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**Computer Law
&
Security Review**

A survey of Network Neutrality regulations worldwide



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ARTICLE INFO

Keywords:

Internet regulation
Network Neutrality
Traffic discrimination

ABSTRACT

The principle of Network Neutrality (NN) has been debated around the world for nearly two decades. NN states that all traffic in the Internet must be treated equally, regardless of content, origin and/or destination. The main motivation for this principle is to protect fair competition, innovation, and ensure freedom of choice for consumers. The global debate revolves around whether NN should be enforced through regulations or not, as well as the potential impact of such regulations – or lack thereof – on the telecommunications market. In this context, multiple governments worldwide have already implemented NN regulations. In this work, we give an overview of NN regulations in 50 countries across five continents. We first give a brief introduction to the NN global debate. Then, we describe some of the main aspects related to the regulatory process of each country/region. Finally, we compare the different regulations according to common and divergent features identified.

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1. Introduction

Network Neutrality (NN) has been the focus of discussions worldwide for nearly two decades (Dustdar and Duarte, 2018). Although it is not the only definition, the literature frequently states that NN is the principle by which all traffic in the Internet must be treated equally, regardless of content, origin and/or destination (Garrett et al., 2018b). Thus, according to NN principles Internet Service Providers (ISPs) cannot block, throttle, or prioritize any traffic unfairly. Exceptions are allowed under specific technical (e.g. quality of service require-

ments) or administrative (e.g. routing in emergencies) constraints. NN by no means precludes different service categories – what is not allowed is to set different priorities within a given traffic category, for any reason. The ongoing global debate revolves around whether NN should be enforced through regulations or not (Ganley and Allgrove, 2006), as well as the potential impact of such regulations, or lack thereof, on the telecommunications market (Leal, 2014). The main motivation in favor of NN is that discriminatory traffic management policies may threaten fair competition, innovation, and the freedom of choice of consumers (Garrett et al., 2017). On the other hand, some argue that less restrictions on how ISPs man-

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<https://doi.org/10.1016/j.clsr.2022.105654>

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age their networks may result in a more competitive market (Bauer and Knieps, 2018; Schulzrinne, 2018). Others claim that consumers should have a say on how their traffic is managed (Yiakoumis et al., 2016). Recently, the Internet Governance Forum (IGF) published an extensive report with contributions from around the world (Internet Governance Forum, 2020), showing that the COVID-19 pandemic has demonstrated that free and non-discriminatory Internet access is essential.

As the global NN debate rages on, several governments worldwide have already implemented and/or withdrew NN regulations. These regulations vary in several aspects. Some countries have established laws that minutely detail which ISP practices are allowed or prohibited, while others are more permissive and/or reactive. Furthermore, the way each regulation came to be vastly differs from one country to another. Regulations may be implemented by a country's legislative body, federal government bodies (such as a ministry), or directly by the regulator agency responsible for the telecommunications market/industry. In some countries there are only recommendations, instead of laws.

This work surveys NN regulations and/or official discussions related to NN across the five continents. For each country (or group of countries in the case of the EU) we describe the major landmarks in terms of the establishment (or repeal) of NN regulations. We adopt the term "regulation" for any rule, principle and/or law that has the purpose to protect NN. We also included countries that have not implemented regulations, but have promoted discussions regarding NN at the government level – i.e. for such a country to be included, the discussions must have been both public and official. Note that the regulatory process in different countries did not follow any standard. Therefore, the discussions regarding NN and the way NN was regulated differs vastly among the different countries. In addition to language barriers, each country also has its own legal procedures. The information for compiling this overview comes mainly from regulatory agencies and other government institutions, such as legislative bodies, plus media articles and websites of different organizations.

From Europe, we describe the regulations and/or discussions in Norway, Russia, United Kingdom, and the 27 member states of the European Union. From the Americas, the following countries are included: Argentina, Brazil, Canada, Chile, Colombia, Ecuador, Mexico, Paraguay, Peru, the United States of America (USA), and Uruguay. From Asia, five countries were included: India, Israel, Japan, Singapore, and South Korea. From Oceania: Australia and New Zealand. Finally, from Africa we describe the NN regulations from Nigeria and South Africa. To the best of our knowledge the survey covers all countries that have adopted regulations or promoted public, official discussions on the NN subject.

The objective of this work is both to provide a comprehensive, global view of how NN regulations have been dealt with in the world. For each individual case we describe how the regulation was implemented, the most important landmarks, as well as the current state of the regulation. In the case of countries that do not have regulations properly, we summarize the public and official discussions on the theme. After describing the different regulation approaches case by case, we present a synthesis to facilitate the comprehension of the global picture as well as allow comparisons of the different approaches.

The purpose is to present a coherent picture that can support further work on the impact of NN and its regulations on the Internet. We note that there is no other single place/source with this amount of comprehensive information on NN regulations worldwide.

Although the political bias of different governments have an impact on the NN debate while they remain in power, even without any political interference there is still no definitive conclusion on the benefits/disadvantages of adopting NN regulations. In the survey, we seek to remain agnostic with respect to the purely political debate, which can certainly lead to preconceived views on the subject. On the other hand, it is undeniable that for Internet users it is at least expected that providers remain transparent about the traffic management practices they adopt on their networks. Furthermore, the ever-increasing convergence of communications and content providers certainly raises concerns in terms of the threats to competition and innovation – which benefit everyone and the evolution of the network itself. We hope that the different perspectives on NN presented in the survey will contribute to the global debate, and help clarify how it has been officially dealt with around the planet.

The rest of this work is organized as follows. Section 2 gives a brief overview of how the global NN debate emerged. A description of NN regulations worldwide is then presented in Section 3. Next, in Section 4 we make a synthesis comparing the different regulations adopted. Related work is then presented in Section 5. Section 6 concludes the survey.

2. The Network Neutrality debate

This section presents an overview of the global NN debate that has been raging on worldwide for almost 20 years. During this period, a large number of NN violations have been reported in several countries (Garrett et al., 2018b). The debate started in 2002 in the USA, when the Federal Communications Commission (FCC) decided to change how it classified broadband services. The classification changed from "telecommunication service" to "information service" (Federal Communications Commission (FCC), 2002). This reclassification caused broadband services to be no longer subject to the same regulations as classic telecommunications services. Among other implications, this meant that ISPs would be able to prioritize or block certain types of traffic. It was in this context that the term *Network Neutrality* was coined by Wu (2002), starting the worldwide debate.

In 2003, a letter was sent to the FCC by Wu and Lessig (2003), containing a proposal for a neutral Internet. That letter advocated that in order to promote fair competition among applications running on broadband networks, a regulatory solution would be preferable to simply letting infrastructure operators regulate themselves. The letter thus urged the FCC to adopt a neutrality regime. A huge number of companies, individuals, and both public and private institutions have since contributed to the debate. Some are in favor of NN, notably consumers and some content providers. Others are against NN, most of them found among the ISPs. There have also been several efforts by the academia for proposing solutions to not only foster the debate, but also develop strategies and tools to

monitor neutrality and guarantee that regulations are being respected (Garrett et al., 2018b).

Since 2002, several controversial topics have emerged in the context of NN. One of those topics is zero-rating (Krämer and Peitz, 2018), by which traffic from specific applications do not count towards user data caps. Another controversial topic in the NN debate is related to Content Delivery Networks (CDNs). A content provider pays a CDN to place its content closer to the users. This is seen by some as paid prioritization (Andreoletti et al., 2018; Baake and Sudaric, 2019), however, in technical terms, no traffic is really being prioritized in the network layer. To be clear: many consider that CDNs are no part of the NN debate. Furthermore, the problem of jurisdiction is also important in the NN debate (de Carvalho et al., 2020; de Carvalho et al., 2018). Traffic in the Internet may travel through several different countries, which may have significantly different regulations, so it is a challenge to understand which guarantees can be expected from a route that traverses countries with different NN regulations. Thus, besides detecting traffic differentiation it is important to locate exactly where it has happened (Garrett et al., 2021).

In more recent years, the advent of technologies such as 5G and the Internet of Things (IoT) further heated the debate. A key 5G feature is network slicing (Akpakwu et al., 2018), which consists of creating virtual networks that support specific Quality of Service (QoS) requirements for different customers and applications (e.g. data rates and latency). It is easy to use slicing to break NN principles, by downgrading/upgrading the QoS settings of each slice. It is thus important to monitor and detect whether slicing is promoting unfair traffic differentiation. Some NN regulations allow traffic differentiation in the context of applications that have strict QoS requirements, often called “specialized services”. Examples include video-conferencing and remote health monitoring. However, it is expected that a large number of future IoT applications and devices will also have specific QoS requirements (Akpakwu et al., 2018; Garrett et al., 2018a), and such cases may not be covered by current regulations (Frias and Martínez, 2018).

3. NN regulations worldwide

In this section, we present an overview of the NN regulations in several countries worldwide. The regulations implemented in several countries are presented in chronological order, according to the year that the regulations were first effectively implemented. Countries that had regulations implemented in the same year are presented in alphabetical order. Case law is not mentioned explicitly. The last three countries presented in this section (Australia, New Zealand, and Uruguay) have no NN regulations implemented, but have had official discussions and/or proposals at the government-level.

3.1. Japan

The regulatory process of NN in Japan began in 2006, when the Ministry of Internal Affairs and Communications (MIC) launched the “New Competition Promotion Program 2010”.

This program aimed at promoting the dissemination of Internet usage in the country. One of the actions triggered by this program was the creation of a Working Group (WG) on NN. The goal of the WG was to build a framework for NN (Ministry of Internal Affairs and Communications (MIC), 2006), establishing guidelines for the telecommunications industry to follow. These guidelines were based on three principles: (i) ISPs should deal with congestion by expanding their infrastructure; (ii) ISPs can only manipulate traffic rates in exceptional cases, (iii) traffic manipulations (if done) have to be justified with objective criteria.

In its first report (Ministry of Internal Affairs and Communications (MIC), 2007), from 2007, the WG examined NN from two different perspectives: (i) fairness of network cost sharing, i.e., how to properly distribute network costs among the involved parties; and (ii) fairness for using the network, i.e., preventing abusive market practices on data traffic management. Furthermore, the WG specified three principles for a neutral network: (i) consumers may flexibly use IP-based networks and freely access any content or application; (ii) consumers are free to connect to IP-based networks through terminals that comply with the corresponding technical standards; and (iii) consumers are free to use any communication platform without discrimination and at reasonable prices.

In 2008, the WG published a report containing an “Investigative Roadmap for Maintaining Network Neutrality” (Ministry of Internal Affairs and Communications (MIC), 2008). This roadmap defines several measures for ensuring NN, divided in three main groups: (i) fairness for sharing network costs, defining measures for dealing with congestion; (ii) fairness for network usage, defining measures for preventing abusive practices in the market, including unfair dominance; and (iii) other measures related to other activities, such as promoting the diversification of access networks and investigating measures to protect users.

In 2008, the Japan Internet Providers Association (JAIPA) together with the Telecommunications Carriers Association (TCA), the Telecom Services Association (TELESA), and the Japan Cable and Telecommunications Association (JCTA) published a series of guidelines for traffic shaping Japan Internet Providers Association (JAIPA). These guidelines established to which extent traffic shaping is considered reasonable, defining rules that should be followed by ISPs in Japan when managing traffic in their networks. These rules were based on the NN guidelines defined by the MIC’s WG.

According to Jitsuzumi (2020), more recently, in 2019, the WG on NN published a new report, in which revised principles for NN are described. The motivation for revising the principles is the evolution of mobile networks, which became the most common form of Internet access in the country. The situation was very different in 2007, when the first set of guidelines were published. Having this shift in the telecommunications market in mind, four principles are redefined as the basis for NN in the 2019 report: (i) users have the freedom to access any content or application; (ii) users are free to provide other users any content or application; (iii) users are free to connect to the Internet using any terminal equipment that complies with technical standards; and (iv) have the freedom to use any communication service or platform fairly and for the appropriate prices. Furthermore, the WG also investigated

zero-rating, reporting that this practice may be beneficial for consumers. However, the WG provided guidelines that should be followed by big players on the market in order to avoid abuses.

Based on the available documentation, it is possible to conclude that there are no strict NN regulations in place in Japan. In other words, there are no laws forcing ISPs to comply with the NN principle. However, industry and government have reached a consensus and established guidelines for traffic management in the Japanese Internet. Therefore, the government is expected to investigate NN violations on a case by case basis (Jitsuzumi, 2011), according to related laws and regulations, such as those regarding fair competition and consumer rights.

3.2. Canada

In 2009, the Canadian Radio-television and Telecommunications Commission (CRTC) presented rules regarding the deployment of traffic management practices by Canadian ISPs (Canadian Radio-television and Telecommunications Commission (CRTC), 2009). CRTC claims that this set of rules constitutes a balance between the freedom of Canadians to use the Internet for any purpose, and the right of ISPs to manage the traffic of their networks. This regulation was based on a public consultation initiated in 2008 (Canadian Radio-television and Telecommunications Commission (CRTC), 2008).

The CRTC ruling consists of four main aspects: (i) Transparency: the deployment of traffic management practices by ISPs should be transparent; (ii) Innovation: network investment should be the primary solution for dealing with network congestion, but traffic management might still be necessary in certain well-defined situations; (iii) Clarity: ISPs must ensure that any traffic management practices they employ are not discriminatory or preferential; and (iv) Competitive Neutrality: the CRTC should review the traffic management practices employed by ISPs. For retail services (provided to end-users), the CRTC should review the practices in case concerns arise, e.g. after complaints by consumers. For “wholesale services” (provided to other ISPs), traffic management practices should follow the framework established by CRTC and must not have a significant and disproportionate impact on the traffic of other ISPs. An ISP needs the CRTC approval in order to employ more restrictive policies on “wholesale services” than on “retail services”.

In 2015, the CRTC issued a decision (Canadian Radio-television and Telecommunications Commission (CRTC), 2015) stating that some mobile Internet providers should stop prioritizing their mobile television services in detriment of other Internet content. The mentioned companies were zero-rating their own services in their networks. CRTC claims that this decision reinforces their commitment to the NN principle. Later, in 2017, CRTC presented a new framework describing several criteria for evaluating offers from ISPs establishing different prices for specific services (Canadian Radio-television and Telecommunications Commission (CRTC), 2017). According to the CRTC, the rationale is that ISPs may influence consumer’s choice with such price policies. The framework thus establishes a well-defined set of rules to determine whether

an ISP specific differential pricing practice is or is not consistent with the NN rules.

3.3. Norway

In 2009 the Norwegian Communications Authority (Nkom), previously called Norwegian Post and Telecommunications Authority (NPT), published its NN guidelines (Norwegian Communications Authority (Nkom), 2020b). These guidelines established that Internet users have the right to access Internet services with predefined capacities and quality levels, that providers should not discriminate between different applications, services, content, neither based on sender nor recipient. Furthermore, the guidelines state that users are free to choose which content, service, application, hardware, and/or software they want to access/use, provided that no damage is done to the network.

In 2014, Frode Sørensen, Nkom Senior Adviser, discusses the Norwegian guidelines for NN (Meyer, 2014). He states that the guidelines, in addition to defining Internet users rights, explicitly state that zero-rating practices are violations of NN. Sørensen emphasizes that, at a first glance, it may seem that all traffic is treated equally under this pricing model. However, once the user reaches the corresponding data cap, the traffic that is zero-rated will be allowed to continue, while all other traffic will be strangled or blocked. Therefore, according to Sørensen this is clearly a case of discrimination between different types of traffic. Finally, he reiterates that the Internet is important for the economy, culture, social life and democracy, and thus Nkom works to preserve the Internet as an open platform.

In 2017, the NN guidelines from 2009 were transformed by the Norwegian parliament into laws (Norway, 2017). Nkom claims that the 2009 guidelines were already effective for ensuring NN in Norway, being a voluntary agreement between stakeholders in the telecommunications industry. The parliament thus replaced this agreement by a binding law, which states that “safeguarding net neutrality is essential in order to ensure good, future-oriented electronic communications services for users throughout Norway and foster industrial development and innovation, and is a prerequisite for further economic, social, cultural and democratic development in modern society. The goal of the work on net neutrality is to ensure that the Internet remains a well-functioning, open and non-discriminatory platform for all types of communication and distribution of content.” However, the 2017 law is less clear regarding zero-rating practices than the 2009 guidelines, which resulted in zero-rating offers appearing in the Norwegian market.

Since 2017, Nkom publishes annual reports describing the state of NN in Norway. In the latest report (Norwegian Communications Authority (Nkom), 2020a), from 2020, Nkom presents their assessments about several topics: NN and Internet traffic during the COVID-19 pandemic, zero-rating, traffic management, specialized services, and quality of Internet services. Despite some concerns about zero-rating in the Norwegian market, the report states that the overall state of the Internet and NN has improved since the previous report. Regarding the pandemic, Nkom claims that a significant increase

in traffic was observed during the period, but the existing infrastructure was able to handle it.

3.4. Paraguay

The telecommunications authority of Paraguay, the Comisión Nacional de Telecomunicaciones, issued resolution 190 in 2009 that establishes regulations to protect Net Neutrality under (Paraguay, 2009). According to this Article, “ISPs are prohibited to interfere or degrade traffic received or generated by the user and to vary the contracted capacity according to the type of content, application, origin or destination decided by the user”. However, there are no national laws enforcing the NN principle. Violations have been reported, including content prioritization and blocking (TEDIC, 2017).

3.5. Chile

Chile was the first country in the world to establish a NN law, that is Law 20,453 from 2010 (Chile, 2010). This law sets the following rules for ISPs: (i) ISPs cannot arbitrarily block, interfere, discriminate, prevent or restrict the right of any user to access, send, receive or offer any legal content, application or service through the Internet; (ii) ISPs cannot limit the right of users to make use or introduce any type of device in the network, provided that such devices are legal and do not damage or hinder the quality of the network; (iii) ISPs must provide, at the expense of users who request them, parental control services for content that violates laws or morals, provided that the user is informed in advance and in a clear and accurate manner regarding the scope of such services; and (iv) ISPs must publish on their website all the information regarding the characteristics of the Internet services offered, such as speed, quality and guarantees of the service, distinguishing between national and international connections.

Later, in 2011, *Subsecretaría de Telecomunicaciones* (SUBTEL), the Chilean regulatory agency, published the results of an inspection carried out at each ISP in the country to verify compliance with the NN Law (*Subsecretaría de Telecomunicaciones* (SUBTEL), 2011). The results show that there were ISPs which did not facilitate the access of consumers to the required information in a transparent and clear manner. In order to address this issue, SUBTEL defined the minimum information that ISPs must provide to the customers, under the NN Law. ISPs must provide, at least, the following information: (i) the name and price of each plan; (ii) the speed advertised in each plan shall contain a maximum and a minimum speed, as well as the download and upload speeds, including an indication of whether there are differences in national and international access; (iii) for wireless technologies or mobile networks, it is necessary to clearly state that speed ranges are subject to the variability and probabilistic behavior of wireless Internet access. Furthermore, coverage maps showing the type of technology, signal propagation, and average rates expected must also be provided; (iv) the so-called bundling rate must explicitly specify the resale rate of Internet services. This rate corresponds to the ratio between the sum of the speeds contracted by all users and the actual capacity contracted (in Mbps); and (v) download limits.

In 2014, SUBTEL demanded ISPs to end their zero-rating offerings (called “Free Social Networks” in Chile) (*Subsecretaría de Telecomunicaciones* (SUBTEL), 2014), based on the NN law. Lack of compliance is to be punished with fines.

3.6. Colombia

In 2011, the Colombian Government approved Law 1450 regarding the “National Development Plan” (*Plan Nacional de Desarrollo*) for the years 2010 to 2014 (Colombia, 2011a). In one of its articles, this Law contains the following rules regarding NN: (i) ISPs may not block, interfere, discriminate or restrict the right of any Internet user to access, send, receive or offer any legal content, application or service through the Internet. ISPs cannot arbitrarily distinguish content, applications or services based on their origin or characteristics. ISPs may make offers targeted at specific market segments or their users, according to their usage and consumption profiles, as long as these offers are not interpreted as discriminatory; (ii) ISPs may not limit the right of users to employ any type of device in the network, provided that such devices are legal and do not damage or hinder the quality of the network. (iii) ISPs must provide consumers with parental control services for content that violates the law, providing users with clear and accurate advance information regarding the scope of such services; (iv) ISPs must publish on a website all information relative to the characteristics of the Internet access offered, its speed and quality of service, distinguishing between national and international connections, as well as the nature and guarantees of the service. (v) ISPs must employ mechanisms to preserve user privacy, and protect them against viruses and other threats. Finally, (vi) ISPs can block access to certain content, applications or services only upon an explicit request from the user.

Resolution 3502 of 2011 establishes more specific conditions regarding the NN principle defined in the 2011 Law (Colombia, 2011b). The following principles are highlighted in this resolution: free choice, no discrimination, transparency, and access to information. Furthermore, the resolution gives more details on technical aspects resulting from the NN Law, such as the quality indicators for Internet access services, content blocking, network security, and traffic management practices. In particular, the resolution lists the traffic management practices that are considered reasonable.

In 2020 Decree 464 (Colombia, 2020a) states that until the World Health Organization (WHO) declares the end of the COVID-19 pandemics, telecom and Internet providers can prioritize user access to content and applications related to health, education and government services, among others. The conditions for prioritization were then specified by the Communications Regulation Commission (CRC) through Resolution 5951 (Colombia, 2020b). The first condition is that providers must inform the regulator 24 h before starting the prioritization, which can only take place under very high and recurring increases in traffic demand compared to similar reference periods. Alternatively, prioritization can also happen after evidences of recurrent degradation of the quality of the service offered to users. Furthermore, providers have to try other traffic management actions without success before adopting prioritization.

3.7. Singapore

In Singapore, the Infocomm Media Development Authority (IMDA) launched a public consultation on NN in 2010 ([Infocomm Media Development Authority \(IMDA\), 2010](#)). The outcome of this consultation was published as a white paper by the IMDA in 2011 (the same day Colombia approved its NN Law), defining NN guidelines ([Infocomm Media Development Authority \(IMDA\), 2011](#)). IMDA states that ISPs may not block legal content in the Internet, must comply with competition and interconnection rules, should provide information in a transparent way, and must meet minimum QoS standards. Provided that ISPs comply with these requirements, they can offer differentiated Internet services, such as specialized services or other custom products. To the best of our knowledge, since 2011 Singapore has not changed these NN guidelines.

3.8. South Korea

In South Korea, the regulatory agency KCC (Korea Communications Commission) included in its 2011 Annual Report basic guidelines regarding NN and Internet traffic management in the country ([Korea Communications Commission \(KCC\), 2012](#)). These guidelines state that: (i) users have the right to be informed about how their Internet traffic is managed, and also to access any content, application or device, unless it is illegal or causes damage to the network; (ii) Traffic management must be transparent, thus ISPs must publicly inform their traffic management practices; (iii) legal content, applications, and devices must never be blocked, unless they damage the network and its services; (iv) ISPs must not discriminate legal content, applications and services in a non-reasonable way; (v) Reasonable traffic management practices are allowed in order to secure or protect the network, to deal with temporary network congestion or overhead, or according to other specific regulations.

In 2013, the Ministry of Science, ICT and Future Planning (MSIP) announced new rules regarding transparency and reasonable traffic management ([Borami Kim and Byoungil Oh, 2014](#)). The goal was to prevent ISPs from employing abusive practices. The rule includes criteria such as: (i) transparency, enough information about traffic management policies should be made available to consumers; (ii) proportionality, traffic management practices employed should be justified by reasonable motives for their adoption; (iii) non-discrimination, similar types of content should not be unfairly discriminated.

In 2020, the Ministry of Science and Information Communication Technologies made changes to the Telecommunications Business Act ([Aroon Deep, 2020b](#)). These changes force foreign content providers to pay network usage fees to local ISPs. The rationale is that foreign content providers should share the network costs with the local ISPs that are delivering the content to consumers. This has been criticized by the media ([Aroon Deep, 2020a](#)), since it is a basic violation of the NN principle: providers have to pay to have their content available. Netflix sued a Korean ISP for these network fees, claiming that it should not be liable to pay any fee for using the ISP network, since the ISP consumers are already paying for the network services ([Mark Anthony Gubagaras, 2020](#)).

3.9. Ecuador

In 2012, the telecommunications authority of Ecuador, the Consejo Nacional de Telecomunicaciones, issued regulations regarding the rights of users of telecommunications services ([CONSEJO NACIONAL DE TELECOMUNICACIONES, 2012](#)). The regulations included rules implementing the NN principle. ISPs cannot prioritize nor block neither throttle any type of traffic because of origin, destination, application, or other feature. The regulations do mention reasonable traffic management practices, which can be adopted to guarantee the quality of service without prejudice for any user.

The NN rules from the 2012 regulation were included in a law in 2015 ([Ecuador, 2015](#)). However, the law has been criticized for weakening the NN rules from the earlier regulations ([Andrés Delgado, 2015](#)). The law explicitly allows ISPs to offer zero-rated services. Indeed, zero-rating became a common practice in Ecuador ([Usuarios Digitales, 2017](#)).

3.10. Peru

In 2012, the National Congress of Peru approved Law 29904, to foster the adoption of broadband communications and the construction of the national fiber optic backbone ([Peru, 2012](#)). Article 6 of this Law ensures the freedom of users to access broadband applications and protocols, and explicitly states that ISPs must respect NN principles. Therefore, ISPs can not arbitrarily block, interfere, discriminate, nor restrict the right of any user to access applications and protocols, regardless of origin, destination, nature or property. This Law also determines that the *Organismo Supervisor de Inversión Privada en Telecomunicaciones* (OSIPTTEL), the telecommunications regulatory body, should determine which practices should not be considered arbitrary.

Later, in 2016, OSIPTTEL launched Resolution 165–2016, which specifies the NN regulations in [Peru \(2016\)](#). This Resolution describes in detail each aspect regarding NN in Peru, and is organized in five parts as follows: (i) describes the principles for ensuring NN, such as free choice, equity, and transparency; (ii) describes several measures to ensure NN to be adopted by ISPs and OSIPTTEL; (iii) describes practices that ISPs are allowed to employ, under different situations (such as emergencies or court orders); (iv) describes the practices that ISPs are not allowed to employ; (v) lists violations and infractions, with the corresponding sanctions.

The OSIPTTEL website ([OSIPTTEL, 2020](#)) is particularly comprehensive, containing a large amount of well organized information about NN in Peru. The website includes a timeline of the events that lead to the adoption of regulations in the country, a very clear chart describing which traffic management practices are allowed and prohibited, as well as a description of actions taken against companies violating NN.

3.11. Argentina

NN was implemented in Argentina in the context defined by the so-called “Digital Argentina” Law, defined in Article 56 of Law 27.078 from 2014 ([Argentina, 2014](#)). The goal of this Law is to promote the development of communications and information technologies in Argentina. In particular, this Law specifies

that every end-user has the right to access, send or receive any content, application, service or protocol through the Internet, without any blocking, restriction, discrimination, differentiation, interference, throttling or degradation of the corresponding traffic. Article 57 states that ISPs cannot: (i) block, interfere, discriminate, throttle, degrade or restrict the use, transmission, reception, or access to any type of content, application, service or protocol, except under judicial order or explicit request from the user; (ii) set different prices for their offerings based on content, service, protocol or applications that are going to be used; and (iii) arbitrarily limit the right of consumers to use any hardware or software to access the Internet, provided they do not pose any threat to the network.

3.12. Brazil

The discussions for defining Internet regulations in Brazil started as early as 2007 (Lemos, 2007). The Brazilian government established a Civil Rights Framework. In 2009, the Brazilian Internet Steering Committee (CGI.br), the agency responsible for Internet governance in the country, released a Resolution containing 10 “principles for the governance and use of the Internet” in Brazil (Comitê Gestor da Internet no Brasil (CGI.BR), 2009), of which NN was the sixth principle. Later in 2009, the Ministry of Justice, in collaboration with the Getúlio Vargas Foundation (FGV), launched a project for building the Civil Rights Framework for the Internet, based on the CGI.br principles.

The collaborative process to build the framework was organized in two phases. The first phase consisted of debates on several topics related to the regulation, specified on an initial draft prepared by the Ministry of Justice. In the second phase, a public consultation on the resulting draft of the Law was triggered (Brazil, 2016b). As a result of this process, a Law Project was sent to the National Congress of Brazil in 2011 (Brazil, 2011). This Law Project established principles, guarantees, rights and duties for the use of the Internet in Brazil. On March 25th, 2014, the Chamber of Deputies approved the Law Project, which was then sent to the Federal Senate on March 26th, 2014. Finally, on April 23rd, 2014, it became Law 12965, the so-called *Marco Civil da Internet* (Civil Rights Framework for the Internet) (Brazil, 2014). The ninth article of this Law is dedicated to NN, and is described next.

The NN article states that any entity responsible for the transmission, switching, or routing of data must treat every data packet in an egalitarian way. Therefore, no distinction of content, origin, source, service, device or application is allowed. The article also states that specific rules for discrimination and degradation of traffic would be presented later by the Presidency, after hearing the CGI.br and the National Telecommunications Agency (Anatel). According to the Law, discrimination and degradation of traffic might only occur upon it being imperative for the proper provisioning of services and applications. Prioritization should only be allowed for emergencies. Moreover, even in the case of an allowed discrimination, the ISP should never harm end-users. ISPs must act with proportionality, transparency, and isonomy. They must inform the users in advance, in a transparent and clear way, which traffic management practices are going to be employed. ISPs must offer services in non-discriminatory commercial condi-

tions, and must not employ anti-competitive practices. Finally, the Law states that ISPs are not allowed to block, monitor, filter or analyze the content of data packets traversing their networks.

Next, several public consultations were conducted by the CGI.br (Comitê Gestor da Internet no Brasil (CGI.BR), 2015), the Ministry of Justice (Brazil), and Anatel. On May 11h, 2016, Decree 8771, presenting the rules for implementing Law 12965, was signed by the President (Brazil, 2016a). The Decree describes in which cases discrimination of traffic is prohibited, allowed, and also specifies the procedures for storing and protecting data that ISPs and content providers must follow. Furthermore, the Decree also defines the parameters for assessing potential violations of the Law. In particular, the Decree clearly states that the rules do not apply to telecommunication services not targeted at providing Internet access, as well as specialized services. Moreover, according to the Decree, ISPs are explicitly prohibited of: (i) compromising the public and unrestricted nature of the Internet in Brazil; (ii) prioritizing data packets in the light of commercial agreements; and (iii) prioritizing its own services. ISPs must adopt business models and commercial offers that preserve the Internet as an open and diverse environment that promotes human, economic, social, and cultural development, contributing for an inclusive and non-discriminatory society. In the same context, in 2017, the Senate approved PLS 174/2016 (Brazil, 2017), a law project which prohibits Internet operators to establish data caps on their fixed broadband contracts. Note that mobile Internet plans were not affected by PLS 174/2016, which was approved by the Chamber of Deputies in 2019 (Brazil, 2019).

3.13. Israel

In 2011, the Israeli parliament passed a Law implementing NN principles for mobile telecommunication services. This law was then extended in 2014 to cover all Internet services (Ginosar, 2021). The law allows exceptions: providers can either throttle and block traffic, given reasonable network management reasons. According to a committee appointed by the Ministry of Communications, the rules included in the law are too general and allow for potential misuse by ISPs. A set of amendments were then recommended by the committee in 2015 in order to address this issue. Those recommendations focused on improving the precision of the rules (regarding allowed traffic management practices and what constitutes discrimination) and making the rules future-proof (i.e. compatible with any future technological advancements). To the best of our knowledge, these recommendations have not yet been followed by the government.

3.14. Mexico

In 2014, the Mexican government changed the Telecommunications Law by including two items related to NN (Mexico, 2014). The first item states that ISPs must comply with the following guidelines from the Federal Institute of Telecommunications (IFT): (a) guarantee freedom of choice for end-users, i.e., users can access any legal content, application or service they choose to, without limitation, degradation, discrimination or any restrictions; (b) ISPs must not block,

throttle, interfere, inspect, filter or discriminate content, applications or services; (c) privacy must be ensured, i.e., ISPs must preserve users' privacy and the security of the network; (d) transparency and access to information must be guaranteed, thus ISPs must publish information about their services, including traffic management policies, speed, quality, nature and guarantees of the provided service; (e) ISPs may employ traffic management practices provided they do not hinder fair competition; (f) ISPs must not go below a minimum predefined level of the quality of service; and (g) a sustainable development of the network infrastructure must be prioritized. The second NN item included in the Law states that ISPs must provide the capacity, speed and quality of service contracted by the consumer, without any distinction of content, origin, destination, or application.

In 2019 IFT opened a public consultation on new Draft Guidelines for traffic management and Internet administration. Although NN was protected by the Federal Law of Telecommunications and Broadcasting reform of 2014, the new Draft Guidelines threaten NN principles. According to [Salvemos Internet](#) the threats to NN include the fact that paid priority is allowed, i.e. ISPs can give preferential treatment to certain content over others in exchange for payment – including zero-rating, and exempting certain services from a data cap. Even worse is the threat to user privacy and censorship, albeit only on “emergencies and situations that threaten national security”, although Mexico is not really an outlier in this respect.

3.15. Russia

In 2014, the Russian government approved an Action Plan on “Developing Competition in Telecommunications” ([Federal Antimonopoly Service of the Russian Federation \(FAS\), 2014](#)), prepared by the Ministry of Communications and the Federal Antimonopoly Service (FAS). According to FAS, this plan includes measures for supporting NN. In order to execute this plan, FAS drafted a report containing proposals for formalizing NN in Russia ([Federal Antimonopoly Service of the Russian Federation \(FAS\), 2015a](#)). Public consultations over these proposals were conducted, as well as a public hearing in January 2015, with the participation of representatives from the telecommunications sector. The FAS report has been considered the basis for regulating NN in Russia. Furthermore, it was agreed that compliance to the anti-monopoly law supports the main NN principles. A FAS Working Group (WG) on NN was then established, with members both from the telecommunications regulator agency and telecommunications companies.

The FAS WG had its first meeting in April 2015 ([Federal Antimonopoly Service of the Russian Federation \(FAS\), 2015d](#)), in which proposals and the agenda of the WG were discussed. The second meeting took place in November 2015, in which the participants agreed to adopt NN regulations for supporting the development of the Internet as an open platform for innovation ([Federal Antimonopoly Service of the Russian Federation \(FAS\), 2015b](#)). Later in December 2015, the third meeting of the WG took place ([Federal Antimonopoly Service of the Russian Federation \(FAS\), 2015c](#)). The objectives, concepts and fundamental principles of NN were discussed. Further-

more, the WG decided to refine all proposals later at a final meeting. Finally, in February 2016, the WG published a document entitled “Fundamental Document on Network Neutrality” ([Federal Antimonopoly Service of the Russian Federation \(FAS\), 2016](#)). This document aims at ensuring non-discriminatory Internet access for both end-users and content providers, while creating the proper conditions for the evolution of telecommunications, including competition, and innovation.

Different sources (e.g. [Hartmann and Giles, 2018](#); [Natalia Krapiva, 2021](#)) mention that the Russian government has tight control over the Internet, monitoring traffic and blocking websites and services. A 2017 article [The Moscow Times \(2017\)](#) mentions that close to 1200 websites had been blocked since 2014. Although censorship is certainly related to NN, it is not the focus of the present survey. Besides Russia, other countries around the world, including China and Iran are also said to employ Internet censorship. For a thorough survey on the topic please refer to [Aceto and Pescapé \(2015\)](#).

3.16. United States of America

The NN debate started in the USA – worldwide, actually – in 2002 when the FCC reclassified Internet broadband services as “information services”, as described in [Section 2](#). In 2005, the FCC announced that the Supreme Court had agreed with that reclassification ([Federal Communications Commission \(FCC\), 2005](#)). A public consultation to get feedback on that issue from both companies and consumers was concluded in July 2007 ([Anderson, 2007](#)). About 27,000 comments were received, both against and in favor of NN. Later, in February 2008, the American Congress held hearings on proposed Law HR 5353, the so-called *Internet Freedom Preservation Act* ([United States of America, 2008](#)). This proposed Law would require the FCC to assess competition in the broadband market, as well as to check whether consumer rights and freedom of choice were being guaranteed, and that content/service providers were not being charged for quality of service (i.e. no paid prioritization).

In 2009, the FCC launched a public consultation over a proposal to regulate the broadband market, in particular specifying how ISPs could adopt reasonable network management practices, while at the same time guaranteeing a secure Internet in which unwanted traffic, such as spam for instance, could be filtered out ([Federal Communications Commission \(FCC\), 2009](#)). Later, in 2010, the FCC adopted three basic rules for preserving the Internet as an open platform for innovation, investment, job creation, economic growth, competition, and freedom of expression ([Federal Communications Commission \(FCC\), 2010](#)): (i) transparency; (ii) no blocking; and (iii) no unreasonable discrimination. These rules were reviewed by the United States Court of Appeals for the District of Columbia Circuit in 2014 ([Federal Communications Commission \(FCC\), 2014a](#)). As a result, the Court of Appeals confirmed the authority of the FCC to regulate broadband Internet access services, and sanctioned the transparency rule, but struck down the non-blocking and unreasonable discrimination rules, as they were not considered lawful in the context of “information services” (which was how broadband services were then classified).

In 2014, 122 technology investors, including pension funds and financial institutions, sent an open letter to the FCC, supporting an open and free Internet that fosters investments and entrepreneurship [Letter to FCC chairman Tom Wheeler](#). The letter claimed that the FCC rules did not cover all necessary aspects to ensure NN. For example, the investors claimed that the FCC rules would not prevent ISPs to prioritize or degrade certain types of traffic by routing through the so-called fast/slow lanes. A few days later, the FCC launched another public consultation ([Federal Communications Commission \(FCC\), 2014b](#)). The goal was to find the best approach to protect and promote an open Internet.

Then, in 2015, the FCC reclassified broadband services as “telecommunication services” again ([Federal Communications Commission \(FCC\), 2015a](#)). With this reclassification, the FCC had the legal means to adopt rules to preserve and protect an open Internet. In [Federal Communications Commission \(FCC\) \(2015a\)](#) the FCC states that “in the years that [the open Internet rules of 2010] were in place, significant investment and groundbreaking innovation continued to define the broadband marketplace. For example, according to US Telecom, broadband providers invested \$212 billion in the three years following adoption of the rules – from 2011 to 2013 – more than in any three year period since 2002.” The new rules of 2015 aimed at guaranteeing free access to legal content on the Internet, as well as preventing ISPs from blocking, prioritizing, degrading or establishing fast/slow lanes for legal content. According to FCC, these new rules were designed to protect the freedom of speech and innovation on the Internet, and promote investments in broadband networks in the country. Furthermore, these rules applied both to wired and mobile services.

The new regulation included the following rules regarding NN. (i) No blocking: consumers must have access to all legal content in the Internet. (ii) No throttling: ISPs cannot degrade traffic based on origin, destination, or content, and cannot prioritize their own services. (iii) No paid prioritization: ISPs cannot be paid (directly or indirectly) in order to prioritize certain types of traffic. (iv) Transparency: consumers must be fully informed about the services they are contracting. Regarding the adoption of zero-rating practices, the FCC states in this ruling that it should analyzed case by case individually.

After their approval, several motions against the NN rules of the FCC were issued, coming mainly from ISPs including The United States Telecom Association (USTelecom) ([Federal Communications Commission \(FCC\), 2015b; Finley, 2016](#)). In 2016, senator Mike Lee presented a bill – the so-called Restoring Internet Freedom Act – that prohibited the FCC from reclassifying Internet services as telecommunication services, and to impose rules on ISPs ([United States of America, 2016](#)). Moreover, also in 2016, the House of Representatives approved Law HR 2.666 ([United States of America, 2015](#)) that prohibits the FCC from regulating the rates charged for broadband Internet access services, the so-called No Rate Regulation of Broadband Internet Access Act. Later, both Acts expired and were never enacted. However, also in 2016 the Court of Appeals for the District of Columbia rejected the industry motion, stressing the rights of the FCC to classify Internet services as telecommunication services, and upheld the FCC rules for an open and neutral Internet ([Karr, 2016](#)).

In 2017, Ajit Pai, the then newly installed chair of the FCC, criticized the 2015 open Internet rules, and stated that they should be revoked ([Federal Communications Commission \(FCC\), 2017c](#)). The FCC then launched a public consultation in April 2017, in order to gather opinions about a new regulation proposal ([Federal Communications Commission \(FCC\), 2017b](#)). According to that proposal, the 2015 regulations actually hindered innovation, threatening the open Internet that the FCC wanted to preserve. Also, Internet services should be reclassified as “information services”, returning to the Federal Trade Commission (FTC) the authority to monitor ISPs.

In the context of the new regulation proposal, several organizations, such as Save the Internet [Press](#) and [Public Knowledge \(2017\)](#), started petitions asking end-users to support their cause in favor of NN. Nevertheless, in 2017, the FCC 2015 regulation was revoked ([Federal Communications Commission \(FCC\), 2017a](#)). Later, in 2019, a bill for restoring the 2015 regulation was presented, the so-called Save the Internet Act ([United States of America, 2019](#)). The bill was approved by the House of Representatives in April 2019, and currently the bill is waiting to be approved by the Senate.

Meanwhile, California passed state law SB-822 in the wake of the FCC net neutrality repeal in 2018 ([Access Now, 2021](#)). Although ISPs opposed SB-822 at court, the lower court ruled that broadband providers cannot prevent the state from enforcing its NN law. Similarly, several other states also launched initiatives to partially or fully reestablish NN rules. A list summarizing such efforts by US states can be found in the website of the National Conference of State Legislatures ([National Conference of State Legislatures, 2021](#)).

3.17. European Union

The European Union (EU) launched several efforts to implement NN between 2009 and 2014. In 2009, the European Commission (ECOM) promoted 12 reforms to ensure stronger consumer rights, an open Internet, a single European telecommunications market, and high-speed Internet connections for all end-users ([European Commission, 2009](#)). Immediately after that, the European Parliament (EP) and the European Council (ECL) released a single framework to regulate telecommunication networks and services ([European Parliament, 2009a](#)), that unified several previous directives. At roughly the same time, the EP and the ECL also created the Body of European Regulators for Electronic Communication (BEREC) ([European Parliament, 2009b](#)), a body of national regulatory agencies from all the EU.

A public consultation on fundamental aspects regarding NN was launched by the ECOM in June 2010 ([European Commission, 2010](#)). Then, a summit on “The Open Internet and Net Neutrality in Europe”, organized by the EP and ECOM, took place in November 2010 ([Neelie Kroes, 2010](#)), giving the opportunity to different interested parties to discuss and share their points of view on NN. Based on the outcomes of the public consultation and the summit, in April 2011, the ECOM communicated to the EP and other relevant bodies, the main conclusions reached ([European Commission, 2011](#)). In November 2011, The EP concluded that no further regulatory measures were necessary, and required transparency from ISPs regarding traffic management practices ([European Parliament, 2011](#)).

In the following year, in December 2012, the BEREC published a summary of its NN positions and measures, following a public consultation conducted from May to July 2012 ([Body of European Regulators for Electronic Communications \(BEREC\), 2012](#)). In September 2014, the ECOM presented a report on the implementation of telecommunication regulations, covering the two previous years ([European Commission, 2014](#)). This report included the situation of NN in each country of the EU during the period.

Finally, in 2015, the EP, ECL, and ECOM reached an agreement and proposed the Open Internet Regulation ([European Union, 2015](#)), establishing the Telecommunications Single Market (TSM) regulations for all the then 28 member-states. The rules related to NN (in particular Articles 3 and 4) established that: (i) there should be no blocking or throttling of content, applications, or services; (ii) European end-users should have access to an open Internet, and all content and service providers should be able to provide their services through an open and high-quality Internet; (iii) all traffic must be treated equally, without paid prioritization on Internet access services; (iv) reasonable traffic management practices are allowed, as long as they can be technically justified; (v) specialized and innovative services are allowed, as long as they do not hinder the access to an open Internet – examples include video conferencing, and telemedicine; and (vi) zero-rating practices are allowed, but must comply with all the other rules.

Still in 2015 Tim Berners-Lee ([World Wide Web Foundation, 2015](#)) claimed that the European Open Internet Regulation was weak as it allowed ISPs to: (i) create fast-lanes, exploiting the exceptions for specialized services; (ii) offer zero-rating; (iii) define service classes, prioritizing or degrading their traffic; and (iv) slow down the traffic at any given time, claiming that congestion was about to happen. Furthermore, Berners-Lee claimed that the European rules threatened innovation, freedom of speech, and privacy. Moreover, more than thirty companies, including BitTorrent, Netflix, Reddit, and other organizations, signed an open letter to the EP, requesting a series of changes on the rules to be made in favor of NN. The EP, however, did not approve the requested changes, leaving the freedom and authority to implement those changes to the regulatory agencies ([Baraniuk, 2015](#)).

In August 2016, the BEREC defined how the regulatory agencies of the EU countries should implement NN rules ([Body of European Regulators for Electronic Communications \(BEREC\), 2016a; 2016b](#)), and how specific cases should be dealt with. These guidelines were based on a public consultation that lasted for six weeks and ended in July 2016. With these new regulations, the BEREC aimed at ensuring the non-discriminatory treatment of traffic for Internet access services, as well as protecting end-users rights. The new guidelines include three important aspects regarding: (i) zero-rating: each regulatory agency has the autonomy to decide how to establish its own zero-rating practices, always following the rules to protect innovation and equal treatment; (ii) traffic management: regulatory agencies must ensure that traffic is not discriminated, regardless of content, origin, and/or destination; and (iii) transparency: regulatory agencies must ensure that ISPs provide information about the provided services in a transparent, clear, and accessible way.

In 2019, BEREC updated the 2016 guidelines and launched a public consultation to gather input from stakeholders regarding the new draft ([Body of European Regulators for Electronic Communications \(BEREC\), 2019](#)). The final version of the updated guidelines was published in 2020 ([Body of European Regulators for Electronic Communications \(BEREC\), 2020](#)). One of the main changes introduced in the updated rules is the inclusion of an “assessment methodology of zero-rating and similar offers.” However, more recently, on October 26th, 2021, BEREC stated that it is revising the zero-rating rules, and a public consultation on a new draft of the Open Internet Guidelines should be conducted in 2022 ([Body of European Regulators for Electronic Communications \(BEREC\), 2021](#)).

Note that before the EU implemented NN rules, some member states had previous experiences in NN regulations. However, in this work we focus on the regulation that is currently in effect for all EU member states. We refer the reader to [Marsden \(2017\)](#) for more information about country-specific regulations in the period before the EU defined general rules.

3.18. South Africa

In 2016, the South African Department of Telecommunications and Postal Services (DTPS) published the National Integrated ICT Policy ([Department of Telecommunications and Postal Services \(DTPS\), 2016](#)), a framework for defining ICT (Information and Communication Technologies) policies in the country. This document includes guidelines for NN. These guidelines recommend ISPs to adopt transparent practices and not block or discriminate any legal content. Exceptions are allowed, in the context of reasonable traffic management practices. DTPS also states that any violation of these recommendations should be verified in conjunction with competition authorities.

Recently ([Robb and Hawthorne, 2019](#)) Robb and Hawthorne have investigated the threats of network operators gaining excessive market power and the reduction of competition, among other issues.

3.19. India

In March 2015, the Telecom Regulatory Authority of India (TRAI) launched a public consultation over a regulatory framework for Internet applications and services ([Telecom Regulatory Authority of India \(TRAI\), 2015b](#)). Results from this public consultation showed that most Indians supported NN ([Roy, 2015](#)). A second public consultation was then launched by TRAI in December 2015 ([Telecom Regulatory Authority of India \(TRAI\), 2015a](#)), focusing on differentiated prices for specific applications and services. During the period this consultation was going on, the debate over NN intensified in India, specially after an ISP decided to charge for voice calls made over the Internet ([PTI, 2015](#)). Based on the results of this second public consultation, in February 2016 TRAI published rules prohibiting zero-rating in India ([Telecom Regulatory Authority of India \(TRAI\), 2016b](#)).

After further public consultations ([Telecom Regulatory Authority of India \(TRAI\), 2016a; 2017a](#)), in 2017 TRAI presented several recommendations for NN ([Telecom Regulatory Authority of India \(TRAI\), 2017b](#)). These recommendations call

for non-discriminatory treatment of content, reasonable traffic management practices, transparency, besides monitoring and the enforcement of rights. ISPs that violate these recommendations are to be punished. In 2018, the Department of Telecommunications (DoT) approved the TRAI recommendations, turning them into rules (Adi Robertson, 2018).

Recently, in January 2020, a new public consultation related to NN was launched by TRAI (Telecom Regulatory Authority of India (TRAI), 2020). The goal of this new consultation was to review some aspects of the NN recommendations from 2017, related to traffic management practices allowed, and also to monitoring NN violations. As a result of this consultation, TRAI published new recommendations in September 2020 (Internet Freedom Foundation, 2021). These recommendations included three main points: (i) the DoT should create a multi-stakeholder body to ensure ISP compliance to the NN rules; (ii) the DoT and the multi-stakeholder body should create a list of reasonable traffic management practices that meet global standards; and (iii) the DoT and the multi-stakeholder body should define transparency measures that ISPs should comply with in terms of traffic management practices adopted.

3.20. United Kingdom

The European Open Internet Regulation of 2015 was made a domestic law in the United Kingdom in 2016 (United Kingdom, 2016). Following the Brexit, in October 2018 the government introduced the Open Internet Access Amendment (EU Exit) as a statutory instrument to the EU Withdrawal Act to provide for continuity with NN requirements throughout the Brexit process (United Kingdom, 2018). Thus the United Kingdom chose to maintain the EU rules. Before the Brexit, Ofcom, the telecommunications regulatory agency, was required to produce an annual report on NN compliance that was sent to the EU yearly. Now, Ofcom is still required to produce an annual report according to local law (Ofcom, 2020).

3.21. Nigeria

In 2017, the Nigerian Communications Commission (NCC) released the Draft Internet Industry Code of Practice (Izuogu, 2019), calling for public reviews and comments. Two years later, in 2019, the NCC released the final version of the regulation (Nigerian Communications Commission, 2019). This regulation states that: “(i) Internet users have the right to access and distribute information and content, use and provide applications and services, and use appropriate terminal equipment of their choice; (ii) no lawful content, applications or services shall be blocked or made unavailable to users of Internet services; (iii) no lawful content, applications or services shall be discriminated against by an ISP; and (iv) where traffic management practices are required in order for the efficient operation of the network, an ISP shall be completely transparent about what practices are in place and how the consumers services are affected.” In addition, the regulation specifies under which conditions zero-rating is to be allowed, and also which traffic management practices are to be considered reasonable. Moreover, measures for transparency that must be followed by ISPs are also defined.

Before the NN draft regulation of 2017, a Cybercrimes Act passed in Nigeria (Eboibi, 2018), in 2015, and in the following year (2016) the government announced a draft of the Digital Rights and Freedom Bill (Nigeria, 2016), of which Section 17(5) mentions the NN principle and other sections define fundamental rights for Internet users. This bill was approved by both the House of Representatives and the Senate in 2018. But in 2019, President Muhammadu Buhari refused to sign the bill into a law, arguing that the bill “covers too many technical subjects and fails to address any of them extensively” (Abisola Olasupo, 2020).

3.22. Australia

The Australian Communications and Media Authority (ACMA) is the agency responsible for regulating telecommunications in Australia. A search for NN-related regulations across the ACMA website shows related regulations on VoIP (Australian Communications and Media Authority (ACMA), 2009) and Internet of Things (Australian Communications and Media Authority (ACMA), 2015) which explicitly mention the principles of NN. However, there are no regulations that aim specifically at enforcing NN principles in the country. Although discussions have been going on for several years, some Australian ISPs are known to have imposed data caps on consumers and offer zero rating services. In November 2015, Ziggy Switkowski, the chairman of the National Broadband Network, stated that Australia should inevitably have to deepen the debate on NN, given the increasing need for bandwidth from emerging services such as video streaming (Sadauskas, 2015). In any case, Australia also has a strong consumer protection agency, the ACCC (Australian Competition and Consumer Commission) which does cover Internet services. The ACCC chair Rod Sims has stated that Australia does not need NN regulations given the tough competition among ISPs in the country (Duckett, 2018).

3.23. New Zealand

In June 2011, the Commerce Commission of New Zealand (COMCOM), which is the telecommunications regulatory agency, initiated a study to identify factors “that affect broadband services in New Zealand”. The final report resulting from this study was published in June 2012 (Commerce Commission, 2012). According to the report, NN should not represent a problem in New Zealand if ISPs inform the limitations and restrictions of their broadband services in a transparent way. The report also mentions that as there is sufficient competition among ISPs in New Zealand, consumers can easily switch from an ISP to another if their broadband service expectations are not being met. Finally, the report states that zero-rating is beneficial for consumers, and the relevance of this practice in the market should diminish as data caps increase.

In June 2015, the website *Internet NZ* released a public discussion document in order to gather the opinion of citizens about NN (InternetNZ, 2015; O’Neill, 2015; Scoop Independent News, 2015). Later, the Ministry of Business, Innovation & Employment issued a public discussion document, with the purpose of discussing possible revisions of the Telecommunications Act from 2001 (Ministry of Business, Innovation & Em-

Table 1 – Summary of NN regulations from different countries.

Country	Year	Type	In Effect	Traffic Differentiation	Specialized Services	Zero-rating	Reasonable Traffic Management	Transparency	Observations
Japan	2008	Guidelines	Yes	Allowed, as long as it is considered to be fair	–	–	Rules define which practices are considered to be fair	–	NN violations judged on a case by case basis
Canada	2009	Rules	Yes	Forbidden	Approval of the regulatory agency is necessary	ISPs can't zero-rate their own services	Defined by the regulation	Demanded by the regulation	–
Norway	2009	Guidelines / Law	Yes	Forbidden	Conditions for provisioning are defined	Forbidden in the 2009 guidelines, but not clear in 2017 Law	Defined by the regulation	Demanded by the regulation	The guidelines from 2009 became Law in 2017
Paraguay	2009	Rules	Yes	Forbidden	–	–	–	–	–
Chile	2010	Law	Yes	Forbidden	–	Forbidden by regulatory agency, but not clear in the law	Defined by the regulation	Demanded by the regulation	First NN law in the world
Colombia	2011	Law	Yes	Forbidden	Conditions for provisioning are defined	–	Defined by the regulation	Demanded by the regulation	Exceptions were implemented during the COVID-19 pandemic
Singapore	2011	Guidelines	Yes	Forbidden	Conditions for provisioning are defined	–	Defined by the regulation	Demanded by the regulation	–
S. Korea	2011	Guidelines	Yes	Forbidden	–	–	Defined by the regulation	Demanded by the regulation	Foreign content providers are being charged extra fees
Ecuador	2012	Rules / Law	Yes	Forbidden	–	Explicitly allowed by the 2015 law	Defined by the regulation	–	The rules were included in a law in 2015
Peru	2012	Law	Yes	Forbidden	–	–	Defined by the regulation	Demanded by the regulation	–
Argentina	2014	Law	Yes	Forbidden	–	–	–	–	–

(continued on next page)

Table 1 (continued)

Country	Year	Type	In Effect	Traffic Differentiation	Specialized Services	Zero-rating	Reasonable Traffic Management	Transparency	Observations
Brazil	2014	Law	Yes	Forbidden	Conditions for provisioning are defined	Regulation is not clear, common in mobile networks	Defined by the regulation	Demanded by the regulation	–
Israel	2014	Law	Yes	Forbidden	–	–	Defined by the regulation	–	The law is vague regarding several topics related to NN
Mexico	2014	Law	Yes	Forbidden	–	Regulation is not clear, the practice is not uncommon	Defined by the regulation	Demanded by the regulation	–
Russia	2014	Rules	Yes	Forbidden	–	–	–	–	–
USA	2015	Rules / Non-regulated	No	Forbidden	Conditions for provisioning are defined	Judged on a case by case basis	Defined by the regulation	Demanded by the regulation	NN rules repealed in 2017
EU	2016	Rules	Yes	Forbidden	Conditions for provisioning are defined	Guidelines for assessing specific practices are provided	Defined by the regulation	Demanded by the regulation	Common rules to all member states
S. Africa	2016	Rules	Yes	Forbidden	–	–	Defined by the regulation	Demanded by the regulation	–
India	2017	Guidelines	Yes	Forbidden	–	Forbidden	Defined by the regulation	Demanded by the regulation	The rules were recently revised through a public consultation
UK	2018	Rules	Yes	Forbidden	Conditions for provisioning are defined	–	Defined by the regulation	Demanded by the regulation	Preserved the EU regulation
Nigeria	2019	Rules	Yes	Forbidden	–	Allowed under specified conditions	Defined by the regulation	Demanded by the regulation	–
Australia	–	Non-regulated	No	–	–	Common practice	–	–	NN still in discussion
N. Zealand	–	Non-regulated	No	–	–	Explicitly allowed by the regulatory agency	–	Demanded by the regulatory agency	NN still in discussion
Uruguay	–	Non-regulated	No	Forbidden in the draft bill	–	–	Defined in the draft bill	Demanded in the draft bill	Draft bill was filed in 2020

ployment, a). This document gathers different perspectives on the regulation of telecommunications, including NN. All interested parties, such as consumers, ISPs, content providers, etc., were encouraged to participate. All contributions received are available at the Ministry website ([Ministry of Business, Innovation & Employment, b](#)). At the time we concluded the present article, NN is still under discussion in New Zealand, thus no NN regulation has been implemented yet.

3.24. Uruguay

Discussions on the NN principle in Uruguay started as early as 2011 ([Uruguay Presidencia, 2011](#)). In 2015, a draft NN bill was issued ([Pedro Bordaberry, 2015](#)). The bill starts declaring the freedom of individuals to access any information they choose to through the network. ISPs should comply with the NN principle, in the sense that no hierarchies and prioritization are allowed based on traffic origin, destination, protocol or content. The bill then states that no blocking and no throttling are admitted; the bill also recognizes the need for exceptions for reasonable management. ISPs must ensure the quality of service contracted by users and be transparent regards the management practices they adopt. The bill also mentions that ISPs must protect user privacy and employ measures to avoid cyber threats. The bill can be considered to be very concise, synthesizing in less than a dozen articles all the main NN principles. Nevertheless, the bill was filed in 2020 ([Parlamento del Uruguay, 2020](#)). Therefore, as of the writing of the present survey, there is no NN regulation in place in Uruguay.

4. Synthesis and comparison of NN regulations

This section presents a synthesis and comparison of the regulations adopted (or official discussions) by the 50 countries described in [Section 3](#). The comparison is presented in terms of: the type of regulation, whether the regulation allows or forbids *traffic differentiation*; whether the regulation has specific rules for provisioning *specialized services*; whether the regulation specifically mentions *zero-rating practices*; whether the regulation defines *reasonable traffic management practices*; and whether the regulation demands *transparency* from ISPs. [Table 1](#) shows the comparison of the NN regulations for the different countries according to these aspects. The order in which the countries appear in the table was defined according to the year that the any NN regulation was first effectively implemented in each country. For each country in the table the information reflects the situation with respect to the most recent regulations. Note that the row corresponding to the USA takes into account the 2015 NN regulation, which was repealed in 2017.

We categorized the NN regulations in three types, according to the method employed for their implementation: guidelines, rules, law, or whether they were only official discussions (*non-regulated*). Some regulations consist of guidelines, which are recommendations that should be followed by ISPs. They are usually less strict and more reactive: a suspicious behavior from an ISP may be investigated and punished, on a case by case basis. A NN regulation may also be implemented through

a set of rules (from a regulatory agency) or law (from legislative bodies). In these cases, the regulation is more restrictive and must be followed by ISPs; forbidden practices are defined beforehand, as well as the potential punishments in case of violations.

As shown in the table, most regulations (except for Japan) explicitly forbid traffic differentiation, i.e. blocking, throttling, or the prioritization of traffic based on content, protocol, origin and/or destination. Furthermore, most regulations demand ISPs to be transparent, and specify reasonable traffic management practices which ISPs are allowed to employ. However, most regulations do not deal explicitly with zero-rating and specialized services.

5. Related work

A comparison of the European regulation for NN with those previously adopted in the USA is presented in [Marcus \(2015\)](#). The author compares both the motivations and specific aspects of each regulation. In [Shepherd \(2019\)](#) the author examines how different public consultation efforts for drafting NN rules have been conducted in different countries. The author in [Marsden \(2016\)](#) compares the NN regulations of several countries, focusing in particular on the zero-rating practice. A comparison of telecommunication policies on seven countries across Europe, Asia and North America is presented in [Falch and Henten \(2018\)](#), including how these policies deal with competition and content prioritization. In [Shin \(2014\)](#) the authors present a thorough comparison of the NN regulations from the USA and South Korea, highlighting the similarities and differences of the regulations on several aspects. A historical overview of the NN debate in the USA and in the EU is presented in [Stocker et al. \(2020\)](#), as well as a comparison between their NN regulations. The authors also identify future challenges for operating and designing networks as the debate continues to evolve. In [Triviño et al. \(2021\)](#) the authors describe and compare the NN regulations from five South American countries: Argentina, Brazil, Chile, Colombia, and Ecuador.

Finally, a survey of NN regulations of multiple countries across three continents was published as a conference paper ([Nguyen et al., 2020](#)). That survey summarizes the adopted regulations, which are compared according to whether zero rating is allowed or not. In the present survey we included regulations from a wider range of countries, spanning all five continents. To the best of our knowledge all countries which have either adopted regulations or conducted public official discussions are included in the present survey. The descriptions are fully up to date as of June 2021.

6. Conclusion

In this work we provided a description of the NN regulations adopted by 50 countries across all five continents. To the best of our knowledge the survey discusses regulations (or public official discussions) for all countries which have had an official stance on the subject matter. We present a comparison, identifying common and divergent aspects present in the regulations. We found out that regulations were implemented

mainly through guidelines, rules, or laws. In general, regulations specified as guidelines are more reactive, i.e. in case an ISP does not follow the recommendations, an investigation may be launched over the suspicious behavior. Rules from regulatory agencies and laws tend to be more restrictive, usually establishing punishments which are inflicted upon violations.

Future work includes a deeper investigation of case law in the context of NN, including the role courts play in the enforcement of NN rules, since case law plays a significant role in the regulatory process of some countries. Future work also includes investigating how the different types of regulations (or lack of regulation) have influenced the evolution of the telecommunication market in different countries: is it possible to measure quantitatively the impact of the adoption of NN regulations? Some of the metrics that can be employed to perform this evaluation include the public/private investment on telecommunications/Internet infrastructures, the capabilities of those networks and how they varied after regulations were adopted, as well as the number of Internet users in each country – in particular the growth of that number, and the percentage with high bandwidth connections.

In particular, protecting innovation and fair competition is one of the main motivations in favor of NN. Therefore, it is important to understand how regulations are effectively impacting the industry, allowing for more informed decisions to be taken when creating public policies for the Internet in the future.

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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