), Network Neutrality, Broadband Discrimination, Journal of Telecommunications and High Technology Law, Vol. 2, p. 141,

https://papers.ssrn.com/sol3/papers.cfm?abstract_id=388863

³³ Wikipedia, https://en.wikipedia.org/wiki/Tim_Wu

The BEREC request of “Providers of internet access services shall treat all traffic equally, when providing internet access services without discrimination, restriction or interference, and irrespective of the sender and receiver, the content accessed or distributed, the applications or services used or provided, or the terminal equipment used” leaves too many interpretations for provision possibilities, and leaves many providers with doubts. The consequence is a dampened ability to invest in new technologies and service offerings³⁴.

With the current development of new technologies, especially 5G, a review of the regulatory rules is requested by telecommunication equipment providers, including Cisco³⁵. Net Neutrality does, in the current form, not provide sufficient investment case for 5G, and results in reduced investment in the current infrastructure³⁶.

In the current economy, customers should be free to choose and operators should be free to innovate. But customers should also not be forced to use the services that the service providers select and should be free to access internet services without restriction.

1.4 “Zero Rating” and Specialized Services

“Zero Rating” is a practice under which the concerned internet service provider applies a price of zero to a specific data traffic, associated to a particular application or class of applications, and the data does not count towards any data cap in place on the internet access services. Zero Rating is not specifically backed by a commercial link between the internet service provider and the content or application provider. In general, Zero Rating is allowed by the national regulatory authorities when the general internet data traffic is not affected by the provision of Zero Rating against some specific data traffic. Some countries have, however, completely banned Zero Rating by applying strict Net Neutrality (e.g. The Netherlands).

³⁴ Martin Giles „The Demise of Net Neutrality Will Harm Innovation in America”, <https://www.technologyreview.com/s/609594/the-demise-of-net-neutrality-will-harm-innovation-in-america/>,

7 December 2017

³⁵ Cate Nymann, “Keeping the internet open and innovation uninhibited in a 5G world”, Cisco, <https://emear.thecisco.com/site/content/lang/en/id/8910>, 4 May 2018

³⁶ Scott Wallsten and Stephanie Hausladen (2009), Net Neutrality, Unbundling, and their Effects on International Investment in Next-Generation Networks, Review of Network Economics, Vol. 8, Issue 1, Washington
<http://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.480.2677&rep=rep1&type=pdf>

Specialized services refer to services other than internet access services which are optimized for specific content, applications or services, when an optimization is necessary in order to meet the requirements of the content, application or services, to provide a specific level of quality for the content, application or services affected. Under the BEREC recommendations, specialized services are authorized when the affected applications, content or services have objectively the requirements to meet specific quality of services. Particularly, the national regulatory authorities have to assess if the affected data traffic needs to respect specific levels of jitter, latency and packet loss to be able to provide the concerned applications, content or services.

1.5 The Regulation of the Internet in Regard to Net Neutrality

Article 5(3) of the Regulation (EU) 2015/2120 obliges the Body of European Regulators for Electronic Communications (BEREC)³⁷, which brings together all the European national regulatory authorities, to issue guidance to the national regulatory authorities on their implementation of the European rules. The Net Neutrality rules are defined as European laws. And having laws, instead of directives, means that the wording of the law will be identical in all the European countries and in the European economic area.

BEREC has been involved with the Net Neutrality subject since early 2010, and carried out investigations on transparency, competition issues, quality of service, monitoring and interconnection, in regard to Net Neutrality.

The regulation establishes rules to safeguard equal and non-discriminatory treatment of internet data traffic. It covers the provision of internet access services and specialized services.

The internet access services, in the scope of the regulatory, is publicly available electronic communication service which provides access to the internet and therefore to virtually all end points of the internet.

The Net Neutrality regulation is applicable as of 30th of April 2016. It is valid for all the content, application and service providers, for all the countries in the European Union and European economic area. The national regulatory authorities are mandated to ensure that the Net Neutrality guidance is followed by the providers.

³⁷ BEREC, <https://berec.europa.eu/>

Several approaches towards Zero Rating exists under the Net Neutrality regulation in the European Union and European economic area. The national regulatory authorities implement their interpretation of the Net Neutrality regulation based on the guidelines defined by BEREC. With this, the Dutch telecommunication authority has, as an example, decided not to follow the BEREC guidelines, but the Dutch national law banning all forms of Zero Rating. While other countries, including the Belgian telecommunication authority, allow Zero Rating under the BEREC guidelines. The European regulation does not prohibit clearly Zero Rating practices. And the total ban of Zero Rating is in contradiction with the interpretation of the Net Neutrality regulation defined by BEREC. Nevertheless, the Dutch government held on its position.

Other countries, including Belgium, and Spain, have taken position on Zero Rating. The Belgian internet service providers can propose Zero Rating offers for an application under the condition that this application, and its content, is not affected outside the Zero Rating offer. This means that the data traffic used for the chosen application (e.g. music streaming) will not count against the data traffic cap agreed in the end-user contractual agreement and will be unlimited instead.

1.6 New Technologies and Internet Development

As Cisco projected in 2014³⁸, the Western Europe IP traffic will increase from 7.7 Exabytes per month in 2012 to 16.8 Exabytes per month in 2017, with an annual growth rate of about 17 percent. Mobile data traffic alone was projected with a compound annual growth rate of about 50 percent every year.

Cisco requested the European legislators to take into account technological developments and innovations that bring new solutions to market every year, and encourage innovation and job creation. The legislators were warned that rules should be put in place to encourage reasonable resource management functionality to prevent data traffic jam, and avoid service degradation to the quality of services that consumers have come to expect.

To ensure that the Net Neutrality rules benefit the end-users, BEREC requests internet, application and content providers to implement reasonable traffic management. However, the BEREC recommendations do not enough distinguish between

³⁸ Pastora Valero, "Roadmap for Additional Discussion on Net Neutrality", Cisco, <https://emear.thecisconetwork.com/site/content/lang/en/id/1029>, 3 April 2014

reasonable and unreasonable network traffic management, while network traffic management is an essential part of the fully functioning internet with the increase of network data traffic, and development of video, real-time communications and next-generation applications, that consumers are requesting more and more.

Slicing³⁹, as the main new development in internet technologies, introduces network slice instances that can be compared to dedicated network data traffic paths. These slices can be configured for each type of network data traffic, in regard to the end points of the traffic or the content of the given traffic. Slicing can therefore be compared to the setup of specialized services⁴⁰.

Service providers request that the definition of specialized services be reviewed, to open the path to future technological innovation. High bandwidth network data traffic is impacted by the Net Neutrality rules, as these do not offer enough flexibility to make enough room to innovation. Customers should be free to choose and operators should be free to innovate in offering added value services to all user segments.

1.7 Providers' Investments

As depicted by Cisco early 2014, with the rapid increase of the Western Europe IP traffic, and the increasing demand of internet services by end-users and consumers, huge investments are required by service providers to cope with the increasing network data traffic carried over the internet. The additional requirements and restrictions adopted by the European legislators have the consequence to dampen the ability of the internet service providers to invest in new technology solutions and service offerings⁴¹. An evaluation of the rules and impact of Net Neutrality is requested to provide the opportunity to correct the course, in time, for technology investments.

Innovation in high bandwidth demanding applications and content is dampened by the Net Neutrality rules. The development of IPTV, Software Defined Networking, Internet of Everything, Video Conferencing, and Tele-Presence, to list a few examples, is limited by the close off definition of specialized services.

³⁹

https://www.ngmn.org/fileadmin/user_upload/161010_NGMN_Network_Slicing_framework_v1.0.8.pdf

⁴⁰ Caroline Chappel & Caroline Gabriel (2018), "Network slicing: the future of connectivity in a 5G and fiber area", Research Strategy Report, www.analysismason.com

⁴¹ Cate Nymann, "Keeping the internet open and innovation uninhibited in a 5G world", Cisco, <https://emear.thecisconetwork.com/site/content/lang/en/id/8910>, 4 May 2018

1.8 Researches and Questions

As shown in the former sections, content, application and service providers are confronted with the Net Neutrality rules, to provide equal treatment of network data traffic and the Zero Rating practices and agreements, where the network data traffic of certain applications is not counted towards the end-user network data cap. While some actors support this as it supports the consumers' interests, other actors request a review of the Net Neutrality rules, and especially the definition of specialized services, to permit more investments in technological and digital innovations. And provide consumers with better internet services and new digital solutions.

The research question that this thesis tries to answer is the following:

What are the requirements for content, application and service providers to deliver digital innovation and better consumer internet-based services?

In order to be able to formulate an answer to the research question, different views and aspects need to be reviewed, including legal, economical, and customer experience.

The European national regulatory authorities apply a legal framework in regard to Net Neutrality and Zero Rating practices or agreements, that application, content and internet service providers need to follow. These define what providers are allowed or not allowed to deliver to end-users. As such, the following sub-question is addressed in Chapter 2:

Which main national regulatory approaches towards Net Neutrality and Zero Rating have been adopted by the European regulators?

When the legal boundaries are clarified, this thesis will then review the requirements of the internet providers to invest in digital innovation. As Cisco indicates in the "Roadmap for Additional Discussion on Net Neutrality"⁴², April 2014, "the Net Neutrality proposal voted [...] risks hampering the very innovation that we would all like to see encouraged". And further, in "Keeping the internet open and innovation uninhibited in a 5G world"⁴³, May 2018, it continues with "The consequence [of the certain provisions] is a dampened ability to invest in new technology solutions and service offerings", and "[...] to the extent we do not have a regulatory framework in

⁴² Pastora Valero, "Roadmap for Additional Discussion on Net Neutrality", Cisco, <https://emear.thecisconetwork.com/site/content/lang/en/id/1029>, 3 April 2014

⁴³ Cate Nymann, "Keeping the internet open and innovation uninhibited in a 5G world", Cisco, <https://emear.thecisconetwork.com/site/content/lang/en/id/8910>, 4 May 2018

place that allows operators and the wider ecosystem to use the full technological capabilities at their disposal, the risk is that 5G will simply not happen”.

For this, the following sub-question is addressed in Chapter 4:

Are the abilities of service providers to invest in digital innovation dampened with the provision of the current Net Neutrality and Zero Rating rules?

Prior to looking at the investments that are affected by the Net Neutrality Regulation, there is a question that needs to be addressed first, which is done in Chapter 3:

Which digital innovation and technological development require investments?

As digital innovation and technological development progresses, new internet services and internet accesses are under review for implementation, including 5G with its slicing, together with a steady increase in internet network data traffic consumption.

This will be reviewed with the following sub-question in Chapter 5:

How to keep the internet open and innovation uninhibited?

Using a review of documentation available from Regulation, concerned organizations, and literature reviewing parts of the subject, and on the basis of the different elements reviewed in the previous topics, this thesis will then conclude with recommendations to be adopted by the European legislators, and content, application and internet service providers.

2. Net Neutrality and Zero Rating regulation and legislation in the EEA

In this chapter, two main regulatory approaches towards Net Neutrality and Zero Rating applied by European legislators are presented, using two different use cases. These use cases help to respond to the question:

Which main national regulatory approaches towards Net Neutrality and Zero Rating have been adopted by the European regulators?

Legislators across the European economic area have made attempts to translate the principle of Net Neutrality and Zero Rating, based on the Regulation (EU) 2015/2120, applicable as of the 30th of April, 2016.

The basic idea is that all the internet data traffic should be treated equally⁴⁴ and the Net Neutrality regulation provides end-users the right to access and distribute content, access applications, and use any terminal equipment at their sole choice, with reference to open internet access⁴⁵. But Net Neutrality prohibits agreements and commercial practices that “limit the exercise of the rights of end users”⁴⁶. A more precise guidance on Net Neutrality, in regard to Zero Rating, is included in the answers of the Commission in regard to a question from the European Parliament⁴⁷: “Neither a blanket ban of zero-rating, nor is there a free pass”.

BEREC provide national regulatory authorities with guidelines, which interpretation is provided to the respective national regulatory authority. The regulation was formerly based on the “recommendation on protecting and promoting the right to freedom of expression and the right to private life with regard to network neutrality”⁴⁸. With reference to fundamental rights, the preamble of the Net Neutrality regulation, the legislator mentions “[...] the freedom of expression and information, the freedom to conduct business, non-discrimination and consumer protection”⁴⁹.

⁴⁴ Regulation (EU) 2015/2120, Article 3(3)

⁴⁵ Regulation (EU) 2015/2120, Article 3(1)

⁴⁶ Regulation (EU) 2015/2120, Article 3(2)

⁴⁷ “Answers given by Mr Oettinger on behalf of the Commission”, “Parliamentary questions”, European Parliament, Question reference: E-014462/2015, 15 January 2016, http://www.europarl.europa.eu/doceo/document/E-8-2015-014462-ASW_EN.html?redirect

⁴⁸ ‘Recommendation on protecting and promoting the right to freedom of expression and the right to private life with regard to network neutrality’ (2016), Council of Europe, CM/Rec(2016), https://search.coe.int/cm/Pages/result_details.aspx?ObjectID=09000016805c1e59

⁴⁹ Regulation (EU) 2015/2120, Preamble (33), <https://eur-lex.europa.eu/legal-content/en/ALL/?uri=CELEX%3A32015R2120>

This chapter will focus on the Belgian telecom authority and the Dutch telecom authority, with their respective conclusions.

2.1 The Belgian telecom Authority and Zero Rating

BEREC makes a difference between the use of certain network data consuming applications that are not counted against the data cap and the bundling of an internet access service that provides a free subscription to specific network data generating applications⁵⁰. The difference is that in the case of Zero Rating (with the network data traffic not counting against the data cap) the pricing of the network data traffic is different, while in the other case the network data traffic is still counted against the data cap and leaves the traffic unaffected by specific treatment. BEREC makes a distinction as considering economic and internet freedom.

BEREC distinguishes between the following Zero Rating offers:

- Some applications are slowed down or blocked
The network data traffic from some applications are slowed down or blocked, but the network data traffic from other applications running in parallel is left out, not affected.
This treatment of network data traffic is not authorized as all the internet data traffic should be treated equally⁵¹.
- All the applications from a category of applications are included in the Zero Rating offer
The treatment of the network data traffic in this case is likely to influence the end user in the access to the open internet⁵². This case has been prohibited by the Dutch telecom authority in the T-Mobile case.
- Individual application from a specific category does not count against the data cap

⁵⁰ B

http://berec.europa.eu/eng/document_register/subject_matter/berec/regulatory_best_practices/guidelines/6160-berec-guidelines-on-the-implementation-by-national-regulators-of-european-net-neutrality-rules/

⁵¹ BEREC, “BEREC Guidelines on the implementation by National Regulators of European Net Neutrality Rules” (2016) BoR (16)127, p. 11

⁵² Ibid, p. 11

This type of consumer offer has a high chance to influence the end-user choice towards the selection of particular applications, in competition with other applications from a similar category of application⁵³.

BEREC considers this type of commercial offer to reduce the practice of end-users⁵⁴, but the Belgian telecom authorities allowed this Zero Rating offer under the BEREC Guidelines.

BEREC considers that the range and diversity of applications that consumers can choose from needs to be investigated in regard to the internet services restrictions, to evaluate whether end-users' rights are affected⁵⁵. Following this, the Belgian telecommunication authority BIPT has taken position that the Zero Rating offer from the Belgian Internet service provider Proximus does not limit the rights of the end-users⁵⁶. The arguments presented to support its position are:

- Multi-homing: the end user has the possibility to install several applications and easily switch between them, and while using one favorite application, the end user may not stop using some other applications that are not zero rated⁵⁷
- Data volume: the high volume of network data does not limit the end-users and consumers because of zero rating⁵⁸
- Data caps: the majority of the Proximus customers are not limited by the network data caps included in the mobile network data volume⁵⁹
- Reduction of range and diversity: as of the report compilation date, the impact of zero rating by Proximus has not such a scale that it limits the end user's choice⁶⁰
- Incumbents: there are enough alternative offers that include a similar level of mobile network data volume, without zero rating for the majority⁶¹

The Belgian national regulatory authority seems to weight the economic impact on the assessment of Zero Rating, and following the BEREC Guidelines does not allow Zero

⁵³ BEREC, "BEREC Guidelines on the implementation by National Regulators of European Net Neutrality Rules" (2016) BoR (16)127, p. 11

⁵⁴ Ibid, p. 11

⁵⁵ Ibid, p. 12

⁵⁶ BIPT, "Report regarding the analysis of Zero Rating of apps in the Proximus offers", p. 19

⁵⁷ Ibid, p. 19

⁵⁸ Ibid, p. 19

⁵⁹ Ibid, p. 19

⁶⁰ Ibid, p. 19

⁶¹ Ibid, p. 19

Rating of one application, but considers unproblematic the Zero Rating offers for categories of applications.

2.2 The Dutch telecom authority, legislation of Zero Rating

The Net Neutrality legislative history includes a reference to a request for total ban to be provisioned in the European regulation, to explicitly exclude all forms of Zero Rating⁶², but the Net Neutrality Regulation finally does not leave the possibility for European Union member states to introduce a categorical ban on Zero Rating. The Dutch legislator nevertheless deviated from the European legislators' decision with respect to Zero Rating practices or agreements.

The Net Neutrality regulation show that there is a relationship between the equal treatment of the network data traffic and the innovation possibilities that the internet permits. The recommendation comes from the idea to “[...] establish common rules to safeguard equal and non-discriminatory treatment of traffic in the provision of internet access services and related end-users' rights.”⁶³ And “[...] protect end-users and simultaneously to guarantee the continued functioning of the internet ecosystem as an engine of innovation”⁶⁴. Also the Commission indicates that “Regulators and courts will analyze Zero Rating [...] on their merits, case-by-case, in their specific national circumstances, to ensure that the objective of effective end-user choice is not undermined in practice”⁶⁵.

The Dutch legislator based their adoption of the Net Neutrality Regulation on the (old) Dutch Telecommunications Act containing provision prohibiting Zero Rating (Article 7.4a, paragraph 3) with the wording:

⁶² CoE, “Proposal for a Regulation of the European Parliament and of the Council laying down measures concerning the European single market for electronic communications and to achieve a Connected Continent, and amending Directives 2002/20/EC, 2002/21/EC and 2002/22/EC and Regulations (EC) No 1211/2009 and (EU) No 531/2012” (20 January 2015), <http://data.consilium.europa.eu/doc/document/ST-5439-2015-INIT/en/pdf>

⁶³ BEREC, BoR (16) 127, BEREC Guidelines on the Implementation by National Regulators of European Net Neutrality Rules, page 4, https://berec.europa.eu/eng/document_register/subject_matter/berec/download/0/6160-berec-guidelines-on-the-implementation-b_0.pdf

⁶⁴ *ibid*

⁶⁵ “Answers given by Mr Oettinger on behalf of the Commission”, “Parliamentary questions”, European Parliament, Question reference: E-014462/2015, 15 January 2016, http://www.europarl.europa.eu/doceo/document/E-8-2015-014462-ASW_EN.html?redirect

Providers of Internet access services shall not make their charges for Internet access services dependent on the services and applications which are offered or used via said services”⁶⁶.

The legislation did not allow to provide a service, consisting of the access to webpages, services and applications, where the use of certain applications or services is charged separately⁶⁷.

After the adoption of the Net Neutrality Regulation, the Dutch legislator considered the BEREC Guidelines in contradiction with Article 3(3) of the Net Neutrality Regulation, providing the following two arguments to keep the total ban of Zero Rating as more effective because:

- The total ban of Zero Rating prevents that new and innovative parties are excluded from the market since incumbent companies are capable of offering their services more at lower costs on the internet⁶⁸.
- The total ban of Zero Rating prevents Internet access providers to use their networks in order to steer the choice of end-users between different applications and content⁶⁹.

The Dutch T-Mobile network data provider was prohibited to provide the Zero Rating based offer, because “data-free music” service is not allowed under the Dutch telecommunications Act and T-Mobile argued that the prohibition should be in regard to the treatment of internet data traffic in technical rather than commercial terms⁷⁰. T-Mobile indicated that Zero Rating is based on a technical different treatment of internet data traffic and therefore not violating Article 3(3) of the Net Neutrality Regulation⁷¹. Finally, on 20 April 2017, the Dutch district court ruled that the Net Neutrality Regulation does not include a total ban on Zero Rating practices or agreements⁷². As

⁶⁶ Legislative History of the Dutch Telecommunication Act, ‘Wijziging van de Telecommunicatiewet ter implementatie van de herziene telecommunicatierichtlijnen (2010-11), 32 549, 29

⁶⁷ Dutch district court Rotterdam 4 February 2016, ECLI:NL:RBROT:2016:810 (Vodafone vs. ACM), paragraph 2.1, <http://deeplink.rechtspraak.nl/uitspraak?id=ECLI:NL:RBROT:2016:810>

⁶⁸ Legislative History of the Dutch Telecommunication Act, ‘Wijziging van de Telecommunicatiewet ter uitvoering van de netneutraliteitsverordening’ (2015-16), 34 379, E

⁶⁹ Ibid

⁷⁰ Authority for Consumers & Markets, ‘Besluit T-Mobile moet stoppen met Datavrije Muziek’ (ACM, 22 December 2016), <https://www.acm.nl/en/publications/publication/16810/ACM-forces-T-Mobile-to-stop-its-Data-free-Musicservice/>

⁷¹ Ibid

⁷² Dutch district court Rotterdam 24 April 2017, ECLI:NL:RBROT:2017:2940 (T-Mobile vs. ACM), paragraph 6.4 – 6.7, <http://deeplink.rechtspraak.nl/uitspraak?id=ECLI:NL:RBROT:2017:2940>

result, the Dutch law banning Zero Rating is in contradiction with the Net Neutrality Regulation.

As conclusion, the technical treatment of network data traffic and not the commercial pricing bound to the use of an application on the internet is determining if the network data traffic is treated equally. It may therefore also be possible to prohibit Zero Rating because of commercial discriminatory practices or agreements.

2.3 The Net Neutrality Regulation

While the Dutch telecommunication authority has taken position on Zero Rating, the Belgian telecommunication authority allows Zero Rating of one application considering the BEREC Guidelines. The evaluation of the BEREC Guidelines may most probably lay between the two extreme cases within the European economic area. And any Zero Rating service offering needs to be assessed on a case-by-case basis, to ensure it is aligned with the BEREC Guidelines and the national regulatory authorities. The total ban of Zero Rating in the Dutch legislation is based on an economic point of view, as incumbents could provide service offerings at lower costs on the internet. Additional, it prevents that Internet access providers influence the choice of end-users between different applications and content.

The Belgian national regulatory authority on the other hand weights the economic impact on the assessment of Zero Rating, and allows categories of applications.

Considering both decisions, it seems that the economic arguments take precedence over the internet freedom discussion. A commercial discrimination is less impacting end-users than a technical discrimination.

In parallel to the Net Neutrality Regulation discussion, with network data caps and Zero Rating of applications and content, the WiFi4EU initiative of the European Commission, under the Digital Single Market strategy, promotes access to wireless connectivity in public places⁷³. As such, the discussion about Zero Rating may soon be transferred to network data traffic over broadband connections. While the BEREC Guidelines apply to network data traffic in general and not only to mobile network data traffic, the discussion about Zero Rating is currently only considering mobile network data traffic.

⁷³ European Commission, “Factsheet on WiFi4EU” (20 March 2018), Digital Single Market, <https://ec.europa.eu/digital-single-market/en/news/factsheet-wifi4eu>

3. Digital Innovation and Technological Environment

With the focus on Net Neutrality and Zero Rating, one can see that the Internet service providers have invested in the deployment of fiber-to-the-home^{74,75}. As unbundling was the main key word in Europe for a long time, the installation of fiber services is still continuing in many cities in Europe. On the other hand, the Internet service providers continue upgrading the Internet backbone, while the edge of the Internet, with the increase bandwidth available to the end-users, is transporting more and more network data⁷⁶, to cope with the continual increase of IP consumption. The most important increase of Internet traffic is generated by smartphones⁷⁷. The traffic generated by these smartphones is predicted to reach a 43% share of networked devices, globally⁷⁸ by 2021, with the highest growth rate.

Understanding this, it will be easy to respond to the question:

Which digital innovation and technological development require investments?

Standard development

With the increasing consumption of IP traffic, by smartphones, the connectivity of these is in the focus of the technology companies. This can also be observed with the rapid deployment of mobile access technologies focused on network data. 3G appeared in 2001. 4G appeared in 2012 and 5G is forecasted soon⁷⁹, with a new mobile generation appearing approximately every 10 years.

The 5G standard that is under development, and is the latest innovation in mobile data communication, will permit to connect tens of thousands of users, data rates over fixed network rates in metropolitan areas, high-bandwidth access for simultaneous

⁷⁴ De Bijl, Paul (2005), Local Loop unbundling in Europe: Experience, Prospects and Policy Challenges, International University in Germany Working Paper No. 29/2005, https://papers.ssrn.com/sol3/papers.cfm?abstract_id=690582

⁷⁵ Scott Wallsten and Stephanie Hausladen (2009), Net Neutrality, Unbundling, and their Effects on International Investment in Next-Generation Networks, Review of Network Economics, Vol. 8, Issue 1, Washington <http://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.480.2677&rep=rep1&type=pdf>

⁷⁶ Cisco Visual Networking Index (2017) <https://www.cisco.com/c/en/us/solutions/collateral/service-provider/visual-networking-index-vni/complete-white-paper-c11-481360.html>

⁷⁷ Ibid.

⁷⁸ Ibid.

⁷⁹ Mohr, Werner (2015), The 5G infrastructure, public-private partnership, 5G Infrastructure Association (<http://5g-ppp.eu/>) https://www.tu-ilmnau.de/fileadmin/media/WSA2015/5G_Vision_and_requirements_WSA_2015_Werner_Mohr.pdf

connections, hundreds of thousands simultaneous connections for wireless sensors and a significant latency reduction compared to LTE (4G)⁸⁰.

With this digital innovation, there is no wonder that mobile service providers want not only adopt the technology, but also develop their infrastructure to deploy the technology, while improving their coverage.

Network data generation

According the analysis by HSBC⁸¹, there is an increasing number of areas generating network data traffic, including

- Electronic content in automobiles for safety, infotainment, power management and generation, and autonomous driving
- Perceptual computing and the continued shift to virtual and augmented reality
- Internet of Things, with connected devices, automation, and robotics

With an explosion of the quantity of network data traffic generated.

Traffic increase

The internet data forecast shows an overwhelming increase of traffic for the coming years⁸². The numbers published by leading internet service providers show the following:

- The global internet traffic will be equivalent to 135 times the volume of the global Internet in 2005⁸³
- Globally, the Internet traffic will grow 3.4-fold from 2016 to 2021, a compound annual growth rate of 26%⁸⁴
- Globally, the IP traffic will grow 3-fold from 2016 to 2021, a compound annual growth rate of 24%⁸⁵
- The average data traffic consumption (per month) on mobile networks will increase from 0.6 GB in 2016 up to 30 GB in 2025⁸⁶

⁸⁰ IEEE 5G and Beyond Technology Roadmap White Paper, IEEE 5G,

<https://futurenetworks.ieee.org/images/files/pdf/ieee-5g-roadmap-white-paper.pdf>

⁸¹ Hung, Samson (2018), Global Technology in a digital world, data is the new alpha, HSBC Global Research (<https://www.reearch.hsbc.com/>)

⁸² Ibid, p. 8

⁸³ Cisco Visual Networking Index (2017)

<https://www.cisco.com/c/en/us/solutions/collateral/service-provider/visual-networking-index-vni/complete-white-paper-c11-481360.html>

⁸⁴ Ibid.

⁸⁵ Ibid.

⁸⁶ The future of mobile broadband (February 2017), Huawei X Labs Wireless

<http://www-file.huawei.com/~media/CORPORATE/PDF/mbb/huawei-mbb-report-final.pdf?la=en>

- The cell edge data transfer rate passes from 5 Mbps in 2016 to 30 Mbps in 2025⁸⁷

Mobile traffic increase

While the overall network data traffic is increasing on a regular basis, the same source shows that the mobile network data traffic experiences the most important development and grow rates:

- The Mobile traffic grow of 63% in 2016, compared to the Fixed/Wi-Fi traffic grow of 32% the same year⁸⁸
- The Mobile traffic forecast grow 7-fold from 2016 to 2021, compared to the Fixed/Wi-Fi traffic forecast grow 3-fold
- The mobile traffic compound annual growth rate of 46%, compared to the Fixed/Wi-Fi traffic compound annual growth rate of 26%

Internet consumption

The average time spent on mobile devices is increasing, with an average of 2 hours per day in 2016⁸⁹, it will reach about 5.5 hours per day in 2025⁹⁰.

The growth in smartphone mobile subscriptions increased alone by 280% from 2010 to 2013⁹¹, with the number of global mobile subscriptions moving from 992 million subscriptions in 2005 to 1 490 subscriptions in 2013⁹² representing an increase of 150% in developed countries, while the increase worldwide is about 302%⁹³.

Connectivity increase

The development of mobile communication, electronic technologies, lower devices prices, estimations predict 10 billion smartphone subscriptions in 2015 and 12 billion in 2030⁹⁴, while the number of non-smartphone subscriptions will decrease during the same period⁹⁵.

⁸⁷ Ibid.

⁸⁸ Cisco Visual Networking Index (2017), <https://www.cisco.com/c/en/us/solutions/collateral/service-provider/visual-networking-index-vni/complete-white-paper-c11-481360.html>

⁸⁹ The future of mobile broadband (February 2017), Huawei X Labs Wireless <http://www-file.huawei.com/~media/CORPORATE/PDF/mbb/huawei-mbb-report-final.pdf?la=en>

⁹⁰ Ibid.

⁹¹ IMT traffic estimates for the years 2020 to 2030, Report ITU-R M.2370-0 (07/2015), ITU https://www.itu.int/dms_pub/itu-r/opb/rep/R-REP-M.2370-2015-PDF-E.pdf, p. 8

⁹² Ibid. p. 10

⁹³ Ibid. p. 10

⁹⁴ Ibid. p. 13

⁹⁵ Ibid. p. 13

At the same time, the M2M global market is also developing, moving from 213 million subscriptions in 2010 to 422 million subscriptions in 2013 enjoying almost 200% increase⁹⁶.

Network data forecast

The estimation of network data traffic generated by mobile devices, not including M2M shows an annual rate of around 54% between 2020 and 2030⁹⁷, with a monthly volume estimated to reach the 543 Exabyte in 2025 and 4 394 Exabyte in 2030⁹⁸. About 800% increase alone from 2025 to 2030.

Network Data Type

The mobile network data traffic statistics and estimations show that the major increase of traffic comes from mobile video traffic. A compound annual growth rate of 54% is estimated between 2016 and 2021⁹⁹, with video counting for 82% of the global mobile data traffic in 2021¹⁰⁰, compared to 60% at the end of 2016¹⁰¹. Mobile Internet traffic and M2M traffic combined will mainly grow around the year 2020, with video traffic 4.2 times non-video traffic¹⁰².

Encryption

The growing utilization of encryption on Internet traffic provides consumers with confidence in privacy, but has some drawbacks for Internet service providers in regard to data usage consumption, data analysis, and traffic management. Additionally, video streaming, with the utilization of network data encryption, moved from a traditional network protocol to the more widely used web protocol HTTPS¹⁰³. The encryption of the network data impacts directly the volume of data transported because of the extra headers and encrypted data payload, and because traditional proxies are unable to use

⁹⁶ IMT traffic estimates for the years 2020 to 2030, Report ITU-R M.2370-0 (07/2015), ITU https://www.itu.int/dms_pub/itu-r/opb/rep/R-REP-M.2370-2015-PDF-E.pdf , p. 14

⁹⁷ Ibid. p. 16

⁹⁸ Ibid. p. 16

⁹⁹ Cisco Visual Networking Index (2017), <https://www.cisco.com/c/en/us/solutions/collateral/service-provider/visual-networking-index-vni/complete-white-paper-c11-481360.html>

¹⁰⁰ The Zettabyte Era: Trends and Analysis, Cisco, <https://www.cisco.com/c/en/us/solutions/collateral/service-provider/visual-networking-index-vni/vni-hyperconnectivity-wp.html>

¹⁰¹ Cisco Visual Networking Index (2017) <https://www.cisco.com/c/en/us/solutions/collateral/service-provider/visual-networking-index-vni/complete-white-paper-c11-481360.html>

¹⁰² IMT traffic estimates for the years 2020 to 2030, Report ITU-R M.2370-0 (07/2015), ITU https://www.itu.int/dms_pub/itu-r/opb/rep/R-REP-M.2370-2015-PDF-E.pdf , p. 8

¹⁰³ The Transport Layer Security (TLS) Protocol — RFC 5246

in-network caches¹⁰⁴. Also traffic management is impaired by the encryption of network data traffic¹⁰⁵, with the inability to analyze the traffic, permitting internet service providers to better manage their data networks and allocate resources. Instead, larger network data paths with more bandwidth are required as well in the internet backbone as the edge of the networks, including the internet access connections for consumers.

Solutions to Cope with Traffic

Most of the solutions for increasing mobile capacity have been implemented, and mobile operators are still faced with the challenge to handle the projected data demand. For additional bandwidth and speed, and reducing latency and jitter, mobile operators are restricted in their possibilities using¹⁰⁶:

- More spectrum: Mobile spectrum is key in mobile network capacity. But allocating more spectrum for data network connections is a time and resource-intensive process that needs to be approved by the Regulation. Additionally, spectrum is very expensive and allocation is depending on auctions¹⁰⁷. Additional revenues are then required, from end customers or other providers to cover the costs¹⁰⁸.
- Spectral efficiency: Compressing more bits into the slices of the spectrum would increase efficiency, but is limited.
- Spectrum reuse: The main activity of splitting cells in different regions is also limited and increases costs.
- Economizing resources: Monthly data plans permit an improved capacity management. Data caps permit to limit the bandwidth consumption and forecast new requirements.

¹⁰⁴ The cost of the “S” in HTTPS, <https://davidtnaylor.com/CostOfTheS.pdf>

¹⁰⁵ Encryption and DPI: Current and Future services impact, Whitepaper, Sandvine <https://www.sandvine.com/hubfs/downloads/solutions/analytics-and-insights/sandvine-wp-encryption-and-dpi.pdf>

¹⁰⁶ Brake, Doug (2016), Mobile Zero Rating: The economics and innovation behind free data, ITIF Information Technology & Innovation Foundation, <http://www2.itif.org/2016-zero-rating.pdf>

¹⁰⁷ Cramton, Peter (2011), Using Spectrum Auctions to Enhance Competition in Wireless Services, Journal of Law and Economic, Vol 54 <http://www.cramton.umd.edu/papers2010-2014/cramton-kwerel-rosston-skrzypacz-spectrum-auctions-and-competition.pdf>

¹⁰⁸ The FCC and Auctions for Radio Spectrum Licenses, Stanford <https://web.stanford.edu/~jdlevin/Econ%20136/Lecture%2013%20The%20FCC%20and%20Spectrum%20Auctions.pptx>

Solution

The 5G technology under development for the past decade will provide mobile operators with new functionalities that will cover their requirements¹⁰⁹, including

- M2M Communication for IoT: connecting billions of devices without human intervention at the same time
- Low Latency communication: mission critical applications and real-time communication support, supporting development of remote surgeries, video conferencing, tele-presence, Voice over IP, and much more
- Faster data speeds: to support applications demands and provide enhanced quality in the content
- Greater capacity: to support capacity requirements for more and more demanding applications
- Slices: for virtualized transport and access domains, and support of isolation levels and services

According data network and mobile providers, 5G technology with slicing¹¹⁰ is the revolution that provides answers to their needs¹¹¹. It is also pointed to when it comes to discussions about investments in digital transformation¹¹².

Innovation

5G, as access and transport to the data networks, and especially the Internet, addresses the problems resulting from increased capacity requirements, the problems resulting from real-time applications developments, the problems resulting from consumers' behaviors, and much more. It is also providing support to innovations coming from other domains than Internet technologies, but using more and more the Internet as medium, and data networks to communicate, share content and gain access to remote devices, services, locations. This includes, among others, remote surgeries, remote control (with IoT and M2M), which are also revolutions in other domains, addressing customer and organization demands, and need support (on Internet) to be able to work. 5G is considered the most important wireless industry developments in 2018.

¹⁰⁹ 5G and EMF Explained (March 2018), <http://www.emfexplained.info/?ID=25916>

¹¹⁰ An introduction to Network Slicing (2017), GSMA Association, <https://www.gsma.com/futurenetworks/wp-content/uploads/2017/11/GSMA-An-Introduction-to-Network-Slicing.pdf>

¹¹¹ Caroline Chappel & Caroline Gabriel (2018), "Network slicing: the future of connectivity in a 5G and fiber area", Research Strategy Report, www.analysismason.com

¹¹² Cate Nymann, "Keeping the internet open and innovation uninhibited in a 5G world", Cisco, <https://emear.thecisconetwork.com/site/content/lang/en/id/8910>, 4 May 2018

4. Investments by service providers in digital innovation

An important part in the lifecycle of a project is the investments done in the products and technologies supporting the products. This does not only include the deployment and support of a product, but also the development of the given products. And the affected organization needs an incentive to invest in these products. And once a solution, and particularly a network, is designed and implemented, undoing investments are quite large and therefore the investment decisions are significant.

The internet was developed using dial-up connections, and expanded with high-speed broadband access links. But the architecture remains the same. The internet service providers can only provide best-effort access and transport of network data. And especially when peering with other providers for downstream or upstream network data traffic, the quality of the services in regard to the transport cannot be guaranteed. It is transported and delivered as best-effort. However, new applications including video streaming, music streaming, voice over IP, and real-time applications require a higher quality in the service assurance. The development of these applications require the development of new technologies for the network data transport and access.

Latency, jitter, and speed are defined by the quality and the size of the network infrastructure over which the network data is transported. However, the access links to the backbone infrastructure of the internet service providers are the most expensive and difficult to implement. As such, these internet service providers need additional tools and services to manage the traffic.

The deployment of new or additional capacity on the internet service providers' infrastructure is a long process with relatively high fixed costs. And while statistics about growing network data consumption exist, the investment in network infrastructure development remains risky. As such, an efficient use of existing and limited capacity is required. An under-utilized data network is too expensive for the revenue it can generate. An over-utilized data network has the result of introducing latency, speed, and jitter problems, while the data network is congested. So some applications will stop working correctly. The first services affected by congestion are especially the newest applications, with video and music streaming, and voice over IP. Special service like remote surgery cannot be guaranteed under such conditions.

In order to overcome many, if not most, problems with congestion, internet service providers can rely on traffic management to prioritize network data connections. The

internet was originally developed with two main protocol categories within the IP protocol suit: TCP as a reliable, ordered and error-checked delivery of network data packets and UDP without guarantee of delivery, ordering and duplicate protection. And even within these protocols, some applications are time sensitive, and others are not time sensitive. Internet service providers can rely on these protocols to manage the network data flows, permit everyone to work, by setting preferences.

The move from the content providers from un-encrypted to encrypted traffic, with the benefit on providing better privacy to consumers moves however the network data traffic from unreliable to reliable network data flows, not depending if the content needs to be treated as time-sensitive with guaranteed delivery (of each network data packet) or as best effort (as it was done previously with video streaming). This move implies that traffic management is more complicated than ever and needs additional deep packet inspection, which can be considered as controversial, and is affecting the Net Neutrality. A detailed review on this is however outside the scope of this analysis. The BEREC Guidelines are pretty clear about the utilization of traffic management and Zero Rating which are in contradiction to the internet service providers' requirements for an effective utilization of their main assets, the data networks. Proponents of Net Neutrality fear that internet service providers reach a monopoly power and could exercise anticompetitive control over access, content and harm consumers by influencing their choices¹¹³. Additionally, usage-based pricing, efficient scarce resources allocation and improvement of customer value are in the focus of the internet service providers and especially the mobile internet service providers. But the BEREC Guidelines and the interpretations of the national regulatory authorities have a challenging impact.

With the consideration of the above mentioned points, the following question needs to be answered:

Are the abilities of service providers to invest in digital innovation dampened with the provision of the current Net Neutrality and Zero Rating rules?

Net Neutrality is supposed to promote the internet innovation as it restricts the possibility of content, application and service providers to prioritize or filter network data traffic based on the content or the applications generating the given traffic, or

¹¹³ Wallsten, Scott (June 2006), The Economics of Net Neutrality, The Berkeley Electronic Press, Economists' Voice

economic reasons. However, these restrictions imposed to providers prohibit practices that could increase the value of products based on the internet network, and even the internet network itself, for consumers¹¹⁴.

The key topics from the BEREC Guidelines are axed around transparency, filtering, and preferences. Transparency requires the disclosure by service providers of the rules in place for managing the data networks. Filtering is about the capacity of content, application and service providers to limit or block access to some content or applications. And preference is the ability to prioritize traffic or content as of the content, the source, or the consumers accessing or trying to access some content. Additionally, the processes involved by the national regulatory authorities need to be considered as these permit products or options or object to these under the current BEREC Regulation.

Understanding that the major digital innovation is based on 5G, and the services offered by 5G may be impacted by the BEREC Guidelines and the interpretation of the national regulatory authorities, the following points will review the requirements from both the regulatory authority and the internet and mobile service providers.

4.1 Technical aspect

As indicated earlier, content, application and service providers are facing new requirements coming from either the customers or applications developed to access or share content. With the growing consumption of bandwidth, with increasing quality of the content transported over the data networks, and the dependency of the applications and contents on the quality of the medium used, internet service providers, and especially mobile service providers, are facing growing technical limitations. And mainly the access links, to the internet service providers, are suffering from the technical constraints: bandwidth and capacity, speed, latency and jitter are the key points. The internet backbone is not suffering from these limitations, because of high capacity and resiliency. At least not at the level the access links are suffering, and not impacting consumer services.

The internet backbone links, or paths, may have problems with latency and jitter, during a short time. This happens at a low level, and is mainly happening on very long transport links like undersea cables (e.g. trans-Atlantic undersea cables), links in

¹¹⁴ Farber, David (19 January 2007), Hold Off on Net Neutrality, The Washington Post, p. A19

region that rely a lot on undersea cables for connectivity (e.g. Indonesia), satellite connectivity for long distances, or in case of fail-overs to backup links that provide enough capacity for backup. But the impact is then solved pretty rapidly, as soon as the services are repaired or reasons of congestion solved. Additionally, with the high internet backbone capacity, access capacity does only impact the backbone capacity slowly. This means that additional backbone resources are in place before the additional access capacity can imply any impact.

The access links, with high costs, limited available technologies (fiber is not available everywhere), and based most of the time on old technologies (PSTN lines based on copper), is the weak point in a data network. Mobile services have even more limitations in terms of capacity than broadband connections, while only having a limited set of possibilities to respond to growing demand.

The 5G technology, with an almost ten years development timeline¹¹⁵ is responding to the access links constraints. And it is however facing challenges with the BEREC Guidelines on Net Neutrality.

A review of the technical requirements gives the following:

Capacity

Capacity management permits to provide different bandwidth to different network data traffic¹¹⁶. The throughput for specific traffic can be controlled according the used network protocols, source and destination addresses, source and destination ports, and even some content if using deep packet inspection.

A more effective utilization of the access links' capacity, with capacity or throughput management, permits to reduce the access costs (for the same traffic), and better cope with demand fluctuation, including the time required to deploy new bandwidth as of short forecasting abilities of consumers.

Zero Rating, as a commercial practice, permits a better capacity consumption forecast, while responding to customer demand and needs.

Data caps, also as commercial practices, also permit a better capacity consumption forecast, as consumers try to keep within the limited capacity and provide investment resources in case they overpass the agreed capacity.

¹¹⁵ ITU, 5G roadmap: challenges and opportunities ahead (July 2017)

<https://www.itu.int/en/ITU-D/Conferences/GSR/Documents/GSR2017/IMT2020%20roadmap%20GSR17%20V1%202017-06-21.pdf>

¹¹⁶ Wikipedia, Capacity management, https://en.wikipedia.org/wiki/Capacity_management

Also data network congestions can be managed with traffic management, in the case that content providers refuse to correctly dimension their access links to the internet, or massively use network data encryption.

The BEREC Guidelines on Net Neutrality ban however commercial practices that would allow Zero Rating and imply that national regulatory authorities analyze the offers in most of the cases.

The analysis by the national regulatory authorities is time consuming, and results in an uncertainty for internet service providers, while delaying the time to market for the commercial offers. This is however reviewed later, in regard to processes.

The Belgian Proximus case shows however that Zero Rating, with one particular category may be possible, while the Dutch T-Mobile case shows that Zero Rating may be prohibited. The arbitration process will define what is possible, but is time consuming and more importantly is providing uncertainties to internet service providers.

Throughput

5G provides more bandwidth than previous developed technologies, as relying on new spectrum, and based on new transport protocols. The throughput can however also be configured in regard to specific content, specific applications, and specific channels. Actually, the channels would mean dedicated bandwidth for specific applications or content. While this is possible for specialized services, this is banned by the BEREC Guidelines for services that are not defined as specialized services.

Additionally, it is complex for national regulatory authorities to objectively assess the requirements and definition of specialized services, that require specific quality of services or could be provided by the general best effort internet access services. Complexities in arbitration by national regulation authorities can have an impact on the development of specialized services. Even more, the qualification of services to be defined as specialized services can be amended or reviewed over time¹¹⁷, leaving uncertainties for internet service providers, and resulting also in long arbitration processes.

¹¹⁷ BEREC Guidelines for quality of service in the scope of net neutrality, BoR (12) 131 (26 November 2012), paragraph 105 and 108

Latency

Reduction of latency is a huge benefit for the applications that are depending on low latency. High latency can have the effects to delay connectivity, out of range or out of control network data packets and break connections. It can create loss of packets as the end device, or a firewall on the communication path, can think the packets are not linked or bound to previous packets. So communication may result as impossible.

The BEREC Guidelines, with the recommendation to treat all network data traffic equally, means that applications requiring low latency should work the same way than applications not depending on low latency. And as the internet data traffic is based on best effort network data transfer, it means that low latency requiring applications may not work, unless using specialized services.

While the arbitration on the possibilities to use specialized services are long lasting processes, and may change with the time, the internet services are facing uncertainties with the possibilities to use technologies that provide low latency, for specific services, as done by 5G.

Jitter

Jitter is defined as the difference in delay in regard to the transmission of network data packets forming network connections. It is important for some services, which are dependent on jitter, because connectivity may break for the impacted applications or the end user may not see or hear as example what was shown or told during a video conference. If network data packets from a video conference are not received by the contact in the same order that sent by the first one, video images may be distorted, and voice and music may result in un-understandable noises.

BEREC's investigations in studies¹¹⁸⁺¹¹⁹⁺¹²⁰ show that jitter is one of the features that needs to be measured for providing standard internet access services or specialized services. However, arbitration is again required in the qualification of the services either as specialized services or standard services.

Speed

The speed of the internet service providers is published by the respective internet service providers as required by the BEREC Guidelines on Net Neutrality.

¹¹⁸ Net Neutrality Regulatory Assessment Methodology, BEREC draft BoR (17) 112, 1 June 2017

¹¹⁹ Monitoring quality of Internet access services in the context of net neutrality, BEREC report BoR (14) 117, 25 September 2014

¹²⁰ Feasibility study of quality monitoring in the context of net neutrality, BEREC report BoR (15) 207, 30 November 2015

In Spain, the review of 24.000 complaints received by MINETAD shows that 0.91% of the cases were in regard to Net Neutrality issues, and the majority of these cases were about problems with speeds on the internet access services¹²¹. Even then, the compliance with the contracts and against Regulation were confirmed by the ministry.

Slices

Slices permit logically isolated network partitions, to cover a wide range of use cases with one single network. They will allow different use cases to be supported on a shared infrastructure. One slice can as example be used for voice communication, a different slice for automated driving, another different slice for standard internet access services and a last slice for access to specific services.

The feature is introduced with the 5G technology and will permit the connectivity limits to be moved back in an important manner.

As of BEREC Guidelines for specialized services, a huge arbitration process is required for the utilization of slices, that also needs to define which services will be provided over which slices. Slices will affect the equal treatment of all the network data traffic, and is therefore in contradiction with the BEREC Guidelines. The full benefit of slices, and thus capabilities of the 5G technology, may therefore not be used while deploying 5G.

Filtering

The BEREC Guidelines have as main objective the protection of the consumers and the freedom of choice. By prohibiting ex-ante most of the practices, it blocks however the possibility to define specific services based on essential applications, as requested by certain communities¹²². Also innovation of some retail offers is restricted.

Quality of Services

A set of rules are defined in the BEREC Guidelines in regard to different roles of quality of services in regard to Net Neutrality¹²³. Article 22(3) provides national regulatory authorities the power to set minimum quality of service (QoS) requirements to “[...] prevent degradation of the Internet access service and the hindering or slowing down of traffic over networks.¹²⁴”. As such, the internet service providers have the

¹²¹ Telefónica S.A., Evaluation of the application of Regulation (EU) 2015/2120 and the BEREC Net Neutrality Guidelines (April 2018), paragraph 19

¹²² <https://policyreview.info/articles/analysis/disrupting-disruptive-making-sense-app-blocking-brazil>

¹²³ BEREC, “BEREC Guidelines for quality of service in the scope of net neutrality” (2012) BoR (12) 131, p. 21

¹²⁴ Ibid. p. 23

obligation to provide a set of tools to provide a view and reports on the quality of services they provide.

Service Quality

A peering dispute, resulting in the de-peering, between Cogent and Level 3 in 2005, shows that some internet service providers have the incentive to provide differentiation in the services they provide to their customers, but also the possibility to charge content providers in regard to levels of service quality they offer to consumers and content providers.

While internet service providers are closer to their customers, the service quality they can provide to their customers while providing content can be higher than the service quality from content providers that are reached over one or more networks that are peered together. The distance or length of the network data path is an important factor for service quality.

The BEREC Guidelines request transparency as a condition for competition and transparent market to consumers¹²⁵. The national regulatory authorities are in charge of detecting deterioration of quality, and subscribers have with this requirement the ability to choose between internet service providers¹²⁶.

4.2 Processes

Capacity management

Capacity management and dynamic bandwidth allocation makes sense when working with scarce resources. This means on one side that the network data traffic is reviewed as of its content, source and/or destination, as to permit to understand which traffic should have a preference on the bandwidth allocation. And on the other side that some network data traffic is preferred over other traffic, and introduces therefore a non-equal treatment of network data traffic. In regard to the BEREC Guidelines for Net Neutrality, requesting that all traffic is treated equally, this is not acceptable, unless using specialized services which are however reserved to limited cases.

¹²⁵ Ibid, p. 21

¹²⁶ Ibid, p. 25

Traffic Management

The BEREC Guidelines¹²⁷, as reviewed by Telefonica¹²⁸ for the BEREC consultation¹²⁹, indicates that “the interpretation from [...] paragraphs 49 to 75 restricts the right of operators to segment the internet access services that is explicitly allowed by the Regulation”. The direct result is that some offers, specialized for corporates and SME, cannot be developed and brought to market. All capabilities that are provided by the 5G technology will therefore not be deployed.

Upgrade and Downgrades

The deployment of additional capacity, by either adding new capacity or changing the existing capacity, or even removing capacity, is a long process bound with fixed costs. Contracts are also mainly binding consumers to contractual terms months or years. As such, the capacity cannot be changed on a regular time, and a forecast of bandwidth consumption and network data transport quality is required. The dynamic evolution of the market, with the rapid deployment of new applications with new demand is not facilitating this process.

The BEREC Guidelines, with the equal treatment of network data traffic, does not permit the utilization of some services that would speed up the change of bandwidth allocation, by either providing dynamic allocation of bandwidth or by manual adjustment of the bandwidth. Understanding that the access links, which are the pipes suffering most of capacity constraints, the bandwidth adjustment should be done with scarce resources (in term of total available bandwidth) and with traffic or content preference.

Congestions

Data network congestions are the direct results of over-utilization of the resources. The results are latency problems, jitter issues, (network data) packet loss, disturbed communication, unclear results, loss of communication. All these effects can be managed, at some extends, by managing the network data traffic. But this implies preferring some traffic over other, filtering some traffic, and prioritizing some traffic. All these are prohibited by the BEREC Guidelines.

¹²⁷ BEREC Guidelines for quality of service in the scope of net neutrality, BoR (12) 131 (26 November 2012)

¹²⁸ Telefónica S.A., Evaluation of the application of Regulation (EU) 2015/2120 and the BEREC Net Neutrality Guidelines (April 2018)

¹²⁹ BEREC Consultation paper on the evaluation of the application of Regulation (EU) 2015/2120 and the BEREC Net Neutrality Guidelines, BoR (18) 33 (8 March 2018)

Effects

In regard to the BEREC Guidelines, with the prohibition of network data preferences, prioritization, and filtering, internet service providers need to offer bundles with additional capacity as Zero Rating does not permit the choice of traffic for consumers. Consumers are obliged to move to higher speed transfer technologies, to cope with the ever growing requirements for content and applications, also impacting capacity. Not knowing the bandwidth and capacity required means that many resources are left out, unused. But these are invoiced to the consumers. Meaning that costs could be reduced, offers enhanced, if some tools would be available to better manage capacity and congestions.

Implementation Time

The national regulatory authorities need to assess all the products and offers from the internet service providers to ensure that they are following the recommendations from the BEREC Guidelines. This is a time consuming process limiting innovation on offers. Especially with internet-based services and the fast development of content and applications.

4.3 Demands and offers

The Proximus example

The Proximus (Belgium) example¹³⁰ shows that consumers are demanding for Zero Rating services, and some applications are well known to be the most used¹³¹, including Facebook and WhatsApp. The consultation requested by Proximus resulted in a list of preferred applications among which Proximus selected the most important¹³².

Other examples, including a clear case in Brazil¹³³, also show that Zero Rating offers are requested by consumers.

The Wikimedia Foundation example

Wikimedia Foundation created in 2012 the Wikipedia Zero initiative¹³⁴, with the target to address the mobile phone costs as main barrier to participating in Wikipedia. The initiative resulted in the participation of ninety-seven mobile operators in seventy-two

¹³⁰ BIPT, “Report regarding the analysis of Zero Rating of apps in the Proximus offers”

¹³¹ <https://www.internetworldstats.com/stats4.htm>

¹³² BIPT, “Report regarding the analysis of Zero Rating of apps in the Proximus offers” (50)

¹³³ <https://policyreview.info/articles/analysis/disrupting-disruptive-making-sense-app-blocking-brazil>

¹³⁴ https://foundation.wikimedia.org/wiki/Wikipedia_Zero

countries reaching over height hundred million people¹³⁵. It was considered as one of the most famous Zero Rating projects without commercial agreements impacting consumer pricing¹³⁶.

Impact of Zero Rating on Data Caps

The Proximus example shows however also that Zero Rating will not increase dramatically the internet bandwidth consumption¹³⁷ and that the increased included data volume will not be consumed totally by the end-users.

With no substantial difference in the out-of-bundle data consumption, between offers including Zero Rating and preceding offers without Zero Rating, it means that sufficient data volume is available to the consumers, with the increased capacity.

Zero Rating permits network data providers to look for differentiation against competition. And consumers enjoying Zero Rating, as shown by the Facebook's experience with Free Basics, will soon move to full Internet. Zero Rating does not affect the quality of the internet services, nor the content, but permit more users to decide for internet access, while controlling costs. Zero Rating can help adopting internet services¹³⁸.

Pricing Question

One question that pops up on a regular time is how to make the internet services affordable and relevant to everyone. While about 70% of the population is covered by mobile services, only 45% of the population is using the internet services. Network operators and internet service providers are challenged in gaining new customers, and keeping the existing one. The BEREC Guidelines are restricting the set of capabilities that internet service providers have to define new offers and new options that would attract a new group of customers.

Zero Rating can be considered as “[...] a shortcut to some of the same objectives [solving the Internet access problem] that's much cheaper, quicker and more focused”¹³⁹. As seen in the Wikimedia Zero project, it permits access to internet

¹³⁵ Ibid

¹³⁶ Net Neutrality Reloaded: Zero Rating, Specialized Service, Ad Blocking and Traffic Management, Annual Report of the UN IGF, Luca Belli Editor, p. 137
<http://www.ict-21.ch/com-ict/IMG/pdf/Net-Neutrality.pdf>

¹³⁷ BIPT, “Report regarding the analysis of Zero Rating of apps in the Proximus offers” (64)

¹³⁸ Brake, Doug (2016), Mobile Zero Rating: The economics and innovation behind free data, ITIF Information Technology & Innovation Foundation, p. 14

¹³⁹ Pegoraro, Rob (26 August 2014), “‘Zero Rating’: The Pros and Cons of Free Online Access,” The Rules of Tech

content in a cheaper way, while attracting consumers to more internet-based products in the long run.

Zero Rating on its side, makes sense in the context of usage-based pricing¹⁴⁰, or to “more efficiently allocate scarce resources”¹⁴¹ and improving customer value¹⁴². Its more affecting mobile network data services than fixed networks as of the availability of more bandwidth.

The 5G technology is challenging not only internet service providers, but also content providers, as the interpretation by the national regulatory authority is based on huge arbitration efforts for specialized services and Zero Rating offers, and assessments are highly complex.

The BEREC approach including commercial offers restrictions blocks “[...] the full deployment [...] of all the capabilities that 5G enables”¹⁴³. This results in less commercial offers, less offers on the entry level for attracting new customers. Internet service providers have therefore included higher volume of data for the cheapest offers, but increasing the basic bundle prices.

The European Commission reports that “[...] in more developed countries with affordable data plans, reducing the effective cost of accessing content could stimulate take-up: zero-rating can promote a wider variety of offers to price-sensitive users, give them interesting deals, and encourage them to use digital services”¹⁴⁴⁺¹⁴⁵.

4.4 Compliance to Regulation

As reported, “[The] [...] strict observation of the [BEREC] Guidelines could have resulted in discontinue certain products or services as the ones given to the wholesale market with QoS”¹⁴⁶, is the result of the application of the BEREC Guidelines and

<https://finance.yahoo.com/news/zero-rating-the-pros-and-cons-of-free-online-access-95775730069.html> (Oct 2018)

¹⁴⁰ Brake, Doug (2016), Mobile Zero Rating: The economics and innovation behind free data, ITIF Information Technology & Innovation Foundation,

<http://www2.itif.org/2016-zero-rating.pdf>

¹⁴¹ Ibid

¹⁴² Ibid

¹⁴³ Telefónica S.A., Evaluation of the application of Regulation (EU) 2015/2120 and the BEREC Net Neutrality Guidelines (April 2018), paragraph 21

¹⁴⁴ European Commission, Zero-Rating practices in broadband markets, p. 108

<http://ec.europa.eu/competition/publications/reports/kd0217687enn.pdf>

¹⁴⁵ European Commission, Press Release: “Roaming charges and open internet: questions and answers” (2015)

[http://europa.eu/rapid/press-release MEMO-15-5275_en.htm](http://europa.eu/rapid/press-release_MEMO-15-5275_en.htm)

¹⁴⁶ Telefónica S.A., Evaluation of the application of Regulation (EU) 2015/2120 and the BEREC Net Neutrality Guidelines (April 2018), paragraph 4

their interpretations by the national regulatory authorities, while internet service providers are switching from products developed before the application of the BEREC Guidelines to products assessed after the application of the BEREC Guidelines, or still under assessment. This transition period takes time to understand the requirements and the implications, and to review also the Regulation. It also means that there is room for improvement as the Net Neutrality Regulations are considered as too prescriptive¹⁴⁷.

A dilemma comes from the development of the Internet, as it was designed for research purposes, but now arranged to fit services, to meet needs from global systems and consumers. And while the Internet has been developed providing best-effort services, new technologies provide the possibility to move from best-effort to prioritization in content delivery, and to include network data traffic filtering, to meet consumer needs. The Regulation permits to avoid content and pricing discrimination on Internet service providers. It is seen as too prescriptive¹⁴⁸ and most reviews suggest to remove unnecessary prophylactic regulation¹⁴⁹. The Guidelines in regard to the Net Neutrality Regulation are seen as “[...] extremely prescriptive overarching the provisions of the Regulation”¹⁵⁰.

One of the main issue is that new products and services are being defined at the same time the Net Neutrality Regulation has been put in place, and while national regulatory authorities are still assessing certain offers. The results can be predicted, or forecasted in a certain measure, but no experience has been reached with the impact of the Regulation. Internet service providers are requesting therefore an ex-post approach instead of the prescriptive ex-ante approach to justify interventions¹⁵¹. In general, the

¹⁴⁷ The Consequence of Net Neutrality Regulations on Broadband Investment and Consumer Welfare (19 November 2009), The American Consumer Institute Center for Citizen Research (ACI), Washington, p. 64

<http://www.theamericanconsumer.org/wp-content/uploads/2009/11/final-consequences-of-net-neutrality.pdf>

¹⁴⁸ Telefónica S.A., Evaluation of the application of Regulation (EU) 2015/2120 and the BEREC Net Neutrality Guidelines (April 2018), paragraph 3

¹⁴⁹ Faulhaber, Gerald R. (2011), Economics of Net Neutrality: A Review, Communications & Convergence Review 2011, Vol. 3, No. 1, 53-64, University of Pennsylvania and Penn Law School
<https://pdfs.semanticscholar.org/14c9/0f8d7295e86ee5da20626f0bfe2b155fa03b.pdf>

¹⁵⁰ Telefónica S.A., Evaluation of the application of Regulation (EU) 2015/2120 and the BEREC Net Neutrality Guidelines (April 2018), paragraph 3

¹⁵¹ The Consequence of Net Neutrality Regulations on Broadband Investment and Consumer Welfare (19 November 2009), The American Consumer Institute Center for Citizen Research (ACI), Washington, p. 61

<http://www.theamericanconsumer.org/wp-content/uploads/2009/11/final-consequences-of-net-neutrality.pdf>

situation leaves uncertainties that the Internet service providers are facing with innovation, delaying investments in new technology solutions and service offerings¹⁵², and hesitate to invest in new service development¹⁵³. It is suggested that barriers coming from Regulation should be removed to “encourage investment in broadband infrastructure and stimulate competition”¹⁵⁴.

It is reported that the BEREC Guidelines exceed the framework of Net Neutrality as some commercial practices are specific to the field of competition law¹⁵⁵.

The European Net Neutrality rules do not ban the 5G technology. But instead prevents the misuse of the technologies developed in combination with proposed services to consumers to ensure the freedom of end users in their choice of applications and service. They also intend to ensure the continuity of innovation within the Internet eco-system.¹⁵⁶.

¹⁵² Cate Nymann, “Keeping the internet open and innovation uninhibited in a 5G world”, Cisco, <https://emear.thecisconetwork.com/site/content/lang/en/id/8910>, 4 May 2018

¹⁵³ Ibid

¹⁵⁴ Wallsten, Scott (June 2006), *The Economics of Net Neutrality*, The Berkeley Electronic Press, Economists’ Voice

¹⁵⁵ Telefónica S.A., *Evaluation of the application of Regulation (EU) 2015/2120 and the BEREC Net Neutrality Guidelines* (April 2018), paragraph 10

¹⁵⁶ Marsden, Chris (2017), *Network Neutrality from Policy to Law to Regulation*, Manchester University Press
<https://www.manchesteropenhive.com/abstract/9781526105479/9781526105479.xml>

5. Open internet and uninhibited innovation

The discussions within the Net Neutrality and Zero Rating debate are mainly axed around the questions to keep the Internet open and to permit innovation in technology solutions.

On one hand, Internet service providers indicate that investments in innovation and technology solutions are slowed down or on-hold because of the uncertainties coming from the Net Neutrality Regulation and the review of this Regulation¹⁵⁷.

On the other hand, the BEREC Guidelines aim to guarantee that the Internet keeps as an engine of innovation¹⁵⁸, aim to ensure the openness of the internet, and to avoid fragmentation of the internal market resulting from measures adopted by individual Member States¹⁵⁹

These messages are in contradiction, and a common measure is required for each party to progress in the right direction.

As such, one can try to ask:

How to keep the internet open and innovation uninhibited?

The TNO analysis¹⁶⁰ shows the importance of technological neutrality, concluding that technology should support services and applications rather than itself. And reports say that “[...] the legislator envisaged that in a healthy functioning market, and with sufficient transparency of the offers made available to end-users by market players, it can be expected that end-users will be able to have the quality of service they desire¹⁶¹”¹⁶². Further, it explains that industry parties and policymakers have a need to roll-out the 5G infrastructure for business and societal reasons¹⁶³. Further, analysis’ results show that unbundling is in favor of Net Neutrality, with an impact on

¹⁵⁷ See BEREC Consultation

¹⁵⁸ BEREC, “BEREC Guidelines on the implementation by National Regulators of European Net Neutrality Rules” (2016) BoR (16) 127, p. 4

¹⁵⁹ Ibid

¹⁶⁰ Nooren, P.A (13 April 2018), 5G and Net Neutrality: a functional analysis to feed the policy discussion (TNO 2018 R10394), TNO Report, p. 6
<http://publications.tno.nl/publication/34626427/NhaOCU/TNO-2018-R10394.pdf>

¹⁶¹ Citizens’ Rights Directive, thirty-fourth recital

¹⁶² BEREC Guidelines for quality of service in the scope of net neutrality, BoR (12) 131 (November 2012), p. 10
https://berec.europa.eu/eng/document_register/subject_matter/berec/download/0/1101-berec-guidelines-for-quality-of-service-0.pdf

¹⁶³ Nooren, P.A (13 April 2018), 5G and Net Neutrality: a functional analysis to feed the policy discussion (TNO 2018 R10394), TNO Report, p. 15

investment¹⁶⁴. It is to point out that a study describing the effects of unbundling on investments would be beneficial. A parallel could be made with the electricity and gas markets in which higher levels of unbundling result in higher investments¹⁶⁵, but this out of the scope of this research.

It is also reported that the Internet brings a huge potential in the EU2020 objectives and that Europe has accepted to invest in the Internet connectivity and services, with a total investment in research of about 870-million-euro, and with 570-million-euro funds from the European commission¹⁶⁶. Additionally, the European Commission has launched a 300-million-euro program between 2011 and 2014 focusing on fundamental capabilities of the Internet¹⁶⁷.

At the same time, it is also reported that the Net Neutrality Regulation was adopted following theories of anticompetitive foreclosure and examples of conduct by broadband Internet service providers running against Net Neutrality¹⁶⁸⁺¹⁶⁹ and that “reduced regulation tends to improve investment incentives for Internet service providers”¹⁷⁰.

Another point that is regarded at by internet service providers more than other providers, is that content and application providers are investing huge sums in video streaming¹⁷¹. The importance of the market seems to be very high as investments reach several billions of euros¹⁷². And investments by content and application providers result in new requirements to Internet service providers who in turn need to invest in

¹⁶⁴ Scott Wallsten and Stephanie Hausladen (2009), Net Neutrality, Unbundling, and their Effects on International Investment in Next-Generation Networks, Review of Network Economics, Vol. 8, Issue 1, Washington, p. 102

¹⁶⁵ Gugler, Klaus (2013), Ownership unbundling and investment in electricity markets — A cross country study, Energy Economics, Elsevier, Vol. 40, p. 702-713
<https://www.sciencedirect.com/science/article/pii/S0140988313001953>

¹⁶⁶ Domingue, John et al. (2011), The Future Internet, Achievements and Technological Promises, Springer (Foreword)
<https://link.springer.com/content/pdf/10.1007%2F978-3-642-20898-0.pdf>

¹⁶⁷ Ibid

¹⁶⁸ Hazlet, Thomas W. (2011), The Law and Economics of Network Neutrality, George Mason University School of Law, p. 46
https://www.law.gmu.edu/assets/files/publications/working_papers/1136Law&EconomicsofNetworkNeutrality.pdf

¹⁶⁹ Farrell, Joseph (2003), Modularity, Vertical Integration, and Open Access Policies: Towards a Convergence of Antitrust and Regulation in the Internet Age, 17 HARV. J.L. & TECH. 85

¹⁷⁰ Hazlet, Thomas W. (2011), The Law and Economics of Network Neutrality, George Mason University School of Law, p. 47

¹⁷¹ Annuth, Doug (December 2017), US Internet Outlook, J.P. Morgan Securities LLC

¹⁷² Ibid

their infrastructure. And the investment in the Internet service providers' infrastructure tend to initiate new investments by content and application providers...

A concern was expressed by content and application providers about the over utilization of specialized services to provide consumers with data and content, as this would avoid the regulation on traffic management with "fast-lanes"¹⁷³. Large and established content and application providers could pay for the prioritization of the traffic of their applications, while entrants would not be able to compete. It would also open doors to content and application providers to move the distribution of their values over non-standard and proprietary protocols that would generate additional issues to the already complex network traffic management. In some European countries, entrants count for over 81% of the total list of internet service providers¹⁷⁴. In these countries, the majority of the content and application providers would be impacted by the allowance of specialized services, while internet service providers could impose different contractual agreements and their preferences.

¹⁷³ BEREC Report on the outcome of the public consultation on draft BEREC Guidelines on the Implementation by National Regulators of European Net Neutrality rules, BoR (16) 128 (August 2016), p. 29

¹⁷⁴ WIK Consult (April 2015), The Value of Network Neutrality to European Consumers, Annex 3 to Bor (15) 65, p. 74
https://berec.europa.eu/eng/document_register/subject_matter/berec/download/3/5024-berec-report-on-how-consumers-value-net-3.pdf

6. Discussion

Some aspects have not been approached during the redaction of this work which would be interesting as having an impact on the results. Or at least for better understanding some key decisions or priorities in economic environments.

A view on the historical development of the network infrastructure that the internet service providers are using shows that the majority of the internet accesses connecting homes are based on copper cables that were installed at the time only fixed phone services were available. This has a significant impact on the providers' assets as of the investments that were required to connect the given locations. Also, some of the internet access providers were privatized during the time the internet access technologies were deployed, most probably leaving cheap infrastructure available for more valued services. Eventually, end users had the benefits of the cheaper access infrastructure, but leaving a gap over the time, as fiber technology has been deployed only recently, though deployment continues in some major cities. And even then, fiber access is still not available everywhere.

Another aspect to consider, is that internet service providers had much time to deploy their infrastructure, though predictions on requirements were actually not available at that time, as content and application providers have a very short development time but huge bandwidth consumption. Two of the most accessed content provider, Facebook has 1.15 billion monthly active users and Twitter has 240 million monthly active users, have respectively emerged in 2004 and 2006. And smartphones have really started generating traffic with the adoption of the first iPhone around 2007, contributing in the explosion of data consumption. The result left internet service providers with huge traffic and time constraints for investments.

Another aspect that could be developed and would provide reasons why some service providers are more interested by changes to the Net Neutrality Regulation than others is the review on the internet value chain segments. Considering the segments "user interface", "connectivity", "infrastructure", "online services", and "content rights", some of them have benefits keeping the Net Neutrality, including the segments "online services" and "content rights", while the segments "infrastructure", and "connectivity" are more impacted.

The development of regulation policies should also be reviewed, as the different internet value chain segments are unevenly regulated. Especially that the infrastructure

and the media sectors are the most regulated. The common part of the different developments of the sectors and the segments, is that they all have a huge impact on key decisions for the development of the internet infrastructure.

Additionally, it should be noted that there are different possibilities to influence end-users on their choices, which are not only based on filtering, prioritizing and preferring traffic or content. While internet service providers are controlled to ensure that they treat all the traffic equally, content providers, as example, have also a set of tools. A content provider, or a search engine, could as example use algorithms that adapt the response time of their web content for end-users' requests. Understanding that statistics show that consumers leave web pages within a short time if a response is not provided, a search engine, as example, could influence consumer choices by using different response times. At the same time, it can be understood that application providers have a similar influence on consumer choices, as algorithms could define the speed at which the content is displayed to the end user. However, there is no regulation on content and application providers for this, and only internet service providers are valued on the transfer speeds they provide to end-users.

In regard to capital expenditures, it should be noted that governments recently introduced auctioning as a way to attribute spectrum. It is obvious that the costs of the auctions are the distributed between the consumers and customers. But it means that the service providers need then to increase their prices, and have less budget for investments, while investments are required to better cope with the increasing demand generated by content and application providers, and end-users attracted by the new contents and applications.

On a similar look than network content preference, the preference in services is available in other sectors: the Belgian BPost got approval to deliver postal mails with a preference. A shorter term delivery is more expensive than a normal delivery, subject on pricing. But internet service providers have to ensure that all traffic is treated equally, without pricing influence.

From the developed aspects, especially bandwidth consumption it is obvious that internet service providers are maximizing the utilization of their infrastructure. Investments are mostly due when the capacity of the infrastructure is reaching the limits, and peak traffic is impacted. This can easily be managed, or even more pushed to limits, using traffic management, with the risk of a too deep impact on the content.

7. Conclusion

Summary

The main aspects of Net Neutrality and Zero Rating have been reviewed in the different chapters. The first part considers the legal framework in which content, application and service providers are evolving. The second part considers investment requirements from digital innovations and technology developments. The third part reviews the abilities of providers to invest within the context defined in the first part (legal framework), and considering the requirements defined in the second part (digital innovation and technology development). The fourth part comes up with an internet that remains open for everyone and available for innovation. These aspects help to define the major requirements for content, application and service providers to deliver digital innovation and better consumer internet-based services. Of course, some aspects have not been included in the analysis, as shortly reviewed in the discussion part.

The legal approach shows that the BEREC Guidelines are still subject to interpretation by the national regulatory authorities, while Rules were issued as laws to avoid multiple versions across the European economic area. It shows also that different approaches are possible within the European economic area and that the national regulations can be adapted, though they are all apparently focusing on economic impacts. The safe-guard of the internet freedom is at value and the proactive work aims to keep the internet open. The content aspect itself of the data shared or transported across the internet is not reviewed, as of the focus of the Net Neutrality subject. But the content alteration and delivery are key factors considered in the open internet. Internet service providers have tools to influence consumers while competition is discouraging some practices. Though attempts were already made that were reviewed under commercial laws.

Investments are mainly required due to the massive development of internet data traffic, the increasing number of content generating providers, the increasing content itself, and the increasing number of applications providers. And the development of the technology during the past years has also a huge effect.

The European Union is supporting the digital revolution, providers have a facilitating environment for their creation and development. The environment should be kept available, unaltered by the misuse of potential that technology is providing.

Under the assumption that infrastructure capacity is almost exhausted for internet service providers, and the internet service providers are also maximizing the utilization of their infrastructure, it becomes evident that different solutions need to be envisaged. On one side, investments in capacity are required. This is a complex activity and time consuming operation. But on the other hand, technology also provides solutions, including traffic management, the possibility to implement specialized services, and the possibility to count or not traffic against the agreed capacity. Or even have network data traffic delivery altered. This is not counting on additional new technologies, including slicing, within 5G, that are providing a new set of capabilities for service providers to improve the quality of the user experience more than the quality of the services. The technology development provides additional solutions to cope with the increasing forecasted traffic, bound with risks for consumers.

However, as depicted in the work, the different elements that are impacted on service providers' infrastructure are not easy to improve under the trend of maximization of infrastructure capacity. Most of the technical solutions improving the quality of the network data transfer are confronted with the legal limitations, under the assumption that a misuse could have an influence on the end-users. The assumption was first a theoretical development, and very few cases could be seen later.

The evaluation of the Internet rules is very new and becomes more and more central to our economic and social environments. Regulators have no or only little experience with potential effects of policy approaches and prefer to avoid problems than to leave too many doors open. Nevertheless, consultations are organized with the relevant parties to improve the situation though being time consuming.

Different reasons can be listed as of why providers have reduced their investments, and are looking at their investment priorities. Uncertainties in the results from the Regulation and consultancies do not favor trust while having the pressure of the revenue of investment. The consultation with the Regulation is putting hope for solutions. The European Commission has interests in the digital innovation and technology development especially following their huge support, and providers are under economic pressure.

But at the end, the freedom of Internet, and the Net Neutrality prevails on everything else. Commercial offers, as Zero Rating, can help to develop new offers or options that attract new customers and bring end-users to more consumption.

Implication

This work is expected to be used to review priorities of the Regulators and service providers, and focus on solutions for providing end-users a Quality of Experience rather than a Quality of Service. Understanding the needs from the involved parties permits to assess solutions and finally agree on future proofed paths, instead of closing laws. This implies that regular consultations between the parties should be organized to align Regulation with technology solutions and innovation, but also to prioritize technology development as of existing and future Rules. As the debate shows, an ex-post approach is preferred over an ex-ante approach. Regulation should on one side be a facilitator for innovation and development, and on the other side provide boundaries to technology solutions. But it should not block solutions that are not known to cause harm before gaining experience from the results.

The final complete solution, including technology solutions and agreements, has a social consequence that cannot be assessed now.

A solution that could fit all parties, including customers, could be to have a set of solutions available. Introducing a minimum level of Net Neutrality, with additional products clearly labeled with the solutions implemented could provide the results to the different needs. The basis would be based on the full implementation of the Net Neutrality, with a guaranteed minimum level of bandwidth to ensure that the end user is able to use all the services. The definition of the minimum level of bandwidth can be defined by easy rules, as used in corporate network contracts: regular review of the average available bandwidth, with the detection of the bottlenecks as reference level for the minimum level. The additional products, could use the set of solutions available to internet service providers to fulfill contractual obligations, meaning that customers would order products with different preferences, or options. As example, it could be “web with free streaming”, or “streaming with free web” (with web allowing to surf and retrieve text and images). The clear indication of the technologies in place would permit consumers to choose between a set of products, and between providers. It would also permit entrants to start with specific services on which they are specialized, based on the technologies they want to set at priority. There is no difficulty in the implementation of these technics, simply that contract management becomes more complex as of the set of solutions possible. And even this should not affect mobile providers that are actually used with almost a single contractual agreement per mobile user. The customer profile is bound to the user, and provides the set of services the

customer has subscribed to. There is still the risk that some content would not be available, as the providers have the possibilities to setup filters. But this case should be left to the competent authority (commerce), and not managed with the Net Neutrality Regulation.

Management

The implementation of the Regulation introduced a set of rules that are completely changing the practice possibilities of the internet service providers in the sense that network data traffic prioritization is no more possible, that filtering is prohibited and that all traffic has to flow untouched. In the past, many providers were using services that could reduce bandwidth consumption, accelerate network data traffic exchange and avoid congestions. Especially that all was possible since there was no regulation. And there is no alternative solution foreseen in the current solution. The issue is that customers have more and more experiences, from fixed networks, mobile networks, working during travels, working from restaurants, working from offices but with own devices, to list only a few.

Management should take into account the new way customers are using the services, and first review the needs of these customers. The Proximus case shows that a potential exists. But within the European economic area, there are only a very few list of examples available. Flexibility is nowadays normally a key word for managers, and should lead the way of thinking results.

It appears that experts were also not consulted during the development phase of both the technology solutions and the regulatory rules. Only now, that the first regulatory rules are in place, service providers go thru the different points of the consultation questionnaires. A consultation should have been done before the regulatory rules were put in place, and take into account the projected state of the development. Given both should go hand in hand, the solutions, on both sides, would have been aligned. Because the solutions that the service providers want to implement do not per-se influence or impact consumers. Only misuse has an impact.

The comments the service providers transmitted to the BEREC Consultation show that the available technical solutions were not taken into account, and that the regulatory rules are based on the plain old Internet – before 5G innovation was being designed.

As target, the Regulation and the Service Providers should put in focus the Quality of Experience instead of the Quality of Service. That would put customers in front and provide technical solutions to these customers, instead of putting technical solutions in place and setting customers behind them. The Net Neutrality is actually only one aspect that provides a customer satisfaction aspect. But a complete solution adapted to customers can provide a full customer satisfaction.

Recommendation

As the development of the regulatory rules and the consultation is pretty advanced in the process, there is only a small room left for recommendations. These are actually already described in the previous parts. Providers should have the possibility to implement products based on a minimum level of Net Neutrality, without restriction, and implement also options and other products that take into account the full set of capabilities the digital innovation is offering them. And the regulation should adopt a more traditional behavior, to regulate topics and avoid to be too prescriptive, leaving room for experimentations and options. The clear labeling of the products and solutions in place should however guide the customers in their choices.

There is still one topic that should be considered by the consultation committee: the budget and influence of marketing compared to the influence of Zero Rating to consumers. This means simply that the Regulation does not permit service providers to use Zero Rating, to safeguard the equality between large providers that have a budget to implement such a solution, and small entrants that don't have the budget for the same Zero Rating option. However, these large service providers have a much important marketing budget available, and have therefore a more important influence on consumers, even without using Zero Rating.

Limitations

This work only focused on three major aspects:

- a legal framework in which the products are able to be developed and brought to market by the service providers, considering the Net Neutrality with only few possibilities for Specialized Services and Zero Rating
- a technical development review showing the huge development done during the past years, an even bigger development that is expected to come, and a digital and technical innovation that should bring solutions to the customer requests
- a review of investment constraints from the service providers

Many additional aspects, including those listed in the discussion part, could be added to the work to provide a full scope.

Suggestions for Research

During the research work, and review of documents and articles, it became more and more clear that consumers are influenced in different ways, but regulatory rules and laws are not aligned.

The Net Neutrality debate only concerns the treatment of the traffic that is being transported, but not generated. The generation of the content, without reviewing the content itself, has also an impact on consumer choice, but is not regulated. Understanding that an end user will leave a web site if the web pages loads too slowly¹⁷⁵, and an end user leaves statistically also a web site if it is not responding within 2 seconds, it would be interesting to review the influence of content generation. As more and more scripts and algorithms are used for the creation and delivery of web pages and content, it can also be understood that web content providers have the possibility to tune the algorithms to deliver the content according a set of predetermined rules, impacting the delivery time and the delivery speed. Both are covered in the Net Neutrality Regulation that affects traffic delivery, but not when it comes to content generation.

An in regard to budgets, a study regarding the difference of influence of marketing against Zero Rating practices would be interesting. Large providers are authorized to run important marketing campaigns that influence consumers, but not authorized to provide Zero Rating options to the products as these could influence consumers. Understanding that Zero Rating only permits to provide more data in regard to a specific content or application, but not limiting the rest of the traffic, the Regulation seems to have omitted part of the root causes.

And when it comes to content, it seems there is also an unfair Regulation between content providers, especially search engines, and service providers.

¹⁷⁵ it is not defined what “too slowly” exactly means

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