

# Externalities between on-line contents drive telecom operators' incentives to provide quality open internet through neutral network

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## Abstract

The necessity of Net Neutrality (NN) rules to safeguard the open internet should be assessed in light of the history of broadband internet and empirical evidence. Actual or alleged "net neutrality breaches" have been marginal in broadband internet history in contradiction with the conclusions of conventional NN theories. This contradiction is explained by the existence of strong positive externalities between internet Contents & Applications (C&As) requiring neutral interfaces between C&As and networks. Therefore, network operators have incentives to provide high quality neutral internet access. This is not incompatible with offering in parallel and as complement specific C&As relying on proprietary information of local relevance and using a priority access to the network (*so-called "specialized services"*). The specific nature of such C&As implies that they cannot represent substitutes but complement to services available on internet access. The access provider is incentivized to provide an internet access service of good quality when it provides specialised service in parallel because as complement, the value of the latter is enhanced by the quality of the former. Such findings on the incentives of network providers should be taken into account when implementing and assessing the Net neutrality rules: in particular there should be no presumptions that network operators have incentive to degrade internet access service quality.

## 1. Introduction

Net Neutrality (NN) is the principle that internet service providers (ISP) treat all data on the internet the same, without discrimination, which could be blocking, throttling or paid prioritization. The need for NN rules to preserve the open internet is still an ongoing debate as the sector specific NN rules have recently been repealed in US in June 2018 whereas the EU rules on NN meant to preserve open internet apply as of 30 April 2016, following the adoption of Regulation (EU) 2015/2120 on 25 November 2015 by the European Parliament and the Council. The Federal Communications Commission (FCC) has justified its decisions by claiming that NN rules restrained broadband providers from experimenting with new business models and investing in new technology. FCC chairman has long argued against the rules, pointing out that before they were put into effect in 2015, service providers had not engaged in any of the practices the rules prohibited.

This paper aims to compare the economic foundations of NN regulation to the actual practices of internet service providers and their incentives to discriminate or the contrary to preserve an open and neutral internet. We contribute to the debate including in the analysis the existence of positive externalities between Contents & Applications (C&As) available on Internet and their effects on the incentives of network operators to provide neutral access.

We would point out that the assumed necessity of NN rules to safeguard the open internet has been based on theoretical considerations. However, the history of broadband (BB) internet and empirical evidence contradict those theoretical underpinnings. Actual or alleged "net neutrality breaches" have been marginal and never materially jeopardised the open internet. Our main point is the

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<sup>1</sup> All opinions expressed are those of the authors and may not represent those of Orange.

following: the existence of strong positive externalities between internet Contents & Applications (C&As) and the requirement of compatibility between the C&As and the network interfaces to support those externalities imply that network operators have incentives to provide high quality open internet access based on a neutral network. The willingness of ISPs to preserve the quality of a neutral and open internet is not incompatible with the offering in parallel of specific C&As relying on proprietary information of local relevance<sup>2</sup> and using a priority access to the network (*so-called "specialized services"*). By their nature, such specific C&As can only be provided as complements and not as substitutes to C&As available on the open internet access. Because of this complementarity, the access provider has no strategic interest in degrading the quality of open internet access to favour "*specialized services*".

As a consequence, open internet access through a neutral network is provided naturally by the market. Such findings on the incentives of network providers should be taken into account when implementing and assessing the Net neutrality rules. in particular there should be no presumptions that network operators have incentive to degrade internet access service quality.

The paper is organized as follows. Section II compares theory with practice in order to assess whether the theoretical basis, summarized in a brief literature review, that net neutrality rules are necessary to safeguard the open internet is justified. Section III demonstrates that network operators have incentives to provide high quality open internet access based on a neutral network due to positive externalities between C&As. Section IV verifies that the main findings of the paper are robust in relation to specific questions and criticisms. The last section concludes.

## 2. Between theory and practice: where is the truth in the debate on net neutrality?

The assumed necessity of Net Neutrality rules to safeguard the open internet has been based on theoretical considerations. However, the history of broadband internet and empirical evidence contradict those theoretical underpinnings. Cases of « breaches of net neutrality » have been marginal at the scale of internet access development and nothing close to the predictions of NN theories ever materialized.

### 2.1. The necessity of Net Neutrality rules to safeguard the Open internet based on theoretical analysis, summarized in a literature review.

The Net Neutrality debate was born in the US in 2003 with the writing of an academic paper by Tim Wu<sup>3</sup> according to which the neutrality of internet access services guarantees the principle of “innovation without permission”. Innovators should not have to ask for permission from gatekeepers (regulators, ISPs, etc.) before launching a new product. Tim Wu mentioned that net neutrality is a means to preserve a Darwinian competition among every conceivable use of the internet so that only the best survive.

Net neutrality can also be perceived as a way to prevent ISPs acting as internet gatekeepers in order to protect freedom of expression and access to culture, opinions and opportunities.

Legislative or regulatory texts on the subject, such as the European Regulation 2021/2015 or the FCC Order of 2015 (which was removed in 2018) call “Open Internet” the political objective of ensuring

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<sup>2</sup> Why C&As relying on proprietary information of global relevance are unlikely to use priority access to networks will be explained in the paper.

<sup>3</sup> Wu T. (2003) “Network Neutrality, Broadband Discrimination” Journal of Telecommunications and High Technology Law, 2, pp. 141-176

freedom of usage of Internet access without interference by ISPs. Those texts impose obligations on the ISP to treat all internet traffic equally (“Net Neutrality” obligations) as a way to meet the “Open Internet” objective. Therefore, NN obligation should be understood as a mean to an end, which is maintaining safeguarding and open internet.

Indeed, for public authorities and theoretical literature, ensuring an Open Internet requires the imposition of Net Neutrality obligations on telecom operators (treat traffics associated to all C&As available on internet without discrimination, blocking, throttling or paid prioritization) otherwise operators would use discriminatory measures to control internet content and application provision.

Theoretical economic literature addresses the NN policy issue under two specific angles:

- First the “zero pricing rule” prohibits an ISP from charging a CAP to send information to consumer. Economides and Tag<sup>4</sup> provide a good example of such analysis. They use a two-sided market formal framework where the ISP plays the role of platform between end-users which represent one side of the market, and C&As which are the other side of the market. They show that under certain conditions, welfare is maximized when ISPs only charge end-users: their result can be understood as supporting the “zero pricing rule” even though more recent papers have led to divergent conclusions<sup>5</sup>. However, those theoretical analyses use a specific setting, namely that each ISP benefit from a termination monopoly which constitute competitive bottleneck. This setting is not considered as relevant by regulatory and competition authorities. Authorities rightly observes that ISP termination can be by-passed using transit services with which ISP are obliged to be interconnected to in order to provide their own services, and that therefore, there is competition to provide termination<sup>6</sup>. This observation may explain why the theoretical literature on the “zero pricing rule” has not been translated in NN formal regulation.
- Second, the “non-discrimination rule” which generally address the question of whether the ability of ISPs to differentiate between high and regular quality offerings to C&As would result into higher or lower network investments. The conclusions of these theoretical analyses ultimately depend on whether the hypothesis behind the theoretical model assumes that quality differentiation is only an artificial lever to generate price discrimination, or if superior quality can support genuine consumer value creation. In the former case, see for instance Choi and Kim (2010)<sup>7</sup>, in their paper, the value of price discrimination depends on scarcity, the ability to discriminate reduces investment. In the latter case, see for instance Bourreau, Kourandi and Valetti<sup>8</sup>, differentiation allows the creation of more consumer value and therefore increases investment. However, in both cases, theoretical analyses support that ISPs have the incentives and ability of to discriminate<sup>9</sup>.

But the existing literature on net neutrality has not considered the existence of strong positive externalities between C&As and those externalities may strongly constraint the incentives and ability of ISPs to discriminate between C&As.

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<sup>4</sup> Economides, N and Täg, J (2012) “Net neutrality on the internet: a two –sided market analysis”, Information Economics and Policy, 24:2, pp. 91-94

<sup>5</sup> Jullien, B et Sand-Zantman, W « Internet Regulation, Two-Sided Pricing, and Sponsored Data », International Journal of Industrial Organization, vol. 58, mai 2018, p. 31–62

<sup>6</sup> See for instance the “Cogent-France Telecom” case from the French Competition Authority (Décision n° 12-D-18 du 20 septembre 2012)

<sup>7</sup> Choi, J. and Kim, B.-C. (2010), “Net neutrality and investment incentives”, RAND Journal of Economics, 41:3, pp. 446-71

<sup>8</sup> Bourreau, M. Kourandi, F. Valetti, T. « Net Neutrality with Competing Internet Platforms « The Journal of Industrial Economics, Vol. 63, Issue1, March 2015, pp. 30-73

<sup>9</sup> See Becker, Carlton, and Sider (2010); Peitz, Martin and Schuett, Florian (2016), Kourandi, F., Krämer, J. and Valletti, T. (2015), and Krämer, J., Wiewiorra, L. and Weinhardt, C. (2013).

## 2.2. Theoretical rationale of NN obligations neither supported by Broadband Internet history nor by empirical evidence.

The history of Broadband Internet and empirical evidence are not consistent with the hypothesis of any strong incentives on the part of ISPs to discriminate against neutral internet traffic.

Narrowband internet access was launched in the mid 90's by independent players which were not Telco operators. But broadband internet access was created open and essentially neutral around the year 2000 by telcos and cable operators for fixed networks and after 2005 for mobile. Quality, volume and bandwidth have been continuously upgraded ever since. So-called cases of « breaches of net neutrality » have been very rare and limited in scope compared to the massive worldwide scale of internet access over the last 20 years. Episodes of blocking of VoIP, which were much discussed and instrumental in justifying regulatory intervention, have in reality been infinitesimal for fixed networks and marginal with no material impacts on the market for mobile<sup>10</sup>. More generally, no sign of any large scale « dirt road » strategy has even been observed, even absent regulation, contrary to what theory suggests.

Only one econometric analysis has tested empirically the incentives of an ISP to breach neutrality<sup>11</sup>. The outcome of this study was that ISP's commercial interest is to provide neutral internet access. An ISP breaching NN in order to favour one of its specific service would take the risk of losing a significant proportion of its revenues from internet access services which represent a large proportion of its turnover, because end-users may prefer to quit an ISP which does not provide an open internet access, against the hope of a increase its revenue from a specific service representing a marginal proportion of its turnover. The negative potential impact of the former is much larger the positive upside of the latter. Therefore the economic balance from the ISP point of view is clearly against NN breach.

Those factual elements are in contradiction with theories forecasting discriminatory behaviour or dirt road strategy from ISPs. So what is wrong in the theoretical framework under which net neutrality has been analysed?

## 3. Network operators have incentives to provide high quality open internet access based on a neutral network

The existence of strong positive externalities between internet Contents & Applications (C&A) and the requirement of compatibility of the interfaces between networks and C&A to support those externalities imply that network operators have incentives to provide high quality open internet access based on a neutral network.

### 3.1. Externalities between C&As and the need for compatibility between C&As and network interface are two essential reasons for ISPs to preserve an Open Internet

The utility and the value of IAS depend on the value associated with C&As which can be accessed through the IAS. This section firstly presents a typology of C&As and associated network requirements in order to demonstrate that strong positive externalities exist between internet C&As. Secondly, we demonstrate that interfaces between C&As and networks need to be compatible to

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<sup>10</sup> This specific point will be addressed more thoroughly in section IV of this article.

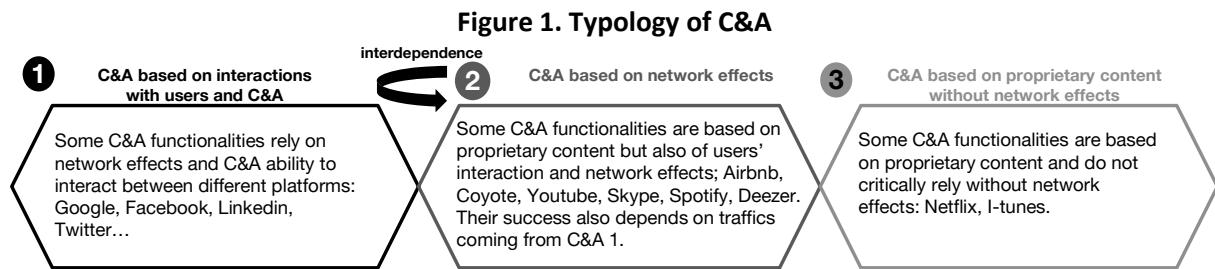
<sup>11</sup> Nurski, L. (2012) «Net Neutrality, foreclosure and the fast lane: an empirical study of the UK », NET Institute Working Paper No. 12-13.

support those externalities and that in practice compatibility implies neutral networks. These two elements justify the need for ISPs to preserve an Open Internet by providing neutral network interfaces to C&As.

### 3.1.1. Existence of strong positive externalities between internet Contents & Applications (C&As).

We can draw up a simplifying typology of C&A to analyse the interactions between the different categories of C&A.

Three categories can be identified (see figure 1 below): C&A based on interactions with users and C&A, C&A based on network effects, C&A based on proprietary content without network effects.



#### **1** C&As based on interactions with users and other C&As

C&A of category 1 needs to interact with other C&As and therefore needs to use a compatible network interface. The most enlightening example is a search engine, such as Google. Google's search service is based on its ability to organize the world's information potentially available on the internet and other C&As and make it universally accessible and useful.

The value of those C&As depends on their ability to interact through the network with a maximum number of C&As and users, because this is necessary for service provision. Such interactions between these C&As through the network require compatible interfaces between all these C&As and the network itself.

Additionally, all applications when they are selected by end-users via first category applications such as a search engine, have a strong interest in using a neutral network interface. It is the only way for them to be visible for applications of category 1 and therefore to be visible to most end-users. Applications using a specific network interface would be invisible to applications of category 1 and therefore for most end-users which use applications of category 1 to guide them within the internet.

#### **2** C&As based on network effects

The category 2 of C&As corresponds to cases for which service functionalities suppose interactions between users, such as Airbnb for example. In such a case, the platform needs network compatibility with users of different ISPs. If a user from ISP A interacts over the platform with user of ISP B, both will experience a quality equal to the minimum quality between A and B.

#### **3** C&As based on proprietary content without network effects

For the third category of C&As, the value of service itself is essentially independent of any interaction with other C&As. Service provision does not require that the interface between C&As of this category and the network are compatible with the interface between other C&As and the network. Therefore, the user can benefit from the existence of a premium transport quality on a specific interface with the network of the ISP, without loss of content quality. This can be the case of IP-TV services for example.

It should be noted that the ability of such C&As to benefit from a specific network interface implies a weak or zero dependence of these C&As on the first category of C&As, in other words that end-users know about those C&As and can find them easily without the intermediation of C&As of category 1.

However, even in that case C&A may prefer a compatible (rather than a specific) network interface in order to reach all users of all ISPs without establishing a specific interface with each ISP. This is rationale if the number of ISPs with which specific interfaces need to be negotiated would become too large and would generate too much transaction costs compared to the benefit of premium transport quality. This appears to have been the reasoning of a global player such as Netflix. By contrast, C&As of category 3 providing proprietary content of local relevance (typically national), may find it worthwhile to negotiate a premium transport quality with a small number of local ISPs.

### 3.1.2. Requirement of compatibility between the C&A and the network interfaces to support those externalities.

Compatibility and neutrality are synonymous in the context of internet access provision and we address in this section the reasons why.

The classical notion of compatibility is the following. Within one type of application (for instance video call), application 1 (Face Time) is not a priori compatible with application 2 (Skype Video). It is conceivable to design a standard allowing interoperability for a single type of application.

But the requirement of compatibility between network interfaces of different C&As available via internet access service provision is more demanding. The Internet is an environment providing a quasi-infinite and continuously growing number of types of applications. This makes the interoperability issue far more challenging: a social network may need to interact with a video streaming service which may need to interact with a search application which may need to interact with a map display application which may need to interact with a directory server application if those applications enable it to do so. It is impossible to design a specific interface between any couple of C&As. It is all the more true than new C&As emerge every day.

Therefore the only solution to make all types of applications interactive through the network is to have a single network interface usable by any type of application. It is by definition an open neutral interface. The need for compatibility of network interfaces of all C&As demands the existence of an open neutral network interface.

### 3.2. The network provider has to deliver a high quality of transport through the neutral interface in order to match the requirements of the users

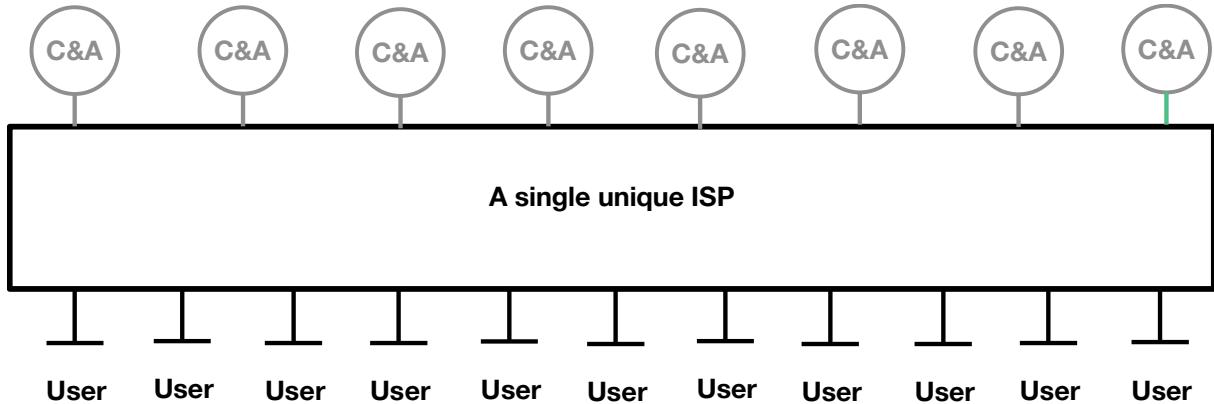
Even in theoretical complete monopoly case, it would be necessary and valuable for an ISP to deliver a high quality of transport through a neutral interface (section 3.2.1). It would be more the case if internet accesses were provided by several local monopolies serving several local markets (section

3.2.2). And it is even more the case if each local internet access market is subject to competition between ISPs (section 3.2.3) which is a situation better reflecting reality.

### 3.2.1. A unique ISP has an incentive to support a quality open internet through a neutral network interface.

We suppose here that all internet users are using a single unique monopoly ISP to access Contents and Applications and that all Contents and Applications Providers are in relation with internet users using the network of this single unique ISP as represented in figure 2.

*Figure 2 Case of a single unique ISP*



For C&As type 1, utility and value critically depend on their access to other contents and applications, and often also to internet users. C&As of type 1 represent an essential component of internet experience of end-users, which generally access to all other C&As via such C&As. This access to other C&As represents a positive externality. To enjoy this positive externality, contents and applications must be able to exchange through the internet with all other contents and applications and all users (or a very large number of them) and thus need the compatibility of their interfaces with the network. Interactions can take place only if C&A have a standard neutral interface with the network.

Indeed, C&As benefitting from a specific interface ("fast lane") with the network would necessarily be an application specific interface only allowing exchange with other C&As using the same compatible specific interface. As the value and utility of the C&A depends on its ability to interact through the network with a maximum number of C&As and users, using a specific interface degrades its value. The value of optimised transport through the network is more than offset by the loss of value of the content/application due to a drop in the externality.

### 3.2.2. When multiple ISPs are considered, the efficiency of a neutral interface is reinforced

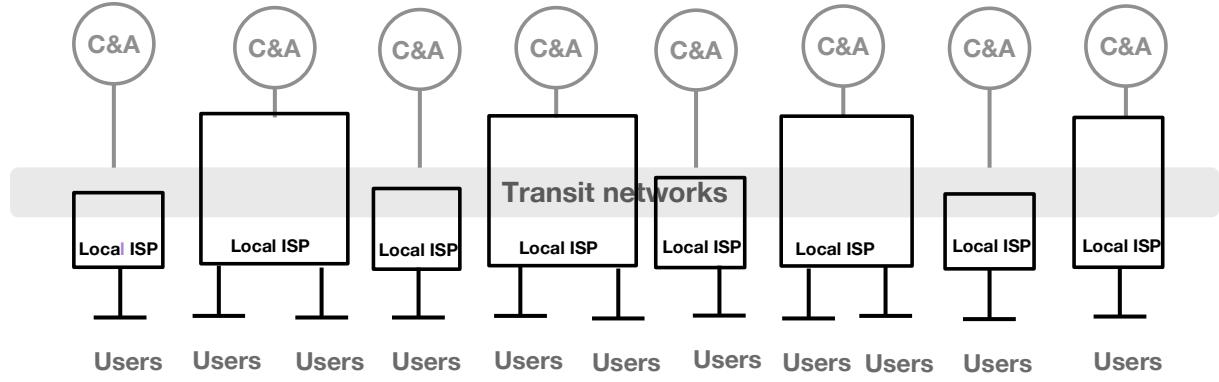
We consider firstly that there are numerous Local ISPs, each one serving a geographical subset of users in monopoly then we consider secondly the impact of competition between local ISPs.

#### a) Case of local monopoly for ISPs

ISPs are supposed to be in monopoly to serve their territory. Different ISPs serving different territories are related together by transit networks which are interconnected with all local ISPs. Among C&A providers, some are connected to the network of a single local ISP and some are connected to transit networks. Hence, there is path through local and transit networks between any pairs of users, any pairs of C&A, and any pair (user, C&A) as demonstrated in Figure 3.

Positive externality between C&As is still at work but the scenario of a specific network interface for a specific C&A becomes even more demanding than in the case of a single global ISP. Not only would compatibilities between C&As need to be managed, but also compatibilities between C&As as implemented in numerous local and transit networks. The challenge is such that C&As whose value depends on the interaction between users of all ISPs are better off using a neutral interface allowing this externality. This is also in the interest of the ISP because it increases the value of the services accessible via the access.

*Figure 3 Multiple ISPs, each one in monopoly in its territory*

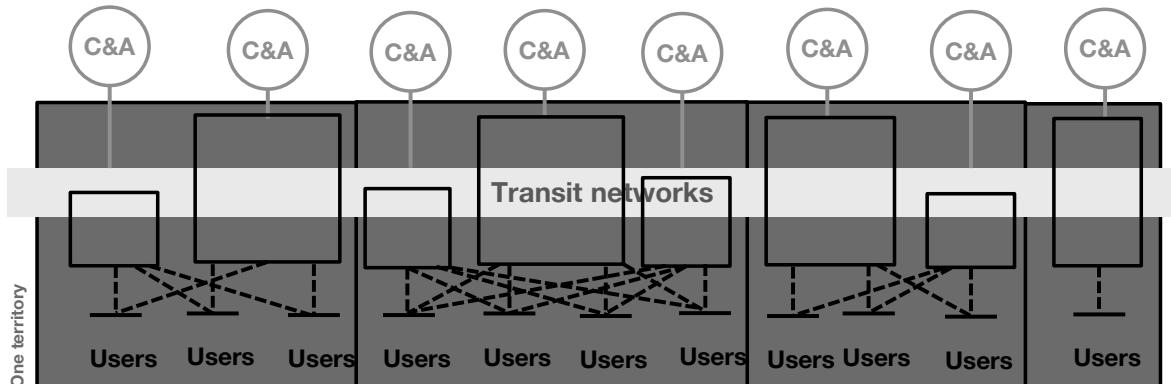


In addition, the users' demand and therefore the value for internet access depend on the number of C&As which can access through the telco operator's network. In particular, access would be much less valuable if only a very limited number of C&As were accessible on the local ISP's network. For the user of a given local ISP, access to all C&As depends on the ability of all transit and local networks to carry all C&A services and on the existence of interconnections between networks and C&As. This requires a generalized compatibility of all networks and all interconnections with all types of services. Such a generalized compatibility requires neutrality of networks functioning in relation with applications for the reasons explained in section 3.1.2.

#### b) Case of local competition between ISPs

We secondly analyse the case where in most territories, several local ISPs compete to provide internet access to end-users. Local ISPs continue to be related together by transit networks which are interconnected with all local ISPs. Among C&A providers, some are still connected to the network of a single local ISP and some are connected to transit networks.

*Figure 4 Multiple ISPs in situation of competition*



All ISP incentives to maintain a quality open internet access through a neutral network explained before are still there but are again reinforced in this setting through two mechanisms:

- First, the issue of compatibility allowing positive externalities to take place is made even more critical because of the multiplication of the number of ISPs even on a single territory.
- Second, in the previous sections, each ISP was a monopoly in supplying users' demand for internet access. Its interest in increasing access to a maximum number of C&As of good quality was related to the increased value attached to the demand for internet access, which it could capture, as a monopoly. In case of competition with other ISPs, the residual demand function of each ISP is even more elastic to the number and quality of C&As because users not only have the option not to pay for access, but also to choose the internet access provided by competitors

### 3.2.3. For compatibility reasons, only specific C&As, complement to internet access service, can be delivered through priority interface

It may be relevant for the ISP to propose a preferential network interface to a limited number of C&As relying on proprietary information of local relevance and which do not need interaction with other C&As. Those C&As are different in nature from most C&As, which need a standard interface in order to interact with other C&As. As they are different in nature, they cannot be substitutes from an end-users' point of view. In other words, an ISP cannot meet consumer demand by substituting services using a preferential interface to services functionally requiring a neutral network interface. The former can only be complement of the latter.

Hence, it would be impossible for an ISP to increase the value of C&As using a preferential network interface by degrading the quality of the neutral interface, contrary to what conventional NN theories conclude<sup>12</sup>.

And this is true independently of the intensity of competition for internet access.

## 4. Robustness of the analysis to specific questions and criticisms

In this section, we demonstrate that the main findings of this paper are robust to specific questions and criticisms.

### *Explanation of telecom operators' motivation for cases of VoIP blocking*

Cases of blocking of VoIP have played a large political role in the emergence of laws and regulations meant to protect net neutrality, and have been instrumental as an alleged proof of ISP incentives to violate NN. However, actual cases of VoIP blocking were limited in scope and market significance.

Cases of VoIP blocking have hardly been observed on fixed internet access<sup>13</sup>. Cases of VoIP blocking occurred during the early period of introduction of significant data allowances in mobile packages. Data was a new functionality, priced at marginal cost to support uptake. Voice at this period covered all fixed costs and data was financially marginal. Such initial tariffs favoured arbitrage between voice

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<sup>12</sup> It should also be noted that preferential transport quality in the network is based on priority access to network resources. Such priority is valuable only if the traffic represents a small proportion of the total traffic, because giving priority to a majority of traffic is contradictory by nature.

<sup>13</sup> The only identified case has been the highly publicized «Madison River-Vonage» case in the USA in 2005, which concerned a very limited number of end-users during a very short period.

and data prices, to the extent that a very cheap data service could be a substitute to more expensive voice services using a VoIP application. This incentivised some mobile operators to impose VoIP blocking, in their contracts, at the launch of data package.

This arbitrage issue was solved by price rebalancing between voice and data, once data service became mainstream, years before non-blocking was mandated by regulation, when only anecdotal cases with no practical impact were remaining. Blocking VoIP on mobile was typical of the first 3G era, when VoIP on mobile data did not work well from a technical point of view, in any case. From a business point of view, the material impact of VoIP blocking on VoIP usage has been marginal on 3G and nil on 4G in Europe.

Traditional voice telephony also represents the unique application for which the reasoning developed in this paper on the requirement of neutrality to allow network effects between end-users of different networks does not apply. Historically telecom operators have developed compatible voice telephony services able to cross interconnections between networks, because this was their unique mission and there was no alternative to ensure any-to-any voice communications. Now that networks benefit via internet from universal application agnostic interconnections, the rationale to develop application specific interconnections between networks has become much more challenging.

#### *Can't one C&A have both a preferential and a neutral interface?*

The reasoning presented in the paper implies that a C&A has a single interface with the network, either preferential or neutral. Would not it be possible for a C&A to have both interfaces?

The answer is yes in principle, but if the C&A technically integrates both, C&A quality will be defined by its weakest link: so if a «dirt road» strategy was used on the neutral interface, it would also hurt its service based on preferential network interface.

Otherwise, if the C&A provider do not integrate both, it boils down to two separate services, one based on proprietary content and a specific interface, one based on content externality and neutral interface and the reasoning above applies.

#### *Vertical integration and exclusivity*

There is no incentive for exclusivity between contents and access, because, absent situations of dominance, exclusivity degrades the commercial value of content and of the access. Things may be different in case of dominance in which case potentials issues can be addressed by competition law.

#### *What about Net Neutrality concerns or breaches identified by National Regulatory Authorities (NRAs) after the adoption of Open Internet Regulation in Europe?*

Since the adoption of the European Regulation 2015/2015 including Open Internet rules and BEREC Net Neutrality guidelines in August 2016, NRAs have launched a number of investigations and adopted a number of decisions, some positive and some negative, on the compliance of commercial offers of ISPs with Net neutrality rules. On substance:

- Most of the NRAs' decisions relate to offers including zero rating for specific traffic. To date, zero rating offers which have purely pricing effects have been considered as compliant with NN rules by NRAs, whereas zero rating offers associated with some forms of differentiated internet traffic management have been considered as non-compliant as such differentiation is prohibited by the European Regulation 2015/2015. A number of such decisions are documented in the BEREC report on NN implementation published in October 2018 (see

BEREC Report on the Implementation by National Regulators of European Net Neutrality Rules (2018)).

- One decision of non-compliance concerns the qualification of a Video on Demand services as a “specialized service” the provision of which requires some form of optimization [see RTR 2018 Net Neutrality Report, p.25-26 § Specialized Services]. The NRA has questioned that qualification because, according to its analysis, the Internet Access quality was good enough to allow the provision of the service.

None of these cases corresponds to the situation anticipated by NN theories which justified the adoption of NN regulation. It should be borne in mind that according to those theories, absent an NN regulation, ISPs would impose high prices to deliver quality to priority traffic and at the same time degrade the quality of transport for non-priority traffic, in order to maintain the positive price differential between priority and non-priority traffic. The actual cases of NN concerns presented above are close to counter-examples of the situation which theories supporting NN regulation claimed to avoid:

- Concerning banned zero rating offers associated differentiated traffic management, the price of preferential traffic is cheaper or even free, not higher, as anticipated by theory. Cases of non-compliance related to traffic management do not consistently fit with theory expectations as they did correspond:
  - Either to case of zero rated video traffic being under-prioritized in order to limit network costs compared to the rest of internet traffic (as it was subject to throttling above a certain threshold of bandwidth, not imposed on other traffic).
  - Or to zero rated traffic being over-prioritized compared to the rest of internet traffic: it continued to benefit from the normal bandwidth even when the end-user had consumed its data allowance and when the rest of internet traffic was subject to reduced bandwidth. The motivation for ISPs in that case is that this would make more sense from an end-users' point of view.
- Concerning the questioning of the qualification of “specialized services” which has been raised for Video on Demand service, non-compliance with the regulation decided by the regulator was based on the observation of the high quality of internet access service, allowing the provision of a service demanding high quality, such as VoD. So the actual high quality of neutral internet access led to a decision of non-compliance, whereas NN theory anticipates that non-compliance would lead to low quality of neutral internet access.

This analysis shows that the cases identified by regulators as non-compliant with the letter of the Open Internet Regulation, have nothing in common with situations anticipated by NN theories advocating the necessity of regulation in order to prevent the risk of ISPs implementing a “dirt road strategy” against their internet access services. From these observations, it can be derived that the existence of these cases does not discount the conclusions of the present paper, according to which ISPs' incentives are not those anticipated by policy makers and NN theory. Moreover, nothing proves that those behaviors which have been prohibited for non-compliance with the Regulation would have generated the damages which the Regulation is meant to avoid.

## 5. Conclusion

Telecom operators have an interest in keeping the internet open and network interface neutral due to positive externalities between C&As over the internet which require neutral interfaces between C&As and networks. Telecom operators may have incentives to develop complementary specific service on specific network interfaces relying on proprietary information of local relevance but not at the expense of the quality neutral internet access, because the value of the former is enhanced by the quality of the latter, as is normally the case between complementary services. Therefore, ISPs have no sustainable incentive to adopt « dirt road » strategies.

Such findings should be taken into account when implementing and assessing the Net neutrality rules: in particular there should be no presumption from the point of view of regulatory authorities that network operators have incentives to degrade internet access service quality.

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