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BY
ROSLYN LAYTON

DISSERTATION SUBMITTED 2017

AALBORG UNIVERSITY
DENMARK

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CV

Roslyn Layton, American, is a PhD Fellow at the Center for Communication, Media, and Information Technologies (CMI) at Aalborg University in Copenhagen, Denmark. She conducted this doctoral study on a grant from Denmark's Industrial Ph.D. program, an initiative of the Ministry of Science, Innovation and Higher Education to support research of both academic and commercial value and to facilitate knowledge transfer between Denmark and the rest of the world. As part of the program requirements, she held a position at a Danish firm, Strand Consult, an independent company providing strategic research on the mobile telecom industry.

Roslyn is a Visiting Fellow at the Center for Internet, Communication & Technology Policy at the American Enterprise Institute in Washington, DC. She writes for Forbes, US News and World Report, TechPolicyDaily, and RoslynLayton.com and has been featured in academic and popular media.

Roslyn worked in the IT industry (analytics software and platforms, disruptive technologies, outsourcing, biotech, and IT development services), was a business development executive for Tata Consultancy Services at Innovation Labs-Hyderabad, and managed a leading digital advertising agency for Coremetrics IBM in Silicon Valley.

Roslyn holds the OneMBA executive MBA degree, an MBA from the Rotterdam School of Management, and an undergraduate degree from the School of International Service at the American University in Washington D.C. with a focus on economics and Japanese studies in partnership with Ritsumeikan University in Kyoto, Japan.

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ENGLISH SUMMARY

Net neutrality or ”Open Internet” rulemaking has been ongoing for more than a decade. Some 50 nations have adopted formal rules including the United States, the European Union, and a number of countries in Latin America while other countries such as India are exploring whether to adopt such rules. Among other arguments, it is asserted that net neutrality rules are necessary for application innovation. While the focus for policymakers has largely been to make rules, there is less attention on how to measure the impact of such rules and how well they achieve their innovation goals. The research thus investigates to what degree the introduction of rules in a given country stimulates innovation in that country's mobile app ecosystem. The focus in on mobile because it allowed the most consistent data across countries.

This thesis reviews a set of 53 countries, their net neutrality policies, and the results to the respective mobile application ecosystems of the countries adopting rules between the period of 2010-2016. This investigation tests the proposition that countries which adopt net neutrality rules should experience an increase in mobile app development innovation within their national economy. To test this, a statistical methodology was developed based upon measuring the number of locally developed mobile apps in the country for relevant periods before and after rules are imposed and the corresponding app downloads, usage, and revenue. Measurement was conducted with two independent toolsets and adjusted for the sophistication and penetration of advanced mobile networks in the country. To make more meaningful comparisons and avoid inevitable heterogeneity across the countries, the investigation focuses on two similar countries with different rules, Denmark with soft rules (self-regulation) and Netherlands with hard rules (legislation).

The thesis also reviews the leading theories of innovation as well as the foundational papers in net neutrality to explain the observed discrepancies. The research finds significant statistical support for “soft” net neutrality measures adopted on a voluntary basis. Hard rules

adopted through legislation and regulation were not associated with greater mobile app development for the given country. Denmark increased in local mobile app development while Netherlands decreased. Additionally the explosion of mobile apps from countries with no net neutrality rules and the general dearth of mobile apps from countries which have had hard rules for years runs counter to expected results. This suggests that policymakers revisit their assumptions and expectations for net neutrality policy. The thesis includes discussion of the limitations of the analysis, the challenges of measurement, and the possibility that the impact of net neutrality might not be able to be observed or measured. It concludes with recommendations for policymakers.

DANSK RESUME

Debatten om netneutralitet eller "åbent internet"-regulering har stået på i mere end et årti. I dag har op imod 50 nationer vedtaget og indført en form for regulering herunder USA, EU og en række lande i Latinamerika. I andre dele af verden ser man på, om man skal indføre en form for netneutralitetsregulering. Et af de argumenter, der ofte bliver brugt i forbindelse med, at man indfører denne form for regulering, er, at netneutralitetsregler er nødvendige for innovationen inden for teleområdet.

Det politiske system har fokuseret på at lave reglerne for reglernes skyld, og der har været mindre fokus på, hvordan man kan måle effekten af sådanne regler, og om de har den positive effekt på innovationen, som nogle påstår. Målet med min forskning er, at undersøge i hvilken grad indførelsen af reglerne i et givet land stimulerer innovation i landets mobil-app-økosystem.

Denne afhandling ser på 53 lande, deres netneutralitetspolitik og betydningen for de respektive mobil-applikationsøkosystemer i de lande. Afhandlingen ser på, hvad der er sket efter vedtagelsen af regler i perioden 2011-2016. Denne afhandling ser på, om lande, der indfører netneutralitetsregler, oplever en stigning i mobil-app-udviklingen og -innovationen. For at teste dette har jeg udviklet en statistisk metode, som er baseret på at måle antallet af lokalt udviklede mobil-apps i de respektive lande i relevante perioder før og efter reglerne implementeres. Jeg har set på downloads, brugen, og på hvilke indtægter disse apps giver. Målingerne blev udført med to uafhængige værktøjssæt og korrigeret for hvor avancerede mobilnet, der er i de respektive lande.

For at gøre sammenligninger mere meningsfulde og for at undgå heterogenitet på tværs af så mange lande, har jeg i denne afhandling inkluderet to lande, der minder meget om hinanden, men som har meget forskellige regler, Danmark og Holland. Afhandlingen ser på resultaterne i lyset af de førende teorier om innovation samt de fundamentale tidsskriftartikler, der er skrevet om netneutralitet med det formål at forklare de observerede forskelle. Min forskning viser, at

der er signifikant statistisk støtte for "bløde" netneutralitetsregler, der vedtages på frivillig basis. Hårde regler, der vedtages gennem lovgivning og regulering, vil ikke stimulere en større app-udvikling. Danmark oplevet en stigning i lokal mobil-app-udvikling efter vedtagelsen af selvregulering, mens man i Holland efter indførelsen af hård regulering så et faldt i lokal app-udvikling. Derudover er der en eksplosion af mobil-apps fra lande uden netneutralitetsregler og den generelle mangel på mobil-apps fra lande, der har hårde regler, tyder på, at politikerne må revidere deres forudsætninger og forventninger til netneutralitetspolitikken. Afhandlingen indeholder en diskussion af de begrænsninger, der er i analysen, og de udfordringer der er med at måle virkningen af netneutralitetsregulering. Afhandlingen slutter af med anbefalinger til de politikere, der har ansvaret for denne form for regulering.

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1 INTRODUCTION

1.1 BACKGROUND

The notion that nations should develop information communications technology (ICT) policy to stimulate innovation and subsequently spur economic growth[1] is uncontested, but the ideal type and mix of ICT policy for any particular nation at any time is by no means agreed. Perhaps the most salient Internet policy issue in the past decade is the concept of net neutrality,[2] frequently interchanged with "Open Internet." Given that different countries define the term differently in their statutes, it can be concluded that there is not an official, globally accepted, definition of network neutrality. Even the new *Merriam-Webster Dictionary* of the term is subject to controversy,[3] which defines the term as "the idea, principle, or requirement that Internet service providers should or must treat all Internet data as the same regardless of its kind, source, or destination, a philosophical contest that's being fought under the banner of "net neutrality," a slogan that inspires rhetorical devotion but eludes precise definition."[4] For example whether net neutrality applies only to the management of Internet traffic or both the *management and monetization* of Internet traffic is hotly debated and litigated.[5] Now that some 50 nations have created net neutrality rules, frequently but not always with the argument that net neutrality support innovation, the question for ICT

[1] See generally Bengt-Åke Lundvall, National Systems of Innovation: Toward a Theory of Innovation and Interactive Learning (Anthem Press, 2010). and Richard R. Nelson, National Innovation Systems: A Comparative Analysis (Oxford University Press, 1993).

[2] Jon M. Peha, William H. Lehr, and Simon Wilkie, "[Special Section on Net Neutrality] Introduction: The State of the Debate on Network Neutrality," International Journal of Communication 1, No. 1 (August 9, 2007): 8.

[3] Brent Skorup, "Merriam-Webster's Awful Net Neutrality Definition," Plain Text, June 4, 2015, https://readplaintext.com/merriam-webster-s-awful-net-neutrality-definition-16490d54b8bd#.6ra1tbrzg.

[4] "Definition of NET NEUTRALITY," Merriam-Webster, accessed November 4, 2016, http://www.merriam-webster.com/dictionary/net+neutrality.

[5] Ibid

policy researchers is to what degree does net neutrality support innovation.

For example the European Commission proposed net neutrality or Open Internet rules as part of its Digital Single Market[6] (DSM) initiative. The DSM "aims to open up digital opportunities for people and business and enhance Europe's position as a world leader in the digital economy." According to the European Commission, a majority of the EU's one-half billion residents use the Internet every day. The opportunity to to increase the take up of new digital goods and services in the EU itself is estimated to be a staggering €415 billion in new growth.[7] A net neutrality law was ultimately passed into the law by the European Parliament in October 2015. The legislation titled "laying down measures concerning open internet access" states that its goal is to "*guarantee* the continued functioning of the internet ecosystem as *an engine of innovation*"[8] (italics added).

In a press release announcing the new guarantee of an Open Internet, the European Commission explained, "Creating the right conditions for digital networks and services to flourish is a key objective of the Commission's plan for a Digital Single Market…The EU will have the strongest and most comprehensive open Internet rules in the world." [9] They further noted, "

> Net neutrality is crucial for users and businesses. It ensures that Europeans have access to the online content and services they wish without any discrimination or interference (like blocking or slowing down) by internet access providers. This is also very important for start-up

[6] "Digital Single Market," Text, European Commission - European Commission, (December 7, 2015), http://ec.europa.eu/priorities/digital-single-market_en.

[7] Ibid

[8] "Official Journal of the European Union," EU, November 26, 2015, http://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=OJ:L:2015:310:FULL&from=EN.

[9] "Commission Welcomes Agreement to End Roaming Charges and to Guarantee an Open Internet," European Commission, (June 20, 2015), http://europa.eu/rapid/press-release_IP-15-5265_en.htm.

> businesses that commercialise their products and services via the internet and need to be able to compete on an equal footing with larger players."[10]

Given the Commission's observation that startups need such rules, it would seem a helpful research project to test the relationship of net neutrality rules to facilitating commercialization of startups.

In the United States, the Federal Communications Commission (FCC) observed that its Open Internet rules "are designed to protect free expression and innovation on the Internet and promote investment in the nation's broadband networks"[11] and that "Rules Will Preserve the Internet as a Platform for Innovation, Free Expression and Economic Growth."[12] The FCC declares that "Internet openness drives a 'virtuous cycle' in which innovations at the edges of the network enhance consumer demand, leading to expanded investments in broadband infrastructure that, in turn, spark new innovations at the edge."

Net neutrality rules are frequently, though not entirely, based on the premise that such rules will protect and/or stimulate "innovation" by third party application providers ("edge providers" in American parlance). The rules are associated with a series of requirements and restrictions for broadband and internet services providers (ISPs). Such rules are necessary because, as the FCC claims, the ISP has the "incentive and ability" to deter "openness."[13] "Without Net

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[10] "Roaming Charges and Open Internet: Questions and Answers," European Commission, (June 30, 2015), http://europa.eu/rapid/press-release_MEMO-15-5275_en.htm.

[11] "Open Internet," Federal Communications Commission, January 12, 2011, https://www.fcc.gov/general/open-internet.

[12] "FCC Adopts Strong, Sustainable Rules to Protect the Open Internet," Federal Communications Commission, February 26, 2015, https://www.fcc.gov/document/fcc-adopts-strong-sustainable-rules-protect-open-internet.

[13] "Federal Communications Commission," Federal Communications Commission, accessed November 4, 2016, https://www.fcc.gov/.

Neutrality, the next Google would never get off the ground,"[14] observes Save the Internet, a leading global advocate for net neutrality.

While policymakers and advocates express that the need for rules is immediate and dire to protect innovation, they are not clear whether such rules will ensure the status quo level of application innovation or actually increase innovation. If the former, it would seem to follow that countries without such rules would fall in their level of innovation. In Brussels, the sense of "falling behind" the US and East Asia would suggest that European policymakers expect their rules to make European app economies more productive (as Europeans overwhelmingly use American and Asian apps). Similarly in Latin American and in emerging countries such as India, the level of locally made mobile app innovation is low, the notion suggests that these countries expect to be more innovative after rules are promulgated.

1.2 LITERATURE REVIEW

This thesis reviews the foundational work on net neutrality and related concepts of free culture, the end to end principle, the neutral platform, and zero rating.

In 2000 Lessig and Lemley appropriated the end to end argument, an engineering concept and applied it to Internet and network access regulation in "End of End-to-End: Preserving the Architecture of the Internet in the Broadband Era."[15] Insisting that intelligence lies in the ends network, not the core, they declared that this end-to-end principle explains not only the internet's operation and commercial success, but a justification for telecom regulation that will ensure the Internet's continued functioning in the future. They equated this end to end concept with the notion of an "open" network to be facilitated by by

[14] Free Press, "Net Neutrality: What You Need to Know Now," Free Press, accessed June 20, 2016, http://www.savetheinternet.com/net-neutrality-what-you-need-know-now.

[15] Mark A. Lemley and Lawrence Lessig, "The End of End-to-End: Preserving the Architecture of the Internet in the Broadband Era," SSRN Electronic Journal, 2000, doi:10.2139/ssrn.247737.

"open access" policies. Such a regime is important to achieve the "free culture" digital commons which Lessig advocated in his subsequent book *Free Culture: How Big Media Uses Technology and the Law to Lock Down Culture and Control Creativity.*[16]

Tim Wu, who studied with Lessig, developed the term network neutrality.[17] He too was concerned about intellectual property and "big business" locking down culture and innovation. His 2003 article includes a survey of the "discriminatory" practices and contracts of a number of fixed line ISPs. Though he posits that the interests of ISPs are inherently in cross purposes to the public, he does not present a structural model or theory of why ISPs would discriminate against third party services that use networks. Wu posits that rules may be necessary to restrict ISP behavior so that third party applications can enjoy "Darwinian" competition and end users can get the "best" innovation.

Barbara van Schewick also studied with Lessig and published *Internet Architecture and Innovation*[18] in 2010 which formalized the notion of "end to end" as policy principle. She asserts that the end to end principle explains the "neutral" architecture of the Internet and that the Internet was expressly designed for the the benefit of the application at end points of the network. Van Schewick confirms that is is appropriate therefore to "suppress"[19] ISP innovation in networks, traffic management and monetization, to favor a regime for innovation in third party applications.

Following these key arguments, the idea of a net neutrality policy is that it should control ISPs so that they do not get in the way of vital

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16 Lawrence Lessig, "Free Culture," Freeculture.pdf, 2004, http://www.free-culture.cc/freeculture.pdf.

17 Tim Wu, "Network Neutrality, Broadband Discrimination," SSRN Scholarly Paper (Rochester, NY: Social Science Research Network, June 5, 2003), http://papers.ssrn.com/abstract=388863.

18 Barbara van Schewick, *Internet Architecture and Innovation*, New edition (Cambridge, MA: The MIT Press, 2010).

19 Personal interview. Barbara van Schewick. 31 August 2016.

end point applications nor restrict users who connect to the Internet expressly for these end point applications. The ISP should thus be neutral to all applications and operate the network without any "discrimination" to applications. Net neutrality rules are thus the embodiment of preserving the Internet in this "neutral" and "open" state for the primary benefit of users and third party innovation at end points. The needs of the network providers, whether their own innovation, efficiency, or solvency, are secondary.

There is some degree of interpretation between the academic assertions of net neutrality and the codification into rules. A review of the rules around the world finds that countries differ somewhat in their definitions, instruments, provisions, and punishments for the policy. While the very activity of companies on the Internet suggests innovative forces at work, it is not clear to what degree "neutrality" or the regulated or legislated "Open Internet" is responsible for such innovation. However the verve and speed of the policymaking over the last decade suggests that policymakers' should have an intuition about how the policy will work. Indeed if neutrality is necessary and desirable, there should be some idea about the optimal distribution of internet traffic and usage. If not, it will be difficult to tell whether the policy is moving the nation in the right direction.

It could be predicted that under neutrality that Internet traffic should lead to a random distribution to all possible end points, perhaps a Guassian (or bell curve) of distribution across all content and applications. Alternatively, one might imagine a a Pareto distribution of traffic, in which 80 percent of the traffic goes to 20 percent of the content and applications. However Wu's notion of an evolutionary, meritocratic, "survival of the fittest" competition between all applications, suggests traffic should follow to "the very best innovation." Perhaps today's status quo is the manifestation of Wu's prescription, as 99 percent of users go to 1 percent of the

destinations.[20] Ostensibly this 1 percent is the "best" of the Internet's innovation, following Wu's definition.

Wu's description of an neutral platform suggests there is perfect competition for content and applications, that any end point can compete equally with any other. In a perfectly competitive world, there are homogenous products, homogeneous users, perfect information, no barriers to entry, and no switching costs. However the fact that global internet traffic is highly concentrated to a few particular end points suggests that the market for apps is imperfectly competitive. Many of the top destinations on the Internet have held their position for more than a decade.

For example, the top most visited internet sites in the USA are each at least 10 years old.[21] It seems counterintuitive that under a neutral regime that the rank of the most popular destinations would have changed so little over time. Indeed it would seem that "neutrality" would enable more disruption to the established internet companies, that disruptors would more easily take the top positions in traffic, and that the "next Google" would emerge from those countries with the hardest net neutrality rules. In fact Google, which is almost 20 years old, has retained its top position as one of the most visited sites (if not the most visited site) in almost every country in the world in spite of the increasing number of countries with Open Internet rules.

The question is whether this traffic distribution is result of "neutrality", a competitive meritocracy in that users find these end points to be "the very best innovation" as Wu says. Could neutrality work in the opposite way, for example by cementing the position of the largest players to the detriment of new entrants? Could it be that rules that require treating data the same have the perverse effect of rewarding the large companies which already have revenue and users while harming the upstarts which need differentiation in order to be

[20] Ramos, Andreas. "Can We Just Build It and They Will Come?," Andreas.com, accessed October 31, 2016, http://andreas.com/can-we-just-build-it-and-they-will-come/.

[21] "Top Sites in United States," Alexa.com, accessed October 31, 2016, http://www.alexa.com/topsites/countries/US.

noticed? The question is then to what degree net neutrality rules create this "neutral platform" for "the very best innovation" on mobile networks and to what degree this model also works for startup innovation.

Such brisk rulemaking across so many countries would seem to indicate that policymakers believe net neutrality rules to be beneficial for their nations. It is surprising, however, that there is not more empirical research. Given the urgency and necessity of net neutrality rules, as it were, empirical research demonstrating the value of the policy would be more forthcoming. In addition one would expect that the national innovation policy authorities would have weighed in in support for such policies, given net neutrality's purported link to innovation. But strangely, these innovation institutes have little to say on the topic.

In the US, the National Academies of Science, Engineering and Medicine organized a committee on Comparative National Innovation Strategies: Best Practice for the 21st Century.[22] The committee met over 6 years and produced a number of reports including *Innovation Policies for the 21st Century.*[23] It emphasizes the need to foster ecosystems, particularly local and regional ecosystems, as well as public-private partnerships. A search of the institute's archives found very little information on the topic of the Internet and nothing on "net neutrality" or "open internet".

The European Union also has a major research function in the European Commission's Research and Innovation arm[24] which by law must conduct research policies and implement research programs. It has not conducted research on net neutrality that is findable in its

[22] "Comparative National Innovation Strategies: Best Practice for the 21st Century," The National Academies of Sciences, Engineering and Medicine, accessed October 31, 2016, http://sites.nationalacademies.org/PGA/step/ComparativeInnovationPolicy/.

[23] Innovation Policies for the 21st Century: Report of a Symposium (Washington, D.C.: National Academies Press, 2007), http://www.nap.edu/catalog/11852.

[24] "Why European Research | Research & Innovation," accessed November 9, 2016, http://ec.europa.eu/research/index.cfm?pg=why.

database, but its report on innovation "Models of Innovation in Global ICT Firms: The Emerging Global Innovation Ecosystems" see innovation occurring within an ecosystem as the result of the "symbiotic" interplay of actors, including models in which telecom operators partner with different actors in the ecosystem.[25]

It appears that the "ecosystem" view of innovation in which actors work together symbiotically is the antithesis to the "net neutrality" view in which one player needs to be controlled. While thousands of articles have described and debated net neutrality, almost none have tested it empirically within the context of national policymaking. This thesis tests the theory on apps in mobile networks and thus offers an important addition to address the gap in the literature.

1.3 RESEARCH QUESTION

The research question is to investigate whether and to what degree the introduction of net neutrality in a given country stimulates that country's third party application and service innovation on mobile networks. As net neutrality is promulgated on a national basis, presumably to benefit the country, its citizens and enterprises, the research question tests whether the introduction of rules stimulates apps from publishers based in that country, and whether these apps show a relevant number of downloads, usage and revenues.

The investigation reports the results for different types of net neutrality regimes, whether soft rules, hard rules, or no specific rules. The investigation then compares countries with relevant socio-economic factors but with different policy regimes to indicate the relative impacts of the policies over the period 2010-2016. There are 53 countries in the study. Nine countries in the study made rules with soft or voluntary measures. Thirteen countries used hard or mandatory measures. Thirty countries have no specific rules but manage conflicts with existing competition and communications laws.

[25] Martin Fransman, "Models of Innovation in Global ICT Firms: The Emerging Global Innovation Ecosystems," European Commission, (2014), https://ec.europa.eu/jrc/sites/jrcsh/files/jrc90726.pdf.

Two countries, Denmark and Netherlands, are selected for further focus because they are similar socio-economic countries with advanced broadband development but have opposing regimes for net neutrality. Denmark opted for self-regulation in 2011, but Netherlands imposed a net neutrality law in 2012. The mobile app markets of the two countries are studied in detail to see where apps originate and whether the choice of net neutrality regime is associated with an change mobile app innovation.

The countries Denmark and Netherlands are similar in many market respects, but they differ in their paths on net neutrality. Both countries score well on the EU's Digital Agenda Scoreboard[26] and the ITU Digital Society Index[27]. Both have competitive broadband markets with multiple broadband networks. The people of both countries are multilingual, well-educated, and generally adoptive of digital technologies. Both have populations of internet entrepreneurs, computer engineers, app developers, and startup companies. Smartphones have been available for at least 5 years in both countries.

The first phase of analysis looks at the free apps downloaded in the countries at a point in 2011/2012 and then again in 2016. While not a complete of the entire app market for both countries, it does characterize some important trends in local and global app development and how it changes for the respective countries over time.

The second phase is a detailed investigation into the most popular apps in both countries over a 90 day period with reference to downloads, usage, revenues, and publisher's location.

Finally an inquiry is made to the sophistication, penetration, and competition of mobile networks in the various countries to see

[26] "Digital Scoreboard - Digital Single Market - European Commission," Digital Single Market, accessed April 14, 2016, https://ec.europa.eu/digital-single-market/en/digital-scoreboard.

[27] "The Digital Economy & Society Index (DESI)," Digital Single Market, accessed November 10, 2016, https://ec.europa.eu/digital-single-market/en/desi.

whether any infrastructure or network factors characterize the level of app innovation.

Measurements are taken with two competing enterprise level mobile app market research platforms and supplemented with data from the GSM Association.

As rulemaking has taken place for more than a decade in some 50 countries, it is an appropriate moment to review the results of the policy and the degree to which the goals are achieved. By understanding how the rules impact mobile app innovation, the paper hopes to provide valuable knowledge for policy makers to evaluate their net neutrality/Open Internet policies.

It bears mention that some may object to the idea of "measuring" the effectiveness of net neutrality, as if one wanted to measure the value of human rights or freedom. The author recognizes this view and acknowledges her own bias, that of valuing measurement and a preference for evidenced-based policymaking. At the same point, measurement can be a way to provide additional support and justification for desired policies. For example there are indices of freedom[28] and human rights,[29] and these are valuable to make policy comparisons across countries. With regard to net neutrality, it is surprising that empirical tests have not been performed as it would seem to give support for policies which have been deemed to be obvious given the speed of rulemaking. This thesis represents only one kind of measurement; there are others.

Another approach to policymaking is that of the randomized controlled trial (RCT).[30] This inductive approach takes a neutral view

[28] "List of Freedom Indices," Wikipedia, September 16, 2016, https://en.wikipedia.org/w/index.php?title=List_of_freedom_indices&oldid=739693467.

[29] "Universal Human Rights Index," accessed November 1, 2016, http://uhri.ohchr.org/en.

[30] Michael Abramowicz, Ian Ayres, and Yair Listokin, "Randomizing Law," University of Pennsylvania Law Review, March 2011, http://scholarship.law.upenn.edu/cgi/viewcontent.cgi?article=1096&context=penn_law_review.

to any policy and instead looks for the desired outcomes as an ex post indicator the policies which work. Such an approach embodies the spirit of this study which brings an open mind to the question. Indeed if net neutrality is so effective to promote mobile app innovation, it could possibility substitute for many other activities nations undertake to promote innovation.

Some assume that nations follow a rational approach to policymaking. Such an approach entails that policymakers observe a problem, weigh the critical variables, review possible solutions (and their costs and benefits), and then apply the appropriate action (or inaction, no harm is shown). Majone suggests a counter view[31] that policymakers use theory selectively after the fact to justify their pre-ordained and favored policies. Regardless of the actual process used in the country to make net neutrality, the research question and methodology assume that the impact of net neutrality can be observed and measured. It takes the rules at "face value", that they do what they claim to do, e.g. create a neutral platform for application innovation.

It is not known whether another has attempted such as study as this project proposes; it could not be found in the literature. Moreover policymakers when implementing net neutrality rules rarely offer any metrics or framework to measure the expected outcome. There is no template on which to base this research, at least within the field of internet policy, as least as far as the author can ascertain. Indeed it seems that measurements of the Internet itself leave something to be desired,[32] let alone the policies attempting to regulate it. However the research uses methods from data science and policy research to create a preliminary method to test the relationship between net neutrality and mobile app innovation. In any case, I am not the first to observe

[31] Giandomenico Majone, *Evidence, Argument, and Persuasion in the Policy Process.* Yale University Press, 1989.

[32] Robert Faris, Heacock Jones, and Rebekah, "Measuring Internet Activity: A (Selective) Review of Methods and Metrics," SSRN Scholarly Paper (Rochester, NY: Social Science Research Network, November 12, 2013), https://papers.ssrn.com/abstract=2353457.

that the theoretical discussion of net neutrality is limited because of a lack of measurement.[33]

The research hypothesizes that in countries with net neutrality rules, especially hard rules, that there should be a higher degree of mobile app innovation as measured by the number of apps, the number of application makers or publisher, the rate that new apps emerge, and their performance (downloads, revenue, rank, usage etc). That is to say, the hypothesis is that in the countries with hard rules, the "neutral platform" or "net neutrality" should work better to enable mobile app innovation than countries with either soft rules or no rules (only existing laws).

The paper proceeds by describing the key ideas in the net neutrality and innovation literature. It presents the research design and methodology for investigation, including the limitations. It describes the data collection and analysis and then present the results. These results are juxtaposed against the expectation. Explanations for the discrepancies are offered. The paper concludes with policy recommendations based upon the findings.

[33] Liebenau, Jonathan, S. Elaluf-Calderwood, and P. Karrberg. "Strategic Challenges for the European Telecom Sector: The Consequences of Imbalances in Internet Traffic." Journal of Information Policy 2 (2012): 248–72, 2016 and Elaluf-Calderwood S and Liebenau S, Measuring Internet - The need for relevant data for economic & policy analysis. Brookings Institution Report - The Idea Must Die - It and the Public Sector. http://www.brookings.edu/blogs/techtank/posts/2016/03/02-internet-without-policy-metrics-elaluf-calderwood-liebenau

2 NET NEUTRALITY AND INNOVATION: THEORETICAL FOUNDATIONS

The literature on net neutrality, though the term is a little more than a decade old, is considerable. There are authoritative reviews of the academic literature by Schuett (2010)[34], Kramer (2013)[35], and Møinichen (2014).[36] The author undertook an additional review through a number of databases including Google Scholar, Web of Science, and a variety of library tools, but did not find that results differed from the aforementioned literature reviews. However the process of conducting the review yielded some valuable points.

Two preliminary searches using the terms "net neutrality" and "network neutrality" were performed. The searches were conducted in English and did not reveal results for papers in other languages where net neutrality is discussed. There are papers on net neutrality in other languages (notably Spanish), however it appears that the number of academics who study net neutrality is a relatively delimited group (perhaps one thousand persons globally), and even those who are not native speakers, will present their papers in English at some point or another.

A Google Scholar query was conducted on June 9, 2015. It provided a broad overview, resulting in some 8460 articles comprising government sources, the popular press, think tanks, advocacy organizations, as well as academic results. Google Scholar has limited functionality to sort and segment results, so additional analysis was

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[34] Florian Schuett, "Network Neutrality: A Survey of the Economic Literature," SSRN Scholarly Paper (Rochester, NY: Social Science Research Network, March 17, 2010), http://papers.ssrn.com/abstract=1573420.

[35] Jan Kraemer, Lukas Wiewiorra, and Christof Weinhardt, "Net Neutrality: A Progress Report," SSRN Scholarly Paper (Rochester, NY: Social Science Research Network, October 24, 2013), http://papers.ssrn.com/abstract=2344623.

[36] Jørgen Møinichen, "The Net Neutrality Debate: Analysis of Economic Implications of Net Neutrality on Internet Service Providers, Content Providers and Internet Users," 193, 2014, https://daim.idi.ntnu.no/masteroppgaver/011/11462/masteroppgave.pdf.

conducted with Harzing.com's Publish or Perish bibliometric tool. It produced a total of 945 articles with 10,381 citations. This query was downloaded into an Excel spreadsheet and was further refined by hand to produce a list that included only articles in academic journals, refining the list further to 523 results with 7945 citations. Thereafter the list was refined further to focus on the articles that comprised the top 80 percent of citations. That resulted in some 129 articles and 6294 citations. Significantly this amount includes about 100 authors, each with at least 5 citations for their articles on net neutrality.

New articles appear daily, so an alert system was set up so that any new articles in Google Scholar would be brought to the author's attention. The process demonstrates that while the topic of net neutrality is widely discussed in the media and the public debate, the share of the academic conversation is small and concentrated with a few academics.

A review of the conclusions of the top 100 academic articles by numbers of citations shows vigorous debate about the merits of the policy, and at least half suggest ambiguous,[37] if not negative outcomes, [383940] for the policy. These articles conclude largely that differentiation in price, service, and quality is beneficial for content providers (e.g. innovation), consumers, and network investment. This conclusion is the opposite of net neutrality, the notion that all data should be treated equally and that there is an essential internet architecture that must be preserved through regulation to ensure innovation. While the rulemaking process may entertain some of the dissenting views, national rules are largely justified with reference to Lessig & Lemley, Wu, and van Schewick. Moreover the vigorous

[37] Peha, Jon. "The Benefits and Risks of Mandating Network Neutrality, and the Quest for a Balanced Policy". Carnegie Mellon University Research Showcase, 1 Sept 2006.

[38] Hahn, Robert and Scott Wallsten. Economics of Net Neutrality. Economists' Voice, June 2006.

[39] Hazlett, Thomas W. The Fallacy of Net Neutrality. Encounter Broadsides, 2011.

[40] Hazlett, Thomas W. and Joshua D. Wright. "The Law and Economics of Network Neutrality." Indiana Law Review, 2012.

academic debate is not necessarily reflected in popular reporting about the issue.

An additional review was conducted in Web of Science on June 19, 2015. The Web of Science query produced 131 results for "network neutrality" and 125 results for "net neutrality". Slightly different results were produced for the term "network neutrality" versus "net neutrality." A query in Google Trends shows that beginning in 2006, "net neutrality" is the more frequently used term.[41] Web of Science results were more relevant and easily segmented by type of journal, and the the number of citations were far smaller. A few results included chemistry articles, so those were discarded.

The authors with most citations include Christopher Yoo, 817, who also had the most papers on the topic. Wu had 813 citations; Economides, 500; and van Schewick, 416. Lemley & Lessig had roughly 500 citations for their end to end paper.

The literature review proceeds by reviewing the leading net neutrality theories, some additional papers on the topic of net neutrality by other authors, and a review of the general literature on innovation. This expansive review is offered because the net neutrality literature emerges largely from the fields of law and communication whereas the literature of innovation is its own field.

2.2 LEADING THEORISTS OF NET NEUTRALITY

2.2.1 FREE CULTURE

Lawrence Lessig, legal scholar, attorney and former Presidential candidate, is a leading thinker of the digital age. His books have been extremely influential in shaping the Open Internet agenda as well as his protégés Jonathan Zittrain,[42] Tim Wu, Barbara van Schewick, and the deceased Aaron Schwartz. While Tim Wu is credited with coining

[41] "Google Trends " Accessed June 20, 2016, https://www.google.com/trends/explore.

[42] "Future of the Internet - And How to Stop It.," Future of the Internet - And How to Stop It., accessed November 1, 2016, http://futureoftheinternet.org/.

the term "network neutrality", it is arguably Lessig who is the more important—and certainly more prolific—author. Lessig with his books *Code and Other Laws of Cyberspace (*updated in *Code: Version 2.0); The Future of Ideas;* and *Remix: Making Art and Commerce Thrive in the Hybrid Economy* has been instrumental to promote the ideas of "free culture" and associated policies to realize it. Indeed net neutrality is just one of a number of polices for which Lessig advocates in addition to campaign finance reform, reducing the restrictions on copyright and trademark, and sharing spectrum under the notion or free or "open" spectrum.[43] Lessig has distinguished legal career, teaches at leading universities, has argued a case in front of the Supreme Court, and has run for President. In the Microsoft antitrust case, he was appointed as a "special master" to Judge Thomas Penfield Jackson, but was later removed by a protest from Microsoft.[44]

Lessig makes a number of critical observations about digital technologies.[45] For example computer code has become the legal and social code, effectively "code is law" and constitutes a form of control. He notes that American copyright rules made in the analog era are unfit for the digital age in which any use of a work in a digital form constitutes a "copy." This increase of length, scope, reach, and control of copyright has led to the concentration and integration of the media industry and such an overbearing copyright regime ("laws that choke creativity") threaten to turn the "read-write" (creativity controlled by people) culture to "read only" culture (creativity controlled by corporations). To combat this, Lessig calls for the acceptance and legalization of a "remix" culture in which users appropriate existing works, "for the love, not the money".

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[43] "Spectrum Policy: Property or Commons?," Cyberlaw, March 1, 2003, http://cyberlaw.stanford.edu/spectrum/.

[44] An Interactive Journal News, "Appeals Court Halts Work of Lessig; States Also Investigating Microsoft," Wall Street Journal, February 3, 1998, sec. Tech Center, http://www.wsj.com/articles/SB886464121622380000.

[45] Some of these observations he summarizes in a Ted Talk. Lessig, Larry"Laws That Choke Creativity." TED 2007, https://www.youtube.com/watch?v=7Q25-S7jzgs.

Lessig provides the example of how the American Society for Composers, Authors, and Publishers (ASCAP), the exclusive licensing regime on most popular content was ultimately "broken" in 1941 by Broadcast Music Incorporated (BMI) which made public domain works available for free. He distinguishes remix (using digital technologies to re-interpret to say things differently) from piracy (works are taken wholesale and distributed without the permission of the owner). He says copyright needs "common sense" reform (e.g. going into public domain after 5 years) instead of "extremism on both sides", whether automatic takedown of works on the Internet or the abolition of copyright. Lessig likens the importance of copyright deregulation as a question of whether a society is "free or feudal."

Lessig founded the Creative Commons in part to realize two goals, that artists make their work more freely available (for example, making it free for non-commercial users whereas commercial uses would be licensed) and that companies embrace the read-write culture. In so doing, free content will have the opportunity to grow on a "neutral platform" and thus compete with paid content and ultimately prevail. Wu extends the idea of the neutral platform in his article, which is ostensibly an important step to realizing the free content commons which Lessig envisions. "Artists' choice is the key for new technology having an opportunity to be open for business," says Lessig.

Lessig founded the Center for Internet and Society (CIS) at Stanford University in 2000,[46] and van Schewick was an early non-resident fellow. The CIS received[47] a $2 million gift from Google for "a collaboration of Google and CIS which seeks to establish a balance between the right to access and use information and the ownership of

[46] "About Us," The Center for Internet and Society at Stanford Law School, accessed November 1, 2016, http://cyberlaw.stanford.edu/about-us.

[47] Stanford Law School, "Google Inc. Pledges $2M to Stanford Law School Center for Internet and Society," Stanford Law School, accessed November 9, 2016, https://law.stanford.edu/press/google-inc-pledges-2m-to-stanford-law-school-center-for-internet-and-society/.

information"[48] and which helped to found the Fair Use project.[49] The magazine Pro Publica, for "Journalism in the Public Interest" observed, CIS "was best known in its early days for work that benefitted Google's cause, including research on net-neutrality issues, which Google has pushed for, and research on fair use, which allows some use of copyrighted material without permission from the author."[50]

Lessig has also been a board member of the Public Knowledge, Free Press, and Electronic Frontier Foundation, leading advocacy organizations for net neutrality. Lessig's books on copyright describes broadcasters as greedy monopolists, and he has similar ideas about the cable and telecom companies. In the midst of writing these books, he also co-authored a paper re-interpreting the end-to-end principle with Mark Lumley.

2.2.2 REINVENTING THE END TO END PRINCIPLE

David Isenberg, a disgruntled AT&T Labs employee published "The Rise of the Stupid Network"[51] in 1997. The idea is that "intelligent" devices and applications reside at the edge of the network while the "dumb" core of the network facilitates transmission. Isenberg felt that AT&T's leaders were not evolving fast enough. He criticized their old-fashioned views, specifically that infrastructure is expensive and scarce and must therefore offered at a premium price; that voice is the

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[48] "Google Inc. Pledges $2M to Stanford Law School Center for Internet and Society," Stanford Law School, November 28, 2006, https://law.stanford.edu/press/google-inc-pledges-2m-to-stanford-law-school-center-for-internet-and-society/.

[49] "Copyright and Fair Use," The Center for Internet and Society at Stanford Law School, accessed November 1, 2016, http://cyberlaw.stanford.edu/focus-areas/copyright-and-fair-use.

[50] Angwin, Julia and Robert Faturechi. "Stanford promises not to use Google money for privacy research." ProPublica, Sep. 23, 2014 https://www.propublica.org/article/stanford-promises-not-to-use-google-money-for-privacy-research

[51] David Isenberg, "Rise of the Stupid Network," Hyperorg, accessed November 1, 2016, http://www.hyperorg.com/misc/stupidnet.html.

dominant form of traffic; that communications services on the circuit switched network are the most important; and that the operator is in control. Isenberg points to a number of shifts that necessitated a new way of thinking about networks including a decline in the cost of traditional telephony infrastructure, unprecedented growth in data traffic, the diversity in the type of traffic (and the fact that the network was not optimized for this heterogeneity), the diversity of communications technologies; and shift of control to the end user. He concluded that the role of the telecom operator should be to "Deliver the Bits, Stupid."

In 2000 Stanford Law professors Lemley and Lessig built upon the stupid network idea when presenting a manifesto[52] for preserving innovation on the Internet, calling it the "end to end principle", appropriating the term from a 1984 paper[53] by network engineers Jerry Saltzer, David P. Reed & David Clark. The original proposition follows:

> The principle, called the end-to-end argument, suggests that functions placed at low levels of a system may be redundant or of little value when compared with the cost of providing them at that low level.

While this could be read as an obvious observation that the functionality in a network should be placed where it's efficient to do so, to Lemley and Lessig the end to end argument explained the virtue of Internet architecture itself, its "openness", how the "ends" of the network where users and applications reside are "intelligent", and that the protocols and pipes must be as simple and general as possible. They celebrate this "default design" of the Internet, and insist that any deviation in architecture should place burden on the deviating party to

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[52] Mark A. Lemley and Lawrence Lessig, "The End of End-to-End: Preserving the Architecture of the Internet in the Broadband Era," SSRN Scholarly Paper (Rochester, NY: Social Science Research Network, October 1, 2000), http://papers.ssrn.com/abstract=247737.

[53] J. H. Saltzer, D. P. Reed, and D. D. Clark, "End-to-End Arguments in System Design," ACM Trans. Comput. Syst. 2, no. 4 (November 1984): 277–288, doi:10.1145/357401.357402.

justify such action. They suggest an End-to-End Argument to guide Internet regulation, evaluate any architectural changes, and disallow any service not in agreement with end to end. "The structure of the Internet itself is at stake", they say, and they warn that if the U.S. Federal Communications Commission does not consider the End-to-End principle in its analysis of a proposed merger of Time Warner and America Online, that innovation will be harmed.

While Lemley and Lessig observe that there are other important features of the network's design beyond the end-to-end principle and "… no one fully understands the dynamics that have made the innovation of the Internet possible," they insist that their definition of the end to end principle to be the sine qua non for innovation and a requirement of mandated access to networks and unbundling.

Moreover they decried what they consider an injustice in that telephone companies were regulated differently from cable, that unbundling requirements were applied to the former but not the latter. They predicted that unless similar restrictions were placed on cable, that prices and innovation would be harmed. They assert that the end to end principle which "governed the Internet since inception" would be compromised.

2.2.3 NETWORK NEUTRALITY, THE NEUTRAL PLATFORM

If the Creative Commons is the "neutral platform" for content, then net neutrality is the neutral platform for internet innovation. Like his mentor Lessig, under whom he studied at Harvard Law School, Wu is concerned about third party innovation being controlled by the network owner. Wu alludes to Edmund Kitch's *The Nature and Function of Patent System*[54] and suggests that the network owner behaves like a quasi-patent holder. Given that the path of innovation is not known in advance, the network owner, suffering his own biases and preconditions to continue its way of doing things, will slow or deter innovation, whether from itself or competing parties. As the

[54] Edmund W. Kitch, "The Nature and Function of the Patent System," The Journal of Law & Economics 20, no. 2 (1977): 265–90.

communications network is a "platform for a competition among application developers", the platform must be neutral to ensure that competition is "meritocratic".

In Wu's paradigm, broadband networks should be operated to deliver a "neutral platform" for third party applications and services. Wu asserts that "network neutrality must be understood as a concrete expression of a system of belief about innovation." His premise is that there is an inherent conflict between "private interests of broadband providers and the public's interest in a competitive innovation environment centered on the Internet", and thus telecom regulators must therefore enforce a "non-discrimination" regime on broadband providers. His non-discrimination principle can be summarized as, "Absent evidence of harm to the local network or the interests of other users, broadband carriers should not discriminate in how they treat traffic on their broadband network on the basis of inter-network criteria."

Wu's premise is that there is an inherent conflict between "private interests of broadband providers and the public's interest in a competitive innovation environment centered on the Internet." He mentions the debate between proponents of "open access" who want structural remedies to prohibit the vertical integration of content and broadband provision to ensure the "neutrality" of the network versus those who believe that such remedies will slow broadband development. In Wu's conception, net neutrality is necessary to ensure "fair evolutionary competition in any privately owned environment" and states that regulation "tries to help ensure that the short-term interests of the owner do not prevent the best products or applications becoming available to end-users." He states that net neutrality is necessary to preserve "a Darwinian competition among every conceivable use of the Internet so that the only the best survive."

Wu examines 3 types of remedies: structural remedies, a non-discrimination regime, and self or non-regulation. Structural remedies or open access is not sufficient because it may favor data applications (websites) over latency-sensitive applications (voice, video). Wu prefers a non-discrimination regime achieved through "direct scrutiny

of broadband discrimination", which he evidences with the regulations applied in the Hush-a-Phone and Carterfone decisions, which Wu describes were about ensuring that users have the right to "use non-harmful network attachments or applications, and give innovators the corresponding freedom to supply them."

With regard to self-regulatory regimes to achieve this outcome, Wu acknowledges that in the long term, private broadband providers and the public have the same interest interest, "both should want a neutral platform that supports the emergence of the very best applications." In the short term, however, he notes that broadband providers do not support a neutral platform, which he evidences with a survey of contract restrictions for 16 American broadband providers. Restrictions are place on the misuse of IP addresses; using a personal internet connection to conduct a business; overuse of bandwidth; reselling of bandwidth; spam; hacking; and offensive, immoral purposes. Wu also cites filings to the FCC by application providers' complaining that certain broadband providers had limited the use of WiFi networks and virtual private networks (VPN). Wu called these actions as broadband providers favoring their short term interests, but he notes that the situation improved somewhat in 2003 with FCC oversight. Wu declares, "Network neutrality, as shorthand for a system of belief about innovation policy, is the end, while open access and broadband discrimination are the means."

Wu likens net neutrality as an "evolutionary model" of innovation, one of survival of the fittest. Wu and Internet Darwinians hold an interpretation of the "end-to-end" design argument, that networks should be neutral to applications. That the Internet is the fastest growing communications network in history is the proof that its "end-to-end" design is superior to other networks, according to Wu and Lessig. Wu recognizes that the merits of evolutionary innovation are not settled, nor the debates over neutral platforms, but that many have come to hold this view and see it as goal for telecom policy.

In a section on "open access", which Wu acknowledges has different meanings, he describes how proponents advocate structural separation on cable networks and that cable operators should not be allowed to

sell cable TV and internet access in the same package because it forecloses the content in the Internet package.[55]

Wu recognizes that a best efforts regime tends to support applications that are latency-insensitive (e.g. email, website etc), but that's unfortunate for the latency sensitive applications such as voice and video which need a quality of service. He recognizes that this requires some contract from the broadband provider. Wu says that only networks can control the quality of service.

Separately, it has been shown that application providers can control their quality of service, for example by purchasing caching and prioritized delivery through content delivery networks (CDNs). In 2015, it was revealed with Netflix secretly degraded mobile video streams sent to AT&T and Verizon while Sprint and T-Mobile received quality streams.[56] Indeed Netflix now allows users to set the quality of their own streams. Van Schewick, as described in the next section, suggests that users should be able to set priority. In any case, Wu ultimately believes that a non-discrimination regime is a better choice than structural remedies such as open access.

Wu opens the section on net neutrality with an allusion to the Hush-a-Phone case, an attachment on the phone to keep conversations private and reduce ambient noise, a case in which the Hush-a-Phone company prevailed against AT&T for the ability for end users to attach non-harmful devices to the network. Wu acknowledges that there are both justified and suspect examples of discrimination by a network provider. He likens discrimination to the work place, buttressed by the Civil Rights Act, where employers are allowed to hire and fire based on skill, but they can't make these decision based on race or

[55] Wu cites Lessig and Lemley on open access. This issue was fought at the U.S. Supreme Court and settled in NCTA v. Brand X. It found that internet delivered over cable is a Title I information service, and therefore not subject to FCC common carrier obligations.

[56] Ryan Knutson and Shalini Ramachandran, "Netflix Throttles Its Videos on AT&T, Verizon Networks," *Wall Street Journal*, March 25, 2016, sec. Tech, http://www.wsj.com/articles/netflix-throttles-its-videos-on-at-t-verizon-phones-1458857424.

sex. Wu observes, "Overall, there is a need to strike a balance between legitimate interests in discriminating against certain uses, and reasons that are suspect either due to irrationality or because of costs not internalized by the broadband operator." Blocking viruses would be one form of acceptable discrimination, but a blanket ban on IP chatting would not.

While Wu acknowledges that price discrimination is understood as a defendable and legal concept, he laments that its presence can have negative implications for innovation and competition among applications and says that applications that demand a VPN are put at a disadvantage. He does not give specific evidence for this, but it could be deduced that VPN activity is used to access content illegally. Wu discusses restrictions on VPN uses, noting that these are used by employees on companies and that such restrictions make them less productive.

Wu discusses a separate but related concept of bandwidth management. Wu recognizes that some broadband providers have limited capacity and need management to ensure that the many services and applications are delivered in the necessary quality so that users can consume them. But Wu is still concerned that the need for the broadband provider to earn a profit by managing the network will harm consumers and innovation.

Wu suggests that regulation, or even the threat of it, can create behavioral change in broadband providers, what he calls "education". He notes that a number of cable providers have removed restrictions on VPNs voluntarily. He also says that broadband providers are irrational about their networks, overstating concerns about security and liability. He suggests that regulations are necessary to teach companies the values of certain practices, for example anti-age discrimination to force companies to hire older workers.

Regarding of broadband usage restrictions, Wu observes that different kinds of networks can be different in their practices, showing the categories with cable and DSL. Wu says that in the 1990s, networks favored the web and client server applications while disfavoring home networking, peer-to-peer, and home telecommuting. One the principle

problems is the design of networks which offer asymmetric plans with greater download than upload capacity.[57]

Wu admits that cable broadband providers do not ban streaming video, which would be the main threat to their business. Wu also admits that contract disclosure is one thing, but enforcement another. Even though the restrictions on are on the books doesn't mean that broadband providers enforce them. In fact, he concludes that even with the contract restrictions, "broadband access is not substantially limited."

Wu offers an anti-discrimination principle, "a rule, only if necessary", he writes. "The effort is to strike a balance: to forbid broadband operators, absent a showing of harm, from restricting what users do with their Internet connection, while giving the operator general freedom to manage bandwidth consumption and other matters of local concern." This means that broadband operators should have "full freedom to 'police what they own' (the local network)" but not restrict the inter-networking. The principle would define forbidden and permissible grounds for discrimination in broadband usage restrictions.

In Wu's net neutrality law forbidding broadband discrimination, "Users have the right reasonably to use their Internet connection in ways which are privately beneficial without being publicly detrimental." Accordingly, no restrictions are allowed except (1) comply with any existing law or governmental directive; (2) prevent physical harm to the network; (3) prevent users' that limits others' connection to the network, including but not limited to neutral limits on bandwidth usage, limits on mass transmission of unsolicited email, and limits on the distribution of computer viruses, worms, and limits on denial-of service-or other attacks on others; (4) ensure the quality of the Broadband service, by eliminating delay, jitter or other technical aberrations; (5) prevent security violations; (6) "serve any other purpose specifically authorized by the Federal Communications

[57] This is has largely been resolved as users can select the ration of downstream/upstream when they buy their plan.

Commission, based on a weighing of the specific costs and benefit of the restriction."

With regards to the bandwidth intensive application of games, Wu says broadband providers should not manage bandwidth either by blocking or rationing the application. Instead the user should upgrade to higher speed in order to access the game.[58] Wu says that the onus should be on the gaming developer if the game needs a higher speed in order to be optimized. It should be the market choice, not the broadband provider's choice, he says.

Importantly, Wu's discussion is focused on user's rights and the management of traffic. Such notions are generally codified in net neutrality rules with provisions about the users' rights to connect to the data of their choice. It bears mention that while Wu may have had opinions about the commercial offers of broadband providers, his article offers only a limited discussion of the *pricing* of the neutral platform. For example he sees nothing wrong with broadband providers charging a higher price for a higher speed or for more bandwidth. Thus to deduce that the presence of a data cap is a net neutrality violation does not seem supported by Wu's article. Moreover, restrictions on zero rating cannot necessarily be deduced as there are no network restrictions going on (e.g. no blocking or throttling).

Moreover Wu declares that broadband providers can "police what they own", meaning how they conduct their proprietary traffic on the proprietary facilities, provided that it does not detract from the neutral platform. This would seem to contradict the tough stance by BEREC on limiting what broadband providers can do on their own facilities under the specialized services provisions.[59]

[58] It's not clear that more speed is what will make the game work, as there can be other technical aspects which could deliver a better gaming experience.

[59] "What Is Traffic Management and What Is 'equal Treatment'?," BEREC, accessed November 4, 2016, http://berec.europa.eu/eng/netneutrality/traffic_management/.

Wu's original "neutrality principle" (interchangeably described throughout the paper as a "non-discrimination" and anti-discrimination" principle) was not primarily intended to enshrine "end-to-end" principles into the fabric of the Internet. Rather, the principle proposed a set of guidelines for the allocation of specific control rights between ISPs and their consumers.[60]

Wu intimates that delivering a neutral network is in the long term interest of a broadband provider, and that the telecom regulator can play an "educational" role to encourage the broadband provider in this respect. While Wu provides an example of an anti-discrimination rule, he hesitates to say that net neutrality should be law. He prefers that broadband providers simply follow the principle, which should be made a rule only "if necessary." Wu does not stipulate at what point a hard rule is necessary.

Many incorrectly ascribe Wu to saying that the Internet is inherently neutral. In point of fact, he said the opposite. Wu states that the Internet was not neutral, as it tended to favor latency-insensitive applications (email, websites) over latency-sensitive apps (VOIP, video). He explains,

> First, the concept of network neutrality is not as simple as some IP partisans have suggested. Neutrality, as a concept, is finicky, and depends entirely on what set of subjects you choose to be neutral among.
>
> A policy that appears neutral in a certain time period, like "all men may vote", may lose its neutrality in a later time period, when the range of subjects is enlarged. This problem afflicts the network neutrality embodied in the IP protocols. As the universe of applications has grown, the original conception of IP neutrality has dated: for IP was only neutral among data applications. Internet networks tend to favor, as a class, applications insensitive to latency (delay) or jitter (signal distortion). Consider that it doesn't matter whether an

[60] Howell, Bronwyn and Roslyn Layton. "An Economic History of Net Neutrality." Forthcoming 2017

> email arrives now or a few milliseconds later. But it certainly matters for applications that want to carry voice or video. In a universe of applications, that includes both latency-sensitive and insensitive applications, it is difficult to regard the IP suite as truly neutral as among all applications.[61]

Lessig, Lemley and Wu claim that the Internet is the fastest growing network in history and that this is the proof that the end-to-end design is superior to others. But in point of fact, Internet is only the second fastest network. The mobile network grew faster.[62] If the standard of the best network is how fast people adopt it, then unquestionably the mobile network will be the winner. However there is no pretense that the mobile network was designed to be "neutral." This brings to mind the earlier point about the stupid network and suggests that the mobile network, which was designed by the telephone companies, is not so stupid at all. In any event, it is hardly a point of disagreement that both networks are important and valuable, but it is hard to reconcile why the Internet is supposed to get separate rules which prioritize it over other networks.

Indeed the idea of preserving the "original" Internet sounds like a museum project, like keeping copies of the old telegraph, phonograph, ENIAC, and so on. It would seem that engineers would want to try new things, to make them better, even to invent new and different protocol designs. The next section reviews Barbara van Schewick's case of why the original IP suite is superior to other designs and why regulation is necessary to preserve it.

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[61] Tim Wu, "Network Neutrality, Broadband Discrimination," SSRN Scholarly Paper (Rochester, NY: Social Science Research Network, June 5, 2003), https://papers.ssrn.com/abstract=388863.

[62] "How Americans Spend Their Money," *Washington Times*, February 10, 2008, http://www.nytimes.com/imagepages/2008/02/10/opinion/10op.graphic.ready.html.

2.2.4 THE ARCHITECTURE OF INNOVATION

Lemley and Lessig presented an argument for end-to-end; Wu described the neutral platform; and Barbara van Schewick melds these ideas together. Van Schewick was inspired by Lessig's books including *Code* and subsequently, her 2004 doctoral dissertation at the Technical University of Berlin *Architecture and Innovation: The Role of the End-to-End Arguments in the Original Internet*[63] explores this idea. Van Schewick was a resident fellow at the Stanford Center for Internet & Society for part of the time she was writing her doctorate, and Lessig served on her PhD defense committee. Van Schewick won a prestigious German legal prize for her thesis among other academic commendations in both law and computer science, joined Lessig at the Stanford CIS in the 2006, where she a professor both of law and computer science.

The thesis she presents in her doctorate--that there is an original internet based upon the end to end principle--she expands in her 2010 book *Internet Architecture and Innovation.*[64] Van Schewick asserts that the "architecture" of the internet, above all, is responsible for innovation in Internet services and applications. She expounds on two versions of end-to-end network design principle. Van Schewick clearly prefers one of the versions, using it to draw conclusions about the original intent of Internet design. She has denoted this as the "broad" version of the end-to-end arguments and further concludes "only the broad version affects the environment for innovation."

According to van Schewick, internet innovation is special for two reasons. There is a (1) large group of diverse innovators and (2) user choice among the competing applications. "Applying the broad version of the end-to-end arguments creates an environment that is more conducive to application innovation than architectures that

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[63] "Fakultät IV Elektrotechnik Und Informatik: Promotionen 2004," accessed November 4, 2016, https://www.eecs.tu-berlin.de/menue/forschung/promotionen/archiv/promotionen_2004/.

[64] Barbara van Schewick, *Internet Architecture and Innovation,* MIT Press, accessed June 20, 2016, https://mitpress.mit.edu/books/internet-architecture-and-innovation.

deviate from this design principle," (381) she writes. Specifically she notes that the mechanism that produces innovation in applications under an end-to-end architecture has two components: widespread experimentation by a large and diverse group of innovators who independently select whether to realize their innovative ideas, and user choice among the resulting applications. Under uncertainty or user heterogeneity, this mechanism will produce more and better applications than innovation in network architectures that concentrate control over innovation or deployment in the hands of a few network providers." (382)

Van Schewick exhibits Skype, Ebay, Amazon, Facebook, and Google as proof that the end-to-end principle leads to innovation but many of these companies competitors may have had similar origins but did not become successes. So it is not clear whether there is a dividing line between inherent features of the internet and other factors such as market, technology, management expertise etc which are at play.

Van Schewick also discusses differential treatment of Internet traffic or prioritization. She notes that application-specific differential treatment and application-class based differentiation should be forbidden[65] but that user-chosen differential treatment[66] is okay. She describes the former as harmful discrimination while the latter is not. However in the scenario the user is allowed to use prioritization but it cannot be application-specific; it must be application agnostic, as she notes in a filing[67] to the FCC on the "General Conduct Rule." She notes,

> In particular, to determine whether a practice is likely to reduce innovation and free speech, the FCC should evaluate

[65] Barbara Van Schewick, "Analysis of Proposed Network Neutrality Rules," Stanford, February 18, 2015, /publications/analysis-proposed-network-neutrality-rules.

[66] Barbara Schewick, "Network Neutrality and Quality of Service: What a Non-Discrimination Rule Should Look Like," June 26, 2014, /publications/network-neutrality-and-quality-service-what-non-discrimination-rule-should-look-0.

[67] Barbara Schewick, "Analysis of Proposed Network Neutrality Rules," Stanford, February 15, 2015, /publications/analysis-proposed-network-neutrality-rules.

> the practice based on whether it preserves the following three factors: User choice; Application-agnosticism; and Low costs of application innovation and free speech. This approach would allow complainants to show that a practice is likely to reduce innovation and free speech and should therefore be prohibited by demonstrating that it violates at least one of these three factors, without requiring them to engage in a detailed analysis of the impact of the practice on application innovation, free speech and broadband deployment."

However if the user cannot differentiate on applications, it is hard to see on which parameters they are making the decision to apply the prioritization. Van Schewick has been a key proponent of bans on what she calls "fast lanes" or "paid prioritization", which is now part of the US and EU net neutrality rules.

2.2.5 ZERO RATING

Van Schewick is also a leading critic of zero rating and free data and has called for outrights bans on the practice.[68] She observed in January 2016, "Zero-rating is harmful discrimination. Zero-rating is the practice of not counting certain applications against users' monthly bandwidth caps. Like fast lanes or other technical discrimination, zero-rating allows ISPs to discriminate against content that users want to see. Zero-rated applications are more attractive to users than applications that are not."

Van Schewick reviews[69] T-Mobile's popular free music and video programs. Her claims justifying the harm of the programs are based on

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[68] Van Schewick (2016) Personal blog: Barbara van Schewick, "Europe Is About to Adopt Bad Net Neutrality Rules. Here's How to Fix Them," *Medium*, October 22, 2015, https://medium.com/@schewick/europe-is-about-to-adopt-bad-net-neutrality-rules-here-s-how-to-fix-them-bbfa4d5df0c8#.fb4r1h2ik.

[69] Van Schewick, Barbara. "T-Mobile's Binge On Violates Key Net Neutrality Principles." Stanford. CA: Cyberlaw at Stanford University, 2016. https://cyberlaw.stanford.edu/downloads/vanSchewick-2016-Binge-On-Report.pdf.

two sources: first, the results of a market research survey[70] from American wireless provider trade association CTIA and second, an article[71] from the *Wall Street Journal* describing an interview with Slate magazine's vice president of technology. Neither of these are academic research or regulatory investigations and neither mention the term "zero rating", but they are worthy of review and actually suggest support for zero rating.

It is interesting that van Schewick would use the CTIA study to bolster her claim that T-Mobile's BingeOn is distorting competition, as the CTIA study appears to have been conducted to provide evidence that mobile providers are creating competition. Van Schewick only mentions one of the nine conclusions of the study, that 74% of those surveyed would prefer to see video from start-up providers if it did not count toward the data cap.

The CTIA study also concludes that 57% the respondents believe they have more choice when it comes to wireless providers than wireline. Two-thirds (67%) said they are more likely to choose a provider that offered content that did not count against the data cap. In defiance of the call for regulation, only 6% of the survey respondents thought the federal government should decide which options and services mobile providers make available, and 73% said the government should be less involved in the regulation of mobile wireless. Even if the government adopted rules, 66% said that the rules should be flexible to reflect the reality of the mobile market. Only 29% were supportive of using the monopoly telephone era rules (Title II) to regulate wireless. In fact 78% favored that the government recognize that wireless is different and treat it distinctly. Two-thirds said they favored quality of service on their mobile subscription over treating all of the data equally, with 64% saying that mobile providers should be able to manage their networks to ensure the best experience for their customers. Moreover

[70] CTIA The Wireless Association (2014) CTIA Mobile Wireless Service Survey. TechoMetrica. 22 pp. Ramsey NJ. Accessible at: http://www.ctia.org/docs/default-source/default-document-library/2014-ctia-mobile-wireless-service-survey-final.pdf

[71] Knutson, Ryan, 2014, Will Free Data Become the Next Free Shipping? *Wall Street Journal*, 2014. http://www.wsj.com/articles/will-free-data-become-the-next-free-shipping-1414105542

42% of the respondents believed wireless carriers to "most innovative", compared to cable TV at 17% ; electricity utilities at 13%; and 9% for the federal government.

Perhaps in the greatest contrast to van Schewick's view, 63% of respondents favored prioritization on mobile networks, and 39% said those applications requiring more quality or more real time functionality should be prioritized. Twenty four percent agreed that users wanting prioritization should pay additional fees.

The second of van Schewick's sources is a *Wall Street Journal* article describing how Slate magazine wanted to increase the listeners to its podcast and experimented with a service by DataMi that gave some users the chance to listen to the podcast without it counting toward the mobile data plan. It found that 61% were more likely to listen when the data was free. The article describes how a range of edge providers, large, small and startup, were taking advantage of free data programs to win new users.

Van Schewick asserts, "BingeOn allows some providers to join easily and creates lasting barriers for others, especially small players, non-commercial providers, and start-ups. As such, the program harms competition, user choice, free expression, and innovation…"[72] She notes that Google is not able to join because it used User Data Protocol (UDP), however YouTube is now the program.[73] More than 100 video services are available in the package.[74]

Van Schewick claims that zero rating distorts competition because consumers prefer things to be free and that T-Mobile is automatically more attractive because it offers free video. She suggests that video

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[72] Van Schewick, Barbara. "T-Mobile's Binge On Violates Key Net Neutrality Principles." Stanford. CA: Cyberlaw at Stanford University, 2016. https://law.stanford.edu/wp-content/uploads/2016/02/vanSchewick-2016-Binge-On-Report.pdf p 3

[73] "Google YouTube and BingeOn. Google Public Policy Blog, 2016. https://publicpolicy.googleblog.com/2016/03/google-youtube-and-binge-on.html

[74] "BingeOn Streaming Video List." TMobile.com, accessed: November 9, 2016 http://www.t-mobile.com/offer/binge-on-streaming-video-list.html

providers in BingeOn are getting a reward they don't deserve; one they have not earned on merit but just the mere fact that they're part of T-Mobile's program. She says that the free program will likely bring more video providers to BingeOn, further distorting competition. Because T-Mobile has only added a subset of competitors from each category, this itself is distorting competition, says van Schewick. She also asserts that zero rating limits user choice because users can only watch the amount of video allotted for the data cap, saying "it's a not a meaningful choice."

Van Schewick claims T-Mobile limits free expression because the 42 providers only provide commercial video entertainment, not user generated, educational or non-profit content. She claims that commercial entertainment is coming at the expense of all other speakers which "undermines the potential of the Internet as a democratic space for free expression." However a review of BingeOn conducted in August 2016[75] shows that among more than 100 providers, there are 3 religious video services, 4 in the Spanish language, 4 user generated services, PBS, Arts & Entertainment, History Channel, National Geographic, and Discovery in addition to categories for news, sports, anime, Asian, music, kids and premium content general entertainment. Verizon's Go90, a service from a competing ISP, is also available.

2.2.6 NET NEUTRALITY RULEMAKING

Van Schewick has been prolific in the rule making process. She is reported to have had 150 meetings[76] with US government officials in support of Open Internet rulemaking. She also has the record for ex parte disclosures for the FCC's rulemaking process for the 2015 Open Internet order,[77] some 18 disclosures, one of which notes 10 separate

[75] Ibid

[76] Ammori, Marvin. "The Women Who Won Net Neutrality." *Slate*. September 22, 2015.http://www.slate.com/blogs/future_tense/2015/09/22/barbara_van_schewick_susan_crawford_and_other_women_who_won_net_neutrality.html

[77] Trujillo. Mario. "FCC hit with net neutrality lobbying blitz." *The Hill*. Feb 25, 2015. http://thehill.com/policy/technology/233750-fcc-hit-with-net-neutrality-lobbying-blitz

meetings in a single week. Van Schewick's comments are referenced at least 9 times in the FCC's 2010 Open Internet Report and Order (related to 4 of her submissions[78]) and 6 times in the 2015 rules (based on 4 supplemental submissions.[79] In the 2010 rules, the FCC cites van Schewick's comment, "gatekeeper control and pay-for-prioritization would have prevented Skype and YouTube from surviving because of the threats they presented to the legacy business of telephone-based network providers and Google Video, respectively)"[80] — to support its view that its rules are necessary to ensure Internet openness norms.

The FCC also references Van Schewick to support the statement, "Broadband providers would be expected to set inefficiently high fees to edge providers because they receive the benefits of those fees but are unlikely to fully account for the detrimental impact on edge providers' ability and incentive to innovate and invest, including the possibility that some edge providers might exit or decline to enter the

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[78] The four submissions include Letter from Barbara van Schewick to Marlene Dortch, Secretary, FCC, GN Docket No. 09-191 (filed Jan. 19, 2010); Barbara van Schewick, Towards an Economic Framework for Network Neutrality Regulation, 5 J. ON TELECOMM. & HIGH TECH. L. 329, 378–80 (2007); Barbara van Schewick, Network Neutrality: What a Non-Discrimination Rule Should Look Like at 22 (Dec. 14, 2010) and attached to Letter from Barbara van Schewick, to Marlene Dortch, Secretary, FCC, GN Docket No. 09-191 at Attach. A (filed Dec. 14, 2010); Letter from Prof. Barbara van Schewick, Professor, Stanford Law School, to Marlene H. Dortch, Secretary, FCC, GN Docket No. 09-191, WC Docket No. 07-52, Attach. at 4 (filed Aug. 2, 2010) (van Schewick Aug. 2, 2010 Ex Parte Letter)

[79] See generally Letter from Barbara van Schewick to Marlene H. Dortch, Secretary, FCC, GN Docket Nos. 09-191, 14-28, Attach. at 7 (filed Sept. 19, 2014) (van Schewick Sept. 19, 2014 Ex Parte Letter) ; Letter from Barbara van Schewick, Professor of Law and (by courtesy) Electrical Engineering, Stanford Law School, et al., to Marlene Dortch, Secretary, FCC, GN Docket Nos. 14-28, 10-127 Attach. at 4 (filed Feb. 18, 2015) (van Schewick Feb. 18, 2015 Ex Parte Letter);Van Schewick April 17 Ex Parte Letter; and Letter from Barbara van Schewick, Professor of Law and (by courtesy) Electrical Engineering, Stanford Law School, et al., to Hon. Tom Wheeler, Chairman, FCC, et al., GN Docket No. 14-28, Attach. at 7 (filed Feb. 2, 2015)

[80] See footnote 61. FCC Open Internet Report & Order, December 21, 2010. https://apps.fcc.gov/edocs_public/attachmatch/FCC-10-201A1_Rcd.pdf

market."[81] She is referenced as well on the assertion that prioritized access fees would "could further raise the costs of introducing new products and might chill entry and expansion."[82]

The FCC references van Schewick further in their rules of taking a more light touch approach, for example. "The record does not convince us that a transparency requirement by itself will adequately constrain problematic conduct."[83] In paragraph 71 of the rules, the FCC quotes van Schewick directly as justification for rules, ". . . letting users choose how they want to use the network enables them to use the Internet in a way that creates more value for them (and for society) than if network providers made this choice."[84] Her submission is the sole justification for a provision on "Use Agnostic Discrimination"[85] and for the need of the FCC to act in the "public interest"[86] on net neutrality. The 2015 rules make reference to van

[81] Ibid. See paragraph 25 and the referenced footnote 67 in which van Schewick's "Towards an Economic Framework for Network Neutrality Regulation", 5 J. ON TELECOMM. & HIGH TECH. L. 329, 378–80 (2007 is noted.

[82] Ibid. Paragraph 26 and footnote 74. Letter from Barbara van Schewick to Marlene Dortch, Secretary, FCC, GN Docket No. 09-191 (filed Jan. 19, 2010) (van Schewick Jan. 19, 2010 Ex Parte Letter.

[83] Ibid. Paragraph 61, footnote 194. Barbara van Schewick, "Network Neutrality: What a Non-Discrimination Rule Should Look Like" at 22 (Dec. 14, 2010) ("In order for disclosure to have a disciplining effect, customers need to be able to switch to another provider that does not impose a similar restriction, and they need to be able to do so at low costs.")

[84]Ibid. See footnote 216. van Schewick Jan. 19, 2010 Ex Parte Letter. See also id. at 4 n.6 observing that: (1) the Internet "does not create value through its existence alone. It creates value by enabling users to do the things they want or need to do;" (2) "[e]nabling widespread experimentation at the application-level and enabling users to choose the applications they prefer is at the heart of the mechanism that enables innovation under uncertainty to be successful;" and (3) "[c]onsumers, not network providers, should continue to choose winners and losers on the Internet".

[85] Ibid. Paragraph 73, footnote 221.

[86] Ibid. Paragraph 78, footnote 242 and 243. See, e.g., Letter from Barbara van Schewick, Stanford Law School, to Marlene H. Dortch, Secretary, FCC, GN Docket No. 09-191, at 1–2 (filed Dec. 10, 2010) (noting that concerns about discrimination go beyond "anticompetitive" behavior or harms to competition, as those terms are

Schewick in 6 footnotes: on no blocking rules;[87] the no throttling rule and ban on discrimination against applications and classes of applications;[88] the claim that that users, not network providers, make the right choices for innovation,[89] on application agnostic traffic management;[90] and the need for forbearance under Title II.[91]

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understood in antitrust law); United States v. FCC, 652 F.2d 72, (D.C. Cir. 1980) ("The agency's determination about the proper role of competitive forces in an industry must therefore be based, not exclusively on the letter of the antitrust laws, but also on the 'special considerations' of the particular industry. As the Supreme Court has said, resolution of the sometimes-conflicting public interest considerations 'is a complex task which requires extensive facilities, expert judgment and considerable knowledge of the . . . industry. Congress left that task to the Commission . . . .'" (quoting McLean Trucking Co. v. United States, 321 U.S. 67, 87 (1944)) Letter from Prof. Barbara van Schewick, Professor, Stanford Law School, to Marlene H. Dortch, Secretary, FCC, GN Docket No. 09-191, WC Docket No. 07-52, Attach. at 4 (filed Aug. 2, 2010) (van Schewick Aug. 2, 2010 Ex Parte Letter) (observing that such a rule would "make[] it impossible to consider the potential impact of discriminatory conduct on the Internet's ability to realize its social, cultural and political potential—important aspects that the open Internet rules are intended to protect").

[87] Federal Communications Commission. "Open Internet Order", February 25, 2015. https://apps.fcc.gov/edocs_public/attachmatch/FCC-15-24A1.pdf Footnote 247 Letter from Barbara van Schewick to Marlene H. Dortch, Secretary, FCC, GN Docket Nos. 09-191, 14-28, Attach. at 7 (filed Sept. 19, 2014) (van Schewick Sept. 19, 2014 Ex Parte Letter) (stating a rule to protect against blocking "is part of all network neutrality proposals; this is the one rule on which all network neutrality proponents agree").

[88] Ibid. Footnote 272. See, e.g., Letter from Barbara van Schewick, Professor of Law and (by courtesy) Electrical Engineering, Stanford Law School, et al., to Marlene Dortch, Secretary, FCC, GN Docket Nos. 14-28, 10-127 Attach. at 4 (filed Feb. 18, 2015) (van Schewick Feb. 18, 2015 Ex Parte Letter) ("[T]he no-throttling rule should explicitly ban discrimination against applications AND classes of applications (so-called 'application-specific' discrimination).").

[89] Ibid. Footnote 335. van Schewick Feb. 18, 2015 Ex Parte Letter, Attach. at 14 "Letting users, not network providers, choose which applications will be successful is an important part of the mechanism that produces innovation under uncertainty. At the same time, letting users choose how they want to use the network enables them to use the Internet in a way that creates more value for them (and for society) than if network providers made this choice for them."

[90] Ibid. Footnote 344 See van Schewick Sept. 19, 2014 Ex Parte Letter, Attach. at 24

Curiously, a cursory review of the FCC footnotes suggests that the agency fulsomely restates and quotes the pro net neutrality arguments in text and footnotes and while submissions that run counter to the rules are not explicated. A more thorough analysis of this observation see Hurwitz[92] and Lyons.[93]

Van Schewick's influence is also felt in the European net neutrality rules. Frode Sørensen, Senior Advisor at the Norwegian Telecom Authority (Nkom) describes van Schewick's "deep analysis"[94] of her concept of "user-controlled", "application-agnostic" QoS architecture with is compatible with net neutrality. Her suggestions were subsequently adopted in the BEREC's Net Neutrality QoS Guidelines in 2012.[95]

Van Schewick criticized the EU net neutrality law passed in October 2015 and suggested a number of amendments. "The future of the Internet in Europe is on the line. It's up to all of us to save it," she writes and calls for amendments that ban "fast lanes", "zero rating"

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[91] Ibid. Footnote 1483 See Letter from Barbara van Schewick, Professor of Law and (by courtesy) Electrical Engineering, Stanford Law School, et al., to Hon. Tom Wheeler, Chairman, FCC, et al., GN Docket No. 14-28, Attach. at 7 (filed Feb. 2, 2015) ("[W]e would expect and encourage the FCC to regulate with a light touch under Title II through application of its forbearance authority.");

[92] Hurwitz, Gus. "Chairman Wheeler and the terrible, horrible, no good, very bad Open Internet Order." TechPolicyDaily.com, March 27, 2015. http://www.techpolicydaily.com/communications/terrible-horrible-no-good-open-internet-order/

[93] Lyons, Dan. "Commissioner O'Reilly's Crusade for FCC Process Reform." TechPolicyDaily.com. July 30, 2015. http://www.techpolicydaily.com/internet/fcc-process-reform/

[94] Van Schewick, Barbara. "Net Neutrality and Quality of Service: What a Non-Discrimination Rules Should Look Like." What June 11, 2012. http://cyberlaw.stanford.edu/publications/network-neutrality-and-quality-service-what-non-discrimination-rule-should-look.

[95]Sørensen, Frode. "How Can the Open Internet Coexist with New IP Services?," Nkom.no, June 4, 2015, http://eng.nkom.no/topical-issues/news/how-can-the-open-internet-coexist-with-new-ip-services.

"application-based discrimination" and congestion management.[96] However he European Parliament rejected the amendments,[97] but variations reappeared in the 2016 draft BEREC guidelines[98] for implementation of the EU net neutrality law. These included significant restrictions on zero rating (a term not mentioned in the EU law); traffic management, and specialised services.

During the question and answer period of the June 2016 launch of the consultation of the guidelines, Henk Don of the Authority on Consumers and Markets (the Dutch telecom regulator) explained that he and Frode Sorensen invited van Schewick and 3 other proponents to inform the guidelines.[99] The session,[100] which was attended by over 100 BEREC representatives, was closed to the public. BEREC denied a request to provide notes of the meeting.

Together with Lessig and Tim Berners-Lee, van Schewick penned an open letter[101] on July 14, 2016 to "European citizens, lawmakers and

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[96] Barbara van Schewick, "Europe Is About to Adopt Bad Net Neutrality Rules. Here's How to Fix Them," Medium, October 22, 2015, https://medium.com/@schewick/europe-is-about-to-adopt-bad-net-neutrality-rules-here-s-how-to-fix-them-bbfa4d5df0c8#.d73pcpodz.

[97] Chris Baraniuk, Chris. European Parliament votes against net neutrality amendments. BBC.com October 27, 2015. http://www.bbc.com/news/technology-34649067

[98] "Draft BEREC Guidelines on Implementation by National Regulators of European Net Neutrality Rules," BEREC, June 6, 2016, http://berec.europa.eu/eng/document_register/subject_matter/berec/public_consultations/6075-draft-berec-guidelines-on-implementation-by-national-regulators-of-european-net-neutrality-rules.

[99] Launch of Public Consultation on BEREC Net Neutrality Guidelines, BEREC. June 6, 2016, https://www.youtube.com/watch?v=RpjXFeBSifo&feature=youtu.be.

[100] "Update on BEREC Work to Produce Guidelines for the Implementation of Net Neutrality Provisions of the TSM Regulation," BEREC, February 24, 2016, http://berec.europa.eu/eng/document_register/subject_matter/berec/press_releases/5740-update-on-berec-work-to-produce-guidelines-for-the-implementation-of-net-neutrality-provisions-of-the-tsm-regulation.

[101] "Four Days to Save the Open Internet in Europe: An Open Letter," World Wide Web Foundation, July 14, 2016, http://webfoundation.org/2016/07/four-days-to-save-the-open-internet-in-europe-an-open-letter/.

regulators" to ban "fast lanes", "zero rating", "discrimination", and "specialised services." The letter included calls to action with Save the Internet, a global net neutrality coalition, and was syndicated to the press and a number of related coalitions. BEREC released the final guidelines in a press conference on August 30, noting the unprecedented level of comments. BEREC Administrative Manager Laszlo Igneczi explained the various IT and technical investments that were needed to facilitate receiving an avalanche of emails. He presented a chart[102] showing the explosion of comments from 132,956 to 481,547 in the last week of the consultation, 640 per minute on July 17, 2016, 3 days after van Schewick's letter was released. He observed that the lion's share of the submissions came from the net neutrality coalitions Save The Internet, Avaaz, OpenMedia and AccessNow.[103]

As part of the consultation on net neutrality guidelines, van Schewick penned another open letter[104] which was signed by 126 academics "led by the belief that neutral access to the Internet in its entirety is a necessary precondition for the full enjoyment of human rights." In introducing the letter, van Schewick warns of the "negative impact that fast lanes would have on our ability to research, collaborate, and educate"[105] and urges strict BEREC guidelines. Apart from van Schewick's papers, of the publications by the 126 academics, only 7

[102] See BEREC presentation p. 5: "Update on BEREC Work to Produce Guidelines for the Implementation of Net Neutrality Provisions of the TSM Regulation," February 24, 2016.

[103] Press Debriefing on Launch of BEREC Guidelines on Net Neutrality BEREC. August 8, 2016 , https://www.youtube.com/watch?v=SBnA5nLxdgA.

[104] "Academics in Support of Sound Net Neutrality in Europe," Cis-Static Law, July 18, 2016, https://cis-static.law.stanford.edu/cis/downloads/AcademicsLettertoBEREC20160719final.pdf.

[105] Barbara van Schewick, "126 Leading Academics to Europe's Telecom Regulators: Protect the Open Internet in Europe," July 21, 2016, /blog/2016/07/126-leading-academics-europe%E2%80%99s-telecom-regulators-protect-open-internet-europe.

papers on net neutrality could be identified, none of which appeared in peer-reviewed journals.[106]

There is no doubt that van Schewick's work is instrumental in the study, if not the rulemaking, of net neutrality. This is also a reason why critical appraisals are necessary. Bauer in his review of van Schewick's book observes, "To make researchers and policy-makers keenly aware of the effects of architectures on economic decisions and innovation in the Internet ecosystem is an outstanding contribution of the book." However notes a shortcoming of the book being a lack of empirical evidence, which leaves room for improvement and an opportunity for more research. Therefore he concludes that van

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[106] The six papers that could be identified include

Luca Belli and Primavera De Filippi, "The Value of Network Neutrality for the Internet of Tomorrow," SSRN Electronic Journal, 2013, doi:10.2139/ssrn.2468534.

Angela Daly, "Regulatory Approaches to Net Neutrality in Europe and Beyond," SSRN Electronic Journal, 2010, doi:10.2139/ssrn.1675744.

Nico Grove and Damir Agic, "Network Neutrality and Consumer Discrimination: A Cross-Provider Analysis", http://www.ptc.org/ptc12/images/papers/upload/PTC12_M4_Nico%20Grove%20(Paper).PDF

Arthur Gwaga, Facebook Internet.org: "A strategic project bridging the African digital divide?", http://www.academia.edu/12834821/Facebook_Internet.org_A_strategic_project_bridging_the_African_digital_divide

Milton Mueller et al., "Net Neutrality as Global Principle for Internet Governance," SSRN Scholarly Paper (Rochester, NY: Social Science Research Network, November 5, 2007), https://papers.ssrn.com/abstract=2798314.

James Losey , Internet freedom, nuanced digital divides, and the Internet craftsman, https://www.academia.edu/4774280/Internet_freedom_nuanced_digital_divides_and_the_Internet_craftsman

Eduardo Bertoni, Net Neutrality and Intermediary Liability in Argentina, https://medium.com/internet-monitor-2014-platforms-and-policy/net-neutrality-and-intermediary-liability-in-argentina-e007f6ff8794#.sa3760c6n

Schewick's findings "while relevant to the continuing policy discourse, should be applied with caution."[107]

2.3 OTHER PAPERS ON NET NEUTRALITY

This section mentions a few of the key theoretical but quantitative papers on net neutrality using game theory and econometrics. The only empirical paper that could be found is Laura Nurski's "Net Neutrality, Foreclosure and the Fast Lane: An Empirical Study of the UK"[108] from 2012. Nurski concludes that offering differentiated services benefits consumers, telecom operators, and content providers (specifically with advertising revenue). She says that there is little incentive for foreclosure because it reduces a broadband provider's profits. This outcome is supported by the intuition of two-sided markets; that blocking content or services, a telecom operator attracts fewer customers and therefore suffers reduced revenue.

Nicholas Economides et al[109] offer econometric models for net net neutrality with two-sided markets. They posit ISPs in the middle, consumers on one side and content providers on the other. Their models suggest ambiguous results for net neutrality rules.[110] They posit arguments both for and against network neutrality, showing that consumers benefit with maximum content, but also that ISPs, if they are able to charge content providers fees, will invest in infrastructure and eliminate congestion. It is a conundrum to both allow and forbid network neutrality at the same time, so they advocate government rather than private network investment. These models assume

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[107] Bauer, Johannes. Book Review of *Internet Architecture and Innovation* by Barbara van Schewick. Telecommunications Policy 38 (2014) 406–410.

[108] Laura Nurski, "Net Neutrality, Foreclosure and the Fast Lane: An Empirical Study of the UK," SSRN Scholarly Paper (Rochester, NY: Social Science Research Network, October 1, 2012), http://papers.ssrn.com/abstract=2164382.

[109] Economides, Nicholas and Benjamin E. Hermalin. "The Economics of Network Neutrality", Rand Journal of the Economics, 2012.

[110] Economides, Nicholas and Joacim Tåg. "Network Neutrality on the Internet: A Two-sided Market Analysis." Information Economics and Policy, Vol. 2, 2012

homogeneous users and content, so results might be different under different conditions.

Cheng, Bandyopadhyay and Guo[111] use game theory to model network neutrality. Both they, and Choi and Kim,[112] conclude that operators have more incentive to invest under network neutrality because consumers demand more content and therefore operators need to provide more network capacity. However, they note that content providers will be worse off if they pay for content delivery than the free regime today. Supplementary work[113] in 2012 by the authors concluded that departures from net neutrality can increase consumer surplus and broadband market coverage.

Mussachio, Schwartz and Walrand[114] model the complexity of the problem by allowing operators to charge content providers termination fees (delivery fees) depending on a number of factors such as the content provider's strength in earning advertising revenue, the concentration of ISPs in a given market, and the entry costs for ISPs. Kramer and Wiewiorra[115] model the effect of tiered pricing to data-heavy content providers for Quality of Service (QoS) guarantees. They conclude that flexible pricing for content providers is the best option for infrastructure investment by ISPs in the short and long run.

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[111] Cheng, Hsing Kenneth, Subhajyoti Bandyopadhyay and Hong Guo. "The Debate on Net Neutrality: A Policy Perspective." 2011.

[112] Choi, Jay Pil and Byung-Cheol Kim. "Net Neutrality and Investment Incentives." RAND Journal of Economics. Vol. 41, No. 3, 2010.

[113] Hong Guo, Hsing Kenneth Cheng, and Subhajyoti Bandyopadhyay, "Net Neutrality, Broadband Market Coverage, and Innovation at the Edge*," Decision Sciences 43, no. 1 (February 1, 2012): 141–72, doi:10.1111/j.1540-5915.2011.00338.x.

[114] Musacchio, John, Galina Schwartz and Jean Walrand. "A Two-Sided Market Analysis of Provider Investment Incentives With an Application to the Net-Neutrality Issue." 2009

[115] Krämer, Jan and Lukas Wiewiorra. "Network Neutrality and Congestion Sensitive Content Providers: Implications for Content Variety, Broadband Investment, and Regulation." 2012

Faulhaber notes in a number of papers[116] [117] [118] [119] [120] [121] that competition and technology evolution have negated the need for network neutrality legislation. He expands upon the two-sided market model, saying that it is not in the interest for an ISP to block content or favor one provider over another, as having as many content providers as possible is profit maximizing for an ISP. He gives the example of a retailer that will offer its own house brand along with competing products in order to appeal to many customers' tastes.

He suggests that transparency, not neutrality, is what is needed to ensure an open internet, and he provides detailed suggestions on how all internet players, content and application providers as well as ISPs, should disclose information to help customers make decisions. He asks regulators to provide uniform standards for disclosure. To address monopoly behavior, regulators should use antitrust.

A complex model by Gupta et al[122] considers the service-based logical architecture for overlay networks in mobile devices, which makes locating content and routing more efficient. The authors are concerned about inevitable congestion with flat-rate pricing (the one size fits all internet price) versus differentiated pricing which can

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[116] Faulhaber, Gerald. Robert Hahn and Hal Singer. "Assessing Competition in U.S. Wireless Markets: Review of the FCC's Competition Reports". FEDERAL COMMUNICATIONS LAW JOURNAL Vol. 64 Number 2. July 11, 2011.

[117] Faulhaber, Gerald. "Economics of net neutrality: A review." Communications & Convergence Review 2011, Vol. 3, No. 1, 53-64

[118] Faulhaber, Gerald and David Farber. "Innovation in the Wireless Ecosystem: A Customer-Centric Framework." International Journal of Communication 4 (2010).

[119] Faulhaber, Gerald and David Farber. "The Open Internet: A Customer-Centric Framework." International Journal of Communication 4 (2010).

[120] Faulhaber, Gerald. "A National Broadband Plan for Our Future: A Customer-Centric Framework." International Journal of Communication 3 (2009).

[121] Faulhaber, Gerald. "Transparency and Broadband Internet Service Providers" International Journal of Communication 4 (2010).

[122] Alok Gupta et al., "An Analysis of Incentives for Network Infrastructure Investment Under Different Pricing Strategies," Info. Sys. Research 22, no. 2 (June 2011): 215–32, doi:10.1287/isre.1090.0253.

alleviate congestion. They find that benefits are optimized to all parties under a situation of differentiated pricing and that the assumptions of net neutrality have not considered the incentives for private investment in infrastructure.

In contrast to concerns about vertical integration in content and communication networks, Owen counters[123] that virtually every production process in the economy is vertically integrated, and the evidence is strong in favor of its consumer enhancing benefits. Antitrust policy that relies on ex post evidence of harm is preferable to the prophylactic net neutrality rules which amount to restrictions on the private property of operators.

Kramer and Wiewiorra[124] found that quality of service tiering may be more efficient in the short run because it better allocates the existing network capacity and in the long run because it provides higher investment incentives due to the increased demand for priority services by the entry of new congestion sensitive content providers. The regime that provides higher incentives for infrastructure investments is more efficient in the long run.

Alexandrov and Deb[125] found that under both monopoly and duopoly, if a firm cannot offer different prices for quality, then it invests less. Society suffers overall with reduced investment, they conclude.

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[123] Bruce M. Owen, "Antitrust and Vertical Integration in 'New Economy' Industries with Application to Broadband Access," SSRN Scholarly Paper (Rochester, NY: Social Science Research Network, November 10, 2010), http://papers.ssrn.com/abstract=1689278.

[124] Jan Krämer and Lukas Wiewiorra, "Network Neutrality and Congestion Sensitive Content Providers: Implications for Content Variety, Broadband Investment, and Regulation," Information Systems Research 23, no. 4 (Maj 2012): 1303–21, doi:10.1287/isre.1120.0420.

[125] Alexei Alexandrov and Joyee Deb, "Price Discrimination and Investment Incentives," International Journal of Industrial Organization 30, no. 6 (November 2012): 615–23, doi:10.1016/j.ijindorg.2012.07.001.

Baranes[126] finds that a non-neutral regime gives advantages both for high quality content and upgrades in infrastructure from copper to fiber.

Bourreau et al[127] found that investments in broadband capacity and content innovation are both higher in the non-neutral regime.

Gans & Katz[128] note that net neutrality may harm efficiency by distorting both ISP and content provider investment and service-quality choices.

Greenstein et al[129] find "little support for the bold and simplistic claims of the most vociferous supporters and detractors of net neutrality." Similar to this paper, they note the importance legal instrument ("precise policy choice") and how it is implemented. The say the outcome a question of long-run economic trade-offs for which there is no experience or consensus expectation.

2.4 THEORIES OF INNOVATION

Given the conflicting views of net neutrality in the academic literature, it is helpful to review the theories of innovation. A review of key concepts in the innovation literature can shed light on the net neutrality discussion and inform ICT policymaking. The discussion begins with an overview of the leading scholars of innovation in the

[126] Edmond Baranes, "The Interplay between Network Investment and Content Quality: Implications to Net Neutrality on the Internet," Information Economics and Policy 28, no. C (2014): 57–69.

[127] Marc Bourreau, Frago Kourandi, and Tommaso Valletti, "Net Neutrality with Competing Internet Platforms: Net Neutrality with Competing Internet Platforms," The Journal of Industrial Economics 63, no. 1 (March 2015): 30–73, doi:10.1111/joie.12068.

[128] Gans, Joshua, Michael Katz. "Net Neutrality, Pricing Instruments and Incentives." NBER Working Paper No. 22040. February 2016 http://www.nber.org/papers/w22040

[129] Greenstein, Shane, Martin Peitz and Tommaso Valletti. 2016. "Net Neutrality: A Fast Lane to Understanding the Trade-Offs." Journal of Economic Perspectives, 30(2): 127-50.

20th and 21st century. It touches upon Joseph Schumpeter and the "gale of creative destruction." Everett Rogers, a sociologist, emphasized the role of people in adopting and diffusing innovation; his theories have been used frequently to explain the adoption of smartphones, mobile apps, social networks, and many digital phenomena. Christiansen's "disruptive innovation" explains why disruptive internet innovation itself has succeeded to unseat telecom operators in providing communications services, regardless of the regulatory regime.

Lundvall developed the National Innovation System to explain the interplay of factors that make a country innovative. His view conforms to that of the Internet as a symbiotic ecosystem in which parts work together, rather than sectors to be singled out for regulation.

David Teece is relevant for the topic, as he is the one scholar of innovation who has investigated the topic of net neutrality in depth. He is not in favor of net neutrality and called it an" intellectual bankruptcy". In Teece's world, net neutrality rules constrain the ability of actors to make partnerships, or to "share complementary assets." If actors are prohibited from getting the complement to their asset, there will be no innovation. This is particularly the case for certain kinds of applications which need quality of service in order to operate. Moreover, the very introduction of new products and service is delivered by the complementary assets of marketing. As such, the ability for startups to use zero rating to improve their marketing and distribution could be helpful to make their innovation known.

Jean Tirole and his two-sided markets concept is perhaps the most referenced explanation in the economics literature about net neutrality. Two-sided markets thinking holds that platforms, the ISPs in this case, have an incentive to get both sides of the market on board. Any blocking or throttling that a telecom operator does will lessen its profits. Moreover differential pricing supports the efficient distribution of services, versus a price control such as net neutrality, which forces all data to be valued the same. Hence net neutrality regulation will not be optimal for all participants, including users.

Christopher Yoo offers a cogent and compelling alternative to net neutrality, that of the Dynamic Internet. He suggests that allowing the dynamic emergence of new technologies is preferable to net neutrality, which is a conservative argument to keep the Internet the same.

Brief reviews of the ecosystem model and circle model of innovation are offered.

Innovation is a broad and popular term and is the subject of millions of articles in the academic press, and even more in the mainstream press. Fagerberg and Sapprasert have charted the literature of innovation and its salient concepts.[130] They conclude that there is a global community of innovation scholars organized in small sub-groups based on geography and professional discipline. They note the emergence of specific academic and professionals journals and associations devoted specifically to the topic of innovation. They updated the analysis in 2011 and define the most important papers published on innovation before and after 1985. [131]

[130] "Publications," Jan Fagerberg, May 7, 2013, http://www.janfagerberg.org/publications/.

[131] Koson Sapprasert and Fagerberg Jan, "TIK WORKING PAPERS on Innovation Studies," Senter for teknologi, innovasjon og kultur Universitetet i Oslo, accessed June 20, 2016, http://www.sv.uio.no/tik/InnoWP/Fagerberg%20%26%20Sapprasert%2020111115.pdf.

Figure 1: Top publications on innovation before and after 1985, complied by Fagerberg et al

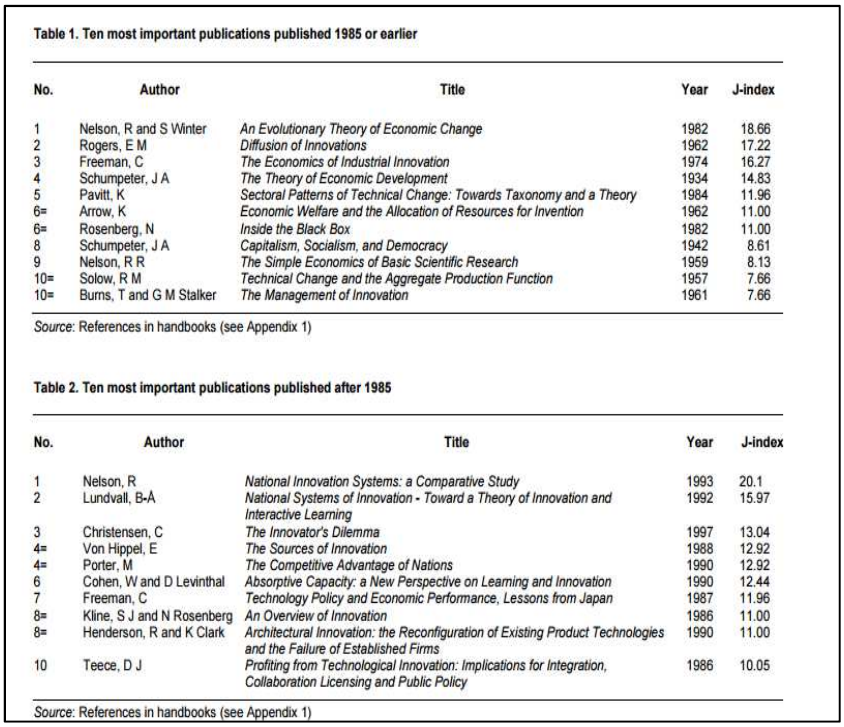

Table 1. Ten most important publications published 1985 or earlier

No.	Author	Title	Year	J-index
1	Nelson, R and S Winter	*An Evolutionary Theory of Economic Change*	1982	18.66
2	Rogers, E M	*Diffusion of Innovations*	1962	17.22
3	Freeman, C	*The Economics of Industrial Innovation*	1974	16.27
4	Schumpeter, J A	*The Theory of Economic Development*	1934	14.83
5	Pavitt, K	*Sectoral Patterns of Technical Change: Towards Taxonomy and a Theory*	1984	11.96
6=	Arrow, K	*Economic Welfare and the Allocation of Resources for Invention*	1962	11.00
6=	Rosenberg, N	*Inside the Black Box*	1982	11.00
8	Schumpeter, J A	*Capitalism, Socialism, and Democracy*	1942	8.61
9	Nelson, R R	*The Simple Economics of Basic Scientific Research*	1959	8.13
10=	Solow, R M	*Technical Change and the Aggregate Production Function*	1957	7.66
10=	Burns, T and G M Stalker	*The Management of Innovation*	1961	7.66

Source: References in handbooks (see Appendix 1)

Table 2. Ten most important publications published after 1985

No.	Author	Title	Year	J-index
1	Nelson, R	*National Innovation Systems: a Comparative Study*	1993	20.1
2	Lundvall, B-Å	*National Systems of Innovation - Toward a Theory of Innovation and Interactive Learning*	1992	15.97
3	Christensen, C	*The Innovator's Dilemma*	1997	13.04
4=	Von Hippel, E	*The Sources of Innovation*	1988	12.92
4=	Porter, M	*The Competitive Advantage of Nations*	1990	12.92
6	Cohen, W and D Levinthal	*Absorptive Capacity: a New Perspective on Learning and Innovation*	1990	12.44
7	Freeman, C	*Technology Policy and Economic Performance, Lessons from Japan*	1987	11.96
8=	Kline, S J and N Rosenberg	*An Overview of Innovation*	1986	11.00
8=	Henderson, R and K Clark	*Architectural Innovation: the Reconfiguration of Existing Product Technologies and the Failure of Established Firms*	1990	11.00
10	Teece, D J	*Profiting from Technological Innovation: Implications for Integration, Collaboration Licensing and Public Policy*	1986	10.05

Source: References in handbooks (see Appendix 1)

Wu, Lessig and van Schewick are not listed as leading scholars of innovation, nor is net neutrality a salient theme in the innovation literature. Of all of these authors, only Von Hippel and Teece discuss net neutrality. Eric von Hippel[132] mentions net neutrality in passing in his paper discussing open innovation models. In a concluding line, the paper notes that net neutrality "might" have implications for innovation, and that "ownership of content and ownership of channel be separate" (quoting Lessig). Hippel also signed a letter in support of the FCC's net neutrality rulemaking along with a group of

[132] Carliss Y. Baldwin and Eric von Hippel, "Modeling a Paradigm Shift: From Producer Innovation to User and Open Collaborative Innovation," 2009, http://www.hbs.edu/faculty/Publication%20Files/10-038.pdf.

academics.[133] However dozens of academics have questioned net neutrality and have also written the FCC in similar crowdsourced style.[134] Teece spends 74 pages addressing the charges of net neutrality proponents and concludes,

> The proposed "nondiscrimination" rule would have the ironic effect of actively discriminating against any kind of content or application that is differentiated by its need for greater assurance of higher quality transmission across the Internet (known as quality of service, or QoS) than undifferentiated best-effort delivery can offer. This result not only would reduce static efficiency by encouraging higher consumer prices, but also would reduce dynamic efficiency by retarding innovation. The proposed rule manifests an inverse relationship between means and ends, for it would actively thwart the Commission's stated purpose of promoting innovation both in and at the edges of the network.[135]

In any case, a number of these authors are helpful to review in defining innovation and helping to inform innovation policy, whether with net neutrality or not. Here are some of the key concepts of innovation discussed in light of the Internet.

2.4.1 SCHUMPETER AND CREATIVE DESTRUCTION

Joseph Schumpeter re-interpreted Marx in *Capitalism, Socialism and Democracy.*[136] Giving the example of the dearth of wood forcing a

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[133] "Letter in Support of the FCC's Net Neutrality Rulemaking," January 29, 2015, http://www.pijip.org/wp-content/uploads/2015/01/Net-Neutrality-Prof-Letter-01292015.pdf.

[134] Jerry Brito et al., "Net Neutrality Regulation: The Economic Evidence," SSRN Scholarly Paper (Rochester, NY: Social Science Research Network, April 12, 2010), http://papers.ssrn.com/abstract=1587058.

[135] J. Gregory Sidak and David Teece, "Innovation Spillovers and the 'Dirt Road' Fallacy: The Intellectual Bankruptcy of Banning Optional Transactions for Enhanced Delivery Over the Internet," SSRN Scholarly Paper (Rochester, NY: Social Science Research Network, April 26, 2010), http://papers.ssrn.com/abstract=1593761.

[136] J.A. Schumpeter, *Capitalism, Socialism, and Democracy*. (Harper, 1942).

need to find energy substitutes, Schumpeter promoted the idea that necessity creates invention. Rather than see the business cycle as a Marxist process of accumulation and annihilation of wealth, Schumpeter proposed "creative destruction" as an engine of renewable economic growth, a force "that incessantly revolutionizes the economic structure from within, incessantly destroying the old one, incessantly creating a new one". Schumpeter saw entrepreneurs as creating economic growth and destroying established industries and monopolies. He would have likely celebrated the emergence of over the top technologies (OTTs) such as Skype and WhatsApp which offer a competitive challenge to traditional operators' communications services.

In addition "creative destruction." Schumpeter advanced other concepts of technical change into neoclassical economic theory. He is also known for his discussion of the trilogy of invention, innovation, and diffusion. He distinguishes between invention (generation of new ideas), innovation (development of new ideas into a marketable products and process), and diffusion (spread of these products and processes across potential markets).

Search engines provide an example of Schumpeter's concepts. While the computer inputs of today's search engine can be traced to Vannevar Bush's 1945 concept of the "memex" which inspired the development of hypertext[137], the first modern search engine was was "Archie", a tool used to search webservers by scientists at McGill University in Canada in the early 1990s. Seven years later, Google created the innovation of pairing search results with advertising, an idea they appropriated from competitor Goto.com.[138] Diffusion could be described as the process by which users adopt Google's services. In any case, the idea of innovation simply being a function of network

[137] "SearchEngineHistory.com," accessed November 10, 2016, http://www.searchenginehistory.com/.

[138] Will Oremus, "Google's Big Break," *Slate*, October 13, 2013, http://www.slate.com/articles/business/when_big_businesses_were_small/2013/10/google_s_big_break_how_bill_gross_goto_com_inspired_the_adwords_business.html.

"openness" ignores decades of science and subsequent tinkering to create new and novel things.

Some additional learnings from Schumpeter include the important distinction between adoption (the decision to incorporate a new technology into activities, typically a firm) and diffusion (how market share changes over time). Schumpeter believed adoption is driven by costs and benefits and prior investment decisions, e.g. replacement versus new goods.

Net neutrality advocates are concerned that telecom operators block competing applications such as Skype and WhatsApp, but these two apps have succeeded to disrupt effectively the revenue of telecom operators worldwide. Already in 2013 one-third of the world's long distance calling took place over Skype.[139] The company was purchased by Microsoft in 2011, and is one of the world's top apps. As of 2016 WhatsApp and Facebook Messenger, two apps owned by Facebook, delivered 30 billion messages per day, exceeding by 10 billion the total amount of proprietary the world's mobile operators delivered at their height, 20 billion SMS daily.[140] WhatsApp has succeeded to become one the world's single most successful mobile applications, regardless of whether net neutrality rules are present or not.

In the US, the case of Madison River, a rural operator in North Carolina which blocked voice of Internet Protocol provider Vonage, is the example proffered by net neutrality advocates as justifying ex ante rules. However the FCC addressed the issue promptly with a cease and desist letter to the carrier and a $15,000 fine,[141] suggesting that the FCC could police bad behavior effectively without new net neutrality

[139] "Report: Skype Makes up One-Third of All International Phone Traffic," *FierceWireless*, February 13, 2013, http://www.fiercewireless.com/story/report-skype-makes-one-third-all-international-phone-traffic/2013-02-15.

[140] Evans, Benedict. "WhatsApp Sails Past SMS, but Where Does Messaging Go Next?," January 11, 2015, http://ben-evans.com/benedictevans/2015/1/11/whatsapp-sails-past-sms-but-where-does-messaging-go-next.

[141] Federal Communications Commission Washington, D.C. 20554, March 3, 2015 https://apps.fcc.gov/edocs_public/attachmatch/DA-05-543A1.pdf

rules. Faulhaber suggests that blocking is not profitable for the serious telecom operator, for reasons of transaction costs, public opinion, and distraction from core business activities.[142]

In Schumpeter's view, regulation is not needed as innovators overtake incumbents though natural, economic forces. The "creative destructive" concept has been evolved to one of "creative cooperation" by Rothaermelin.[143] That telecom operators need not be destroyed but rather they can partner with competitors is also implicit in the notion of co-opetition,[144] that dynamic organizations both cooperate and compete.

2.4.2 ROGERS AND THE DIFFUSION OF INNOVATION

Net neutrality proponents suggest that end-to-end design of the network itself is what leads to innovation. This may be a simplistic notion as all networks are end-to-end systems by definition. Sociologist Everett Rogers suggested that more complex social process underlie the process of adoption of innovation and his bell-curve of the diffusion of innovation is a touchstone in the literature.[145]

Rogers defined diffusion as a process in which innovation is shared over communication channels over time among the members of a social system. An innovation (also called technology) is an idea,

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[142] Gerald R. Faulhaber, "Economics of Net Neutrality: A Review," SSRN Scholarly Paper (Rochester, NY: Social Science Research Network, June 9, 2011), https://papers.ssrn.com/abstract=1894286.

[143] Frank T. Rothaermel, "'Creative Destruction' or 'creative Cooperation'?: An Empirical Investigation of Technological Discontinuities and Their Effect on the Nature of Competition and Firm Performance," ResearchGate, accessed June 20, 2016, https://www.researchgate.net/publication/33519274_Creative_destruction_or_creative_cooperation_an_empirical_investigation_of_technological_discontinuities_and_their_effect_on_the_nature_of_competition_and_firm_performance.

[144] Arthur H. Copeland, "Book Review: Theory of Games and Economic Behavior," Bulletin of the American Mathematical Society 51, no. 7 (July 1, 1945): 498–505, doi:10.1090/S0002-9904-1945-08391-8. in 1944 and also Bradenburg and Nalebuff

[145] Everett Rogers, *Diffusion of Innovations*, 5th Edition (Free Press, 2003).

practice, or object that is perceived as new. It can include a hardware and/or software aspect. It may or may not be a part of a technology cluster. Rogers outlined re-invention as a change or modification of an innovation.

Rogers discussed the perceived attributes of the innovation including relative advantage (improvement over the status quo), compatibility (how it fits into the person's life), complexity (degree of difficulty of adoption), "trialability" (how much one can experiment before adoption), and observability (degree to which benefits are visible to others).

Rogers defined the communication channels as mass media (creates knowledge and awareness), interpersonal (persuading individuals), heterophly (experts), and homophily (peers). Rogers discussed time as steps in the innovation process: knowledge, persuasion, decision, implementation, and confirmation. Decision are made either optionally, collectively or by authority. Rogers emphasized that the diffusion of innovation as a social, not economic process. He described the norms, degree of networks, and interconnectedness in social systems. In Rogers' model, opinion leaders and change agents are important.

Rogers' model and its attendant bell curve have been used to explain numerous innovations, especially the growth in smartphones. Net neutrality as an autonomous principle would likely be too general for Rogers, who would have probably emphasized the role of social actors in technology adoption, for example how viral adoption is facilitated by both online and offline social networks.

In Rogers' world, simply having an innovation is not in itself enough to drive adoption. He was particularly interested in laggards, the people who don't adopt technology regardless of the benefits it brings. Rogers suggest that people have to be introduced to innovation through peers.

2.4.3 CHRISTIANSEN AND DISRUPTIVE INNOVATION

Disruption is a another term frequently used with innovation. It comes from Clay Christiansen's *The Innovator's Dilemma: When New Technologies Cause Great Firms to Fail.*[146] Christiansen describes how well-managed companies addressing their best customers fail to see opportunities created by low-cost competitors focusing on an unprofitable market segment or "disruptive innovation".

Christiansen describes the difference between sustaining and disruptive technologies and notes that most technological advances are sustaining technologies; they improve the performance of existing products. Occasionally technologies are disruptive. They underperform existing products at first, but then emerge to be simpler, better, faster, and cheaper than existing products.

One characteristic of disruption Christiansen observes is that it provides firms lower margins, not higher profits. This can be observed with Skype and WhatsApp. Skype may be the single most powerful disruptor in the history of telephony. For the year ended 2010 Skype's revenue was $860 million, its last published revenue before it was purchased by Microsoft for $8.5 billion. Skype had 668 million users, 18 percent of which were active users, and 8.8 million paying users.[147] With 124 million active users, Skype made less revenue than the annual operating profit of many mobile operators. It is worth noting that an operator with 124 million subscribers would earn many billions of dollars, but Skype made less than $1 billion.

Microsoft purchased Skype as a sustaining innovation. Microsoft does not provide individual financials for Skype, but it is bundled in the same business line with Microsoft Lync, an enterprise communications platform. Of the world's largest 100 companies, 90

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[146] Clay Christiansen, *The Innovator's Dilemma: When New Technologies Cause Great Firms to Fail.* (Harvard Business Review, 1997).

[147] "Microsoft Advertising International Skype Media Overview." (Microsoft, July 2013), http://advertising.microsoft.com/en-us/WWDocs/User/display/cl/brand_subproperty/1589/global/Microsoft-Advertising-International-Skype-Media-Overview.pdf.

purchase the Lync platform for enterprise communications.[148] Indeed Skype may well be a "loss leader"[149] for Microsoft, a flagship service brand that increases the value of the overall platform.

Most of Skype's users are individuals who do not pay for the service. Like many Internet companies, Microsoft offers Skype both in free and premium versions, with the paying customers subsidizing the non-pay users. Microsoft earns fees on the enterprise sales of Lync and from off-net communications revenue from Skype. Connecting to Skype.com may be governed by the end to end principle, but any enhancement or features in the service are now ensured by Microsoft, so it cannot be that the end to end principle alone is responsible for Skype's innovation.

The online messaging service WhatsApp is similar example of disruptive and sustaining innovation. Millions of users substitute free WhatsApp for the proprietary SMS solutions offered by operators. Facebook found that some of its users were defecting to WhatsApp, so it acquired the startup for $19 billion.[150]

2.4.4 LUNDVALL AND NATIONAL INNOVATION SYSTEM

The National System of Innovation (NIS)[151] emerged as a critique of neo-classical economics with its focus on scarcity, allocation, and exchange in a static context. The NIS attempts a more dynamic understanding of innovation and the role of learning in a system. Its key assumption is that the most important resource in an economy is knowledge, and the most important process is learning. It also notes

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[148] Dina Bass, "Microsoft Skype Unit Approaching $2 Billion in Annual Sales," Bloomberg, February 19, 2013, http://www.bloomberg.com/news/2013-02-19/microsoft-s-skype-unit-approaching-2-billion-in-annual-revenue.html.

[149] Federal Trade Commission and Patrick DeGraba, Volume Discounts, Loss Leaders, and Competition for More Profitable Customers (Pennyhill Press, 2013).

[150] "Facebook to Acquire WhatsApp | Facebook Newsroom," February 19, 2014, http://newsroom.fb.com/news/2014/02/facebook-to-acquire-whatsapp/.

[151] Bengt-Åke Lundvall, ed., *National Systems of Innovation: Toward a Theory of Innovation and Interactive Learning*, Revised ed. edition (London; New York, NY: Anthem Press, 2010).

that learning is embedded in a social context and can't be understood without reference to institutions and culture. Globalization both strengthens and weakens the NIS.

The NIS posits the notion of learning and industrialization predicated on the classic idea of a nation state with its particular endowments. The nation state has two key dimensions, national-cultural (the individuals belonging to a nation with their linguistic, ethnic and cultural characteristics) and the political state (the geographic area belonging to a single authority). The paradigm of a nation state is that it is an "engine of growth" which has experienced a process of economic transformation from the agricultural to the industrial age and now to the information age.

The NIS is first a social system. Systems can have both virtuous and vicious circles that both support and well as hinder innovation, a dynamic system that includes positive feedback and reproduction (of knowledge, i.e. remembering). As such, the borders of national innovation system may be loose.

Lundvall and many of his collaborators in the Innovation, Knowledge and Economic Dynamics (IKE) school at Aalborg University focused their study on the Nordic countries, which they recognize to be culturally homogenous and economically coherent, as well as "small" nations in the sense of geography and population. They believed their work to be relevant for the European Union, a supra-structure for 28 European nations, where there are both national and regional innovation systems, with indistinct borders at times. They note that national innovation systems are evolving and heterogeneous, reflecting how countries have been open to trade.

A key issue today is that corporations can weaken their tie to a nation state as they source innovation and inputs from other nations, creating both the challenge that firms are less connected to their native country, but on the other hand, globalization may bring new firms to the country.

Lundvall notes a number of issues and concerns of the NIS from a public policy perspective including

- The level at which the government intervenes. This is important because a government could reproduce weaknesses at the national level or induce a dynamic that is illogical to the system.
- The interplay between countries and conflict about who "pays" for innovation and who benefits
- That countries differ in their ability to exploit innovation
- That the classic measure of R&D expenditure as a portion of GDP, could also be described as patents, new products, high technology in trade. There is problem in that discrete measures don't necessarily take into account the diffusion process.
- That progress itself is not the goal, but an outcome that can be measured in economic growth , e.g. income or consumption, but these measures are not necessarily related to innovation. For example innovations in vaccines could reduce income and consumption in certain kind of health services. People would be better off because a vaccine obviates the need for less effective treatment.
- The recognition that some global problems do not lend themselves to be addressed at the nation state level
- That solution is not necessarily to dismantle national institutions (though that could be one outcome), but rather to see how an institution must learn and evolve.

The NIS also critiques the neoclassical view of innovation that assumes innovation as something that happens from the outside, a defined event that upsets the equilibrium and the sets a new equilibrium. Lundvall observes,

> In modern capitalism, however, innovation is a fundamental and inherent phenomenon; the long-term competitiveness of firms, and of national economies, reflect their innovative capability and, moreover, firms must engage in activities which aim at innovation just in order to hold their ground.

National innovation systems assume innovation not as an event, but as a ubiquitous and cumulative process. Innovations may be as

Schumpeter described, simply new and obvious "combinations" but also "creative destruction". Fundamental to the innovation process are interactive learning and collective entrepreneurship, both of which Schumpeter described. However his first discussion of innovation focusing on the lone entrepreneur (1934) evolved into collective R&D laboratory (1942). Perhaps the defining scientific advancement in the 20th century was innovation as a collective activity, as a result of interdependence between many actors.

To be sure, the institutional set up matters. Institutions, which are the set of organizations, establishments, laws, and norms, play an important role to reduce uncertainty as well as to support innovation.

The NIS also distinguishes between incremental and fundamental innovation. Innovation is not wholly accidental or wholly predetermined, but there is a strong element of randomness.

Lundvall describes a few of the actors the innovation system including firms, the public sector, the financial sector, R&D organizations, and the educational system. To that list, one could include entrepreneurs and users.

These actors are constituted differently across countries. The importance of how the market is organized in terms of firms as well as the organization of the firm itself seems obvious. The Public sector is important not just for the rules and regulations it creates, but as a user of innovation. How innovations are financed is also an aspect of the national innovation system as is the research and development function in the various places it resides. Finally the various elements of learning and education will comprise an NIS, as well as the degree of its egalitarian or elitist dimensions. It would seem that now in the age of information and Internet, one could add the set of users, whether human or machine, to the list of actors.

Lundvall recognizes the influence of Friedrich List who argued about the need for nations to support nascent industries.[152] List offered a

[152] Friedrich List, *The National System of Political Economy*, 1845, http://oll.libertyfund.org/titles/list-the-national-system-of-political-economy

critique of Adam Smith's "cosmopolitan" approach, focusing on resource allocation among countries and the notion that nations were engaged in producing and exchanging a finite set of goods.

2.4.5 DAVID TEECE AND COMPLEMENTARY ASSETS

When thinking about Internet innovation, David Teece's 1986 paper "Profiting from technological innovation: Implications for integration, collaboration, licensing and public policy"[153]is essential. Teece observed that most innovations are not products themselves. They have to be combined with complementary assets before they can be marketable products. Such partnerships lower barriers to entry for the innovator and can provide rewards to an innovator upfront.

Teece discusses a number of assets that must be in place before an innovation can take root. They include marketing, specialized manufacturing, and/or after-sales support. He distinguishes the assets into generic, specialized, and co-specialized categories. In the context of the Internet, HTML may be a generic asset, a language that allows innovators to create websites. Just as a factory is needed to make shoes, a mobile application needs a network. Thus a specialized asset may be an operating system that runs on a mobile phone, such as Apple iOS or Android. A co-specialized asset may be a 4G mobile network for the Apple iPhone, its complementary asset. Many iPhone features can't be realized unless the phone is connected to the appropriate 4G mobile network.

Marketing is a type of complementary asset. For many firms the cost on getting online is nominal: fees of hosting, storage, and servers. Where they face major barriers may be competition from other content, applications, and services, not to mention being findable on platforms such as search engines, social platforms, and app stores. The practices of SEO (search engine optimization) and ASO (app store optimization) are designed to help companies and innovative

[153] David Teece, "Profiting from Technological Innovation: Implications for Integration, Collaboration, Licensing and Public Policy," School of Business Administration, University of California, Berkeley, CA 94720, U.S.A., June 1986, http://www4.lu.se/upload/CIRCLE/INN005/Teece_Reflections.pdf.

applications overcome these intermediaries. It seem that if there was a "neutral" internet, there would be no need for such marketing practices. Consumers would blithely traverse the network without the intermediation of search engines or social networks.

The Teece thesis contradicts Lemley and Lessig's end to end principle. Teece says that different parties have to make partnerships or "join complementary assets" (e.g. content provider and broadband provider) in order to make applications known. Applications on their own have no value, or will almost never be found, unless they are joined with their complementary asset. Net neutrality rules in some instances are prohibitions against telecom operators creating partnerships with content providers.

Further, Teece's paper attempts to predict when the innovator will succeed or the follower. To determines who wins, one needs to examine (1) appropriability, how easy is it to leverage knowledge, ease of imitation, intellectual property etc; and (2) complementary assets, who owns what (generic, co-specialized, specialized).

Teece also distinguishes between invention and innovation (ability to do something better than the state of the art), the latter of which adds value to users and economy. It bears mention that net neutrality implicitly values the innovation at the "edge" of the network, greater that of the core or the network. In this way, the value of an edge application or service, whether Wikipedia or Conservapedia is greater than any fundamental innovation in the network itself, such as 5G.

Teece observes that innovating firm frequently fail to win the profits of their innovation, that the owner of the intellectual property doesn't necessarily get the benefit. It goes instead to customers, suppliers, or competitors—that actor which has the complementary assets. He gives the examples of EMI having developed the CAT scanner but competitors succeeding to commercialize it (EMI dropped out of the market seven years later); RC Cola having developed diet soda but both Coca-Cola and Pepsi succeeding; Bowmar introducing the calculator but HP and Texas Instruments commercializing it; and Xerox developing the fundamental innovations that Apple managed to commercialize.

To overcome this, incumbent firms would be wise to get a position in the complementary asset market. Frequently it is not the firm that is first to market that wins, but rather that which is third, fourth and so on. This may explain the rising success of Chinese apps that is discovered in the analysis. In any case, the need to work with complementary firms is reflected in the presence of joint ventures, co-production agreements, cross-distribution arrangements, and technology licensing.

Teece also describes two stages of scientific evolution, the pre-paradigm stage and the paradigm stage. In the pre-paradigm stage there are generally accepted designs. There are competing ideas, and designs are fluid. In the paradigm stage, designs become accepted, codified, and standardized. One design emerges as best, e.g. Model T, IBM 360, Douglas DC-3. Once design emerges, competition shifts to price away from design. Scale and capital then become important. Innovation can still occur, but may be in niches. This model tends to characterize large consumer markets with homogenous tastes.

Few industries have the benefit of strong appropriabilities. Most of the time the appropriability is weak, so the innovator needs a business model to make its innovation known. In the pre-paradigm stage, innovators need to allow their designs to "float" to get enough of a market test to see whether they can work. In the pre-paradigm stage, the focus in on the winning design. Production is low (few users), so doesn't yet make sense to deploy specialized assets. There are no scale economies, and price is not necessarily an issue With the move to the paradigm stage, investment become irreversible. Once the design becomes standardized, then the importance of complementary assets takes over.

Marketing/distribution is a key complementary asset. This was demonstrated with PC market. Many companies made computers but few succeeded because the scale required to sell to companies in the US (need a large sales force, get on retail shelves etc). So the strategy is to sell to the big provider, .e.g IBM.

In any case, Teece concludes that strategic partnerships frequently don't work for the reasons he cites. This should assuage net neutrality

proponents which are concerned that if a telecom operators provides access to some destinations for free, that those destinations and that operator will gain market share. Separate analysis on this question shows that such partnerships actually result in little to no benefit for the parties, as the markets they operate are so competitive that even offering free access is not a sufficient inducement[154].

IBM's success in PC market was related to its joining the complementary assets, many of them generic. It made more sense for IBM to find them in the market than to develop them in house. IBM's asset relative to the generic inputs was its strong brand which, engendered credibility with customers, plus its formidable marketing and distribution network.

For a detailed discussion of complementary assets applied to mobile app development in emerging countries, see the research conducted by Layton and Elaluf-Calderwood.[155]

2.4.6 JEAN TIROLE AND TWO SIDED MARKETS

Tirole won the 2014 Swedish Royal Bank Prize in Economic Sciences in Memory of Alfred Nobel for "his analysis of market power and regulation"[156]. At 61, Tirole was among the youngest among winners of the Economics Noble Prize, however there is no doubt that his work in industrial economics and game theory has revolutionized the

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[154] Roslyn Layton and Silvia Monica Elaluf-Calderwood, "Zero Rating: Do Hard Rules Protect or Harm Consumers and Competition? Evidence from Chile, Netherlands and Slovenia," SSRN Scholarly Paper (Rochester, NY: Social Science Research Network, August 15, 2015), http://papers.ssrn.com/abstract=2587542.

[155] Roslyn Layton and Silvia Monica Elaluf-Calderwood, "Free Basics Research Paper: Zero Rating, Free Data, and Use Cases in Mhealth, Local Content and Service Development, and ICT4D Policymaking," SSRN Scholarly Paper (Rochester, NY: Social Science Research Network, September 27, 2016), https://papers.ssrn.com/abstract=2757384.

[156] "Jean Tirole - Facts," accessed June 20, 2016, http://www.nobelprize.org/nobel_prizes/economic-sciences/laureates/2014/tirole-facts.html.

understanding of many industries including internet-based businesses, telecommunications, advertising, banking, and finance.

Key amongst his contribution is the notion of two-sided markets or platforms, first presented with Jean-Charles Rochet[157] in 2003. This theory offers a robust counterpoint to network neutrality. The literature of two-sized markets comprises over more than 70,000 articles covering a variety of industries.

The theory of two-sided platforms observes that there is an inherent incentive to price efficiently, meaning that market failures are unlikely to occur. Platforms want to get both sides of the market "on board" so they tend to maximize—not foreclose—the participation of the other parties. Anything that a broadband provider does to foreclose one side or the other, reduces its profits. This suggests that there is not an incentive for operators to behave in a warm that harms content providers or users. But vitally the companies reinforce each other. A recent release from the companies shows that Comcast and Netflix have integrated their offerings into a single user interface so that users can sort through all the options in the same place.[158]

Two-sided markets could explain why Netflix has grown to be the world's leading streaming video service with over 81 million members[159], even though it competes against Comcast, a cable company that delivers its services. Anything that Comcast would do to threaten the popular service would risk it losing customers. Two-sided markets might also suggest that Netflix could become so popular that it could withhold its content from Comcast and demand a

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[157] Jean-Charles Rochet and Jean Tirole, "Platform Competition in Two-Sided Markets," Journal of the European Economic Association 1, no. 4 (2003): 990–1029.

[158] Comcast To Launch Netflix On X1 To Customers Nationwide, November 4, 2016, http://corporate.comcast.com/news-information/news-feed/comcast-to-launch-netflix-on-x1-to-millions-of-customers-nationwide

[159] Ben Popper, "Netflix Passes 81 Million Subscribers, but Predicts Slower Growth Ahead," The Verge, April 18, 2016, http://www.theverge.com/2016/4/18/11454362/netflix-q1-2016-earnings-81-million-subscribers.

payment from Comcast for the right to deliver to Comcast customers. All of these relationships are based on supply and demand.

There are millions of sources of content, services, and applications on the internet. End users buy a subscription to access them under best efforts conditions. In general it is not in the broadband providers' interest to make a contract with every possible information source on its network. The transactions costs are simply too high.

It is the case, however, that a handful of applications and services are particularly popular and highly demanded above others. It becomes the case that the operator must deliver these services or the end users won't subscribe to the network. The debate has emerged as to how to pay for the access to the network and its various sides.

Netflix offers a streaming video service that consumes more than half of the network's capacity and frequently impinges on other, non-Netflix users' ability to enjoy the network. Frequently broadband providers need to provision additional capacity to deliver Netflix. Because the Netflix subscribers are a small portion of any one network's user base, the ISP would like Netflix to participate in the cost of delivering the service, so it does not have to impose the cost across all its subscribers, especially those that do not desire Netflix. The Netflix perspective, following the net neutrality argument, is that the broadband providers' choice of technology is its responsibility, and it is incumbent on the broadband provider to deliver Netflix data regardless of the cost. Netflix's desired outcome is for the broadband provider to invest in excess network capacity and raise the subscription price on all network users, rather than the cost be borne by Netflix and its subscribers.

In other instances, a content provider may want to subsidize the delivery of its content to maximize viewing. A health care provider would be willing to subsidize the cost of mobile subscriptions to its members to encourage adoption of preventative health care and monitoring tools. The cost of avoiding an adverse health event is well worth the price of a broadband subscription. The health care member benefits with better health outcome and the health care provider

reduces costs. This is clearly a win-win for the parties, but such arrangements are also verboten in the net neutrality notion.

Two-sided markets explains much of how participation by advertisers and content providers drove the expansion of the media industries in the US. One of the key benefits of this model is that viewers didn't need to bear all the costs themselves; it was shared by the participants on the other side of platform, namely advertisers who funded radio and television programs so consumers didn't have to pay out of pocket. With regard to newspaper and magazines, people have availed themselves to a variety of models whether by subscription, advertising subsidized, publisher-underwritten, or a combination thereof.

Tirole and the highly developed theory and practice of two-sided markets demonstrates that outright bans on internet business models do not support consumer welfare. Furthermore the concerns raised by net neutrality supporters, that operators have incentives to foreclose content, services, and applications are not justified. In any case, two-sided markets would say that it is inconsistent to allow content and service providers (for example how Google's AdWords platforms serves both users and advertisers) to enjoy the benefits of two-sided markets, but not broadband providers.

Two-sided markets exist in media, credit cards, insurance, video games, internet platforms, nightclubs, and so on. Disputes in these markets are generally managed with competition law, which can also work for broadband providers. It's not evident that a special set of rules are needed for net neutrality as the concerns recapitulate classic competition law issues bundling, tying, refusal to supply, predatory pricing etc.

Tirole observes, "Successful regulation is built on an intellectual consensus about the existence of clearly identified and sizeable market

failure."[160] He adds, "Public policy should be guided by social interest, not special interest."[161]

2.4.7 CHRISTOPHER YOO AND THE *DYNAMIC INTERNET*

Professor of Law and Computer Science Christopher Yoo is in fact the author with the most citations for net neutrality using the aforementioned Google Scholar search. Yoo's *Dynamic Internet*[162] provides the most cogent arguments countering the neutral platform paradigm of Tim Wu.

Yoo asserts that the needs of users, services, and applications demand that the Internet's architecture become more dynamic and is thus ill-suited to a one-size-fits-all "neutral platform." Wu describes network engineering as a "pragmatic, context-sensitive discipline that is an exercise in tradeoffs and is not susceptible to broad, theoretical generalizations." Diversification provides users with more services that fit their needs while simultaneously making the network more competitive. The network must evolve to meet new demands required by a constantly-changing environment

Wu suggests that regulators and network engineers need to be open for experimentation. The benefits of solutions may be ambiguous before they are tried, but if possible approaches are foreclosed by ex ante rules, engineers are denied valuable real world experience they need to design and innovate. As such, policymakers should not try to predict which solution will prevail. Rather they should allow change as a natural part of the internet's evolution.

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[160] Jean Tirole, "Review of Network Economics," March 2011, idei.fr/doc/by/tirole/tsenotes4.pdf.

[161] Jean-Charles Rochet and Jean Tirole, "Platform Competition in Two-Sided Markets," IDEI Working Paper (Institut d'Économie Industrielle (IDEI), Toulouse, 2003), http://ideas.repec.org/p/ide/wpaper/654.html.

[162] J. Gregory Sidak, David Teece "Innovation Spillovers and the 'Dirt Road' Fallacy: The Intellectual Bankruptcy of Banning Optional Transactions for Enhanced Delivery Over the Internet." SSRN," accessed June 20, 2016, http://papers.ssrn.com/sol3/papers.cfm?abstract_id=1593761.

Wu summarizes the major changes in the Internet since 1995 when it became a commercial phenomenon, suggesting that these changes demand a dynamic, not neutral, approach. The changes include

1. Increase in the number and diversity of end users, while moving away from this close-knit engineer/academic community. The Internet has grown beyond just the World Wide Web.

2. Increase in the diversity and intensity of applications such as peer-to-peer technologies and and cloud computing which create different traffic patterns compared to early applications. There are profound differences as users select technologies with a range of requirement and capabilities such as unicasting to multicasting models; client-server to peer-to-peer setups; applications which demand symmetrical vs. asymmetrical traffic; the interplay between app store and platform; browsers and operating systems; and the requirements of cloud computing such as increased bandwidth, ubiquity, privacy, and security.

3. Increase in the variety of technologies, including the shift from dial up to cable, DSL, fiber and mobile. New networks vary with bandwidth, reliability, mobility, susceptibility to congestion, and new kinds of devices: laptops, tablets, smartphones, e-readers, RFID readers etc. Pervasive computing and sensor networks may require a different network architecture. Smartphones have special challenges. A modern smartphone has nearly the same computing power as a mainframe computer, and it pressures the network's capacity, increases the intensity of network utilization. Some varieties of phones and applications take vastly greater network consumption than others the rate of other users, constraining the network. Hence one-size-fits-all solutions don't work with such a heterogeneous mix of networks, devices, applications

4. Emergence of complex business relationships. The original topology of the Internet was backbone, regional operator, and last mile providers. That has evolved to accommodate new relationships through private peering, multihoming, secondary peering, CDNs, and server farms.

Yoo concludes that the founding principles of the Internet, if there even was such a thing, are no longer appropriate and gives the following reasons:

1. Changes in the optimal level of standardization. Not all goods in every market are standardized, and customers often benefit from purchasing customized products and services. There is a tradeoff between providing all connections on a best efforts basis versus allowing consumers and providers to contract for quality guarantees for specific services.

2. The focus on one price to entire internet tends to commodify services, forces networks to compete on price and volume, reinforcing the power of the dominant players. Increasing the dimensions on which networks compete can allow new players to emerge. The increasing heterogeneity in the network should allow flexibility both in pricing and management. There is no one network paradigm that does it all. Different networks and practices are suited to different services and applications.

3. The migration of functions into the core of the network is desirable, such as security and congestions management.

4. Internet pricing needs to flexible to reflect heterogeneous bandwidth consumption, congestion management, and the increasing diversity of applications each with different demands on the network. Financing as a flat fee across the board is both unfair and uneconomical. In fact the diversity of

business relationships and pricing regimes serves to weaken rather than strengthen market power

5. There has been significant maturation of the industry necessitating modernization of regulation. Moreover innovation depends on consumers ability to absorb pace of product innovation. Yoo alludes to Teece in noting that "Partnerships are not attempts to stifle competition but mechanisms for lowering entry requirements for innovators."

Yoo describes the implications for net neutrality as one of tradeoffs, that while many users can enjoy the same product at lowered cost, this reduces product variety and forces some users to forego alternative versions better suited to their preferences. It If everyone wants the same thing, then a reduction in variety is ok. But if end user preferences become heterogeneous, networks should be allowed to provide different things. There is no such thing as the perfect architecture. It depends on the nature of data flows and the costs. Rather than ex ante rules, Yoo suggests that policymakers focus on reducing switching costs for consumers, lowering entry barriers for producers, and increase transparency in business relationships

Yoo would observe that the Internet has become even more complex with the emergence of mobile and wireless, an important technological reality that was not a part of Wu's paradigm. Emergence of diversity is less of a problem and more of a precondition for meeting users' needs

2.4.8 THE ECOSYSTEM THEORY OF INNOVATION

Innovation is frequently described in terms of an ecosystem, a term from biology related to the complexion of living organisms and physical environments functioning together.[163] A biological ecosystem

[163] Deborah J. Jackson, "What is an Innovation Ecosystem?", accessed November 10, 2016. http://erc-assoc.org/sites/default/files/topics/policy_studies/DJackson_Innovation%20Ecosystem_03-15-11.pdf

is also characterized by a state of equilibrium in which nutrients can be exchanged at a sustainable level. Whereas a biological ecosystem is a model of the energy dynamics by organisms and their environment, an innovation ecosystem is the model of economic exchange between a complex set of actors to enable technological development. The inputs include materials resources, human capital, and institutions. Innovation ecosystems bridge the knowledge economy based on fundamental research and the commercial economy based on the marketplace, both of which are mediated by government. The belief that innovation leads to wealth creation undergirds the focus on innovation policy both by national leaders and national science foundations, and particularly the fact that high-tech industries have productive capacity to increase jobs and salaries.[164]

An innovation ecosystem is said to be thriving and healthy when the resources invested in the knowledge economy are subsequently replenished by innovation induced profit increases in the commercial economy. When profits exceed the investment, the economy is said to be growing. A feedback loop or "virtuous circle" is said to result when profits are invested back into fundamental research. Jackson offers a circular diagram noting fundamental technology breakthroughs; leading to new products, processes and features; increased sales and profits (whereby the commercial and knowledge economies meet); and subsequent investment in R&D, which replenishes the cycle in fundamental breakthroughs.

2.4.9 THE CIRCLE THEORY OF INNOVATION

The idea of a virtuous circle is a powerful one, a subsequent cycle of events in which each brings benefits to the next. The notion was first noted by the British Vernon Lee, the late 19th century novelist and aesthete in her appraisal of John Ruskin and his "virtuous circle of virtuous efficacy."[165] Just as the Internet drives themes of the

[164] ibid

[165] Vernon Lee, Gospels of Anarchy, and Other Contemporary Studies, vol. 1908 (New York: Brentano's, n.d.), https://archive.org/details/gospelsofanarchy00leev.

interconnected world today, Ruskin was interested in the intersection of nature, art, and society.

However the virtuous circle was preceded by the "vicious circle", noted in 1792 by the *Encyclopedia Britannica*, "He runs into what is termed by logicians a *vicious circle*."[166] In 1908 Mathematician Henri Poincare introduced the vicious circle principle[167] stating that no object or property may be introduced by a definition that depends on itself. Such measures are taken to avoid circular reasoning and logical fallacy. However compelling these ideas may be, they may be difficult to prove mathematically and lead to reverse causality. As such, having solid data with instrumental variables may be necessary to evidence such relationships as proposed by the virtuous circle.[168]

Professor of Law and Computer Science Christopher Yoo criticizes the FCC's virtuous circle, saying that it assumes that adding more users to the network always creates additional benefits and inexhaustible demand-side returns to scale. His assessment of the network effects literature suggests that users may value some end-points more than others. That is to say that some users may value having reliable quality access to a subset of applications (for example Netflix, Twitter, Google, Facebook and Wikipedia) over accessing any and all possible points on the Internet. He suggests that the tradeoffs are the similar for content and application providers which prefer a set of users with preferences suited for their advertising-funded applications versus the set of all possible users.[169]

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[166] Oxford English Dictionary, 2015, http://www.oed.com/view/Entry/223850?redirectedFrom=virtuous+circle#eid276555657.

[167] Stephen C. Kleene, Introduction to Metamathematics, (Amsterdam, NY: North-Holland Publishing Company, 1952).

[168] Roslyn Layton, "Testing the Virtuous Circle of Innovation: Does It Increase Broadband Investment? A Preliminary Discussion," CMI Working Paper, 2014, http://www.cmi.aau.dk/digitalAssets/91/91510_cmi_working_paper_4.pdf.

[169] Christopher Yoo, "Internet Policy Going Forward: Does One Size Still Fit All?," in Communications Law and Policy in the Digital Age: The Next Five Years (Carolina Academic Press, Randolph J. May ed., 2012).

While feedback loops and circles are common illustrations of innovation, the FCC asserts that it can identify the specific sector, if not the very firms, which are in position either to create or deter innovation. It thus proposes regulation which will control, if not maximize, the innovation process. The FCC first mentioned the "Virtuous Circle" in its Notice of Proposed Rulemaking on its Preserving the Open Internet and Inquiry to Broadband Industry Practice on October 22, 2009 which it describes as follows[170]

> The Internet's accessibility has empowered individuals and companies at the edge of the network to develop and contribute an immense variety of content, applications, and services that have improved the lives of Americans. Such innovation has dramatically increased the value of the network, spurring—in a virtuous circle—investment by network operators, who have improved the Internet's reach and its performance in many areas. (Paragraph 4)

In the FCC model, it designates parts of the circle in need of regulation (broadband providers) and those in need of protection (edge providers). The language was further incorporated with the word "openness" and appeared in the 2010 Open Internet Report & Order, the FCC presented the "virtuous circle of innovation"[171] as an argument in support of network neutrality in paragraph 14 page 6 of the rules,

> The Internet's openness is critical to these outcomes, because it enables a virtuous circle of innovation in which new uses of the network—including new content, applications, services, and devices—lead to increased end-user demand for broadband, which drives network improvements, which in turn lead to further innovative network uses.

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[170] Federal Communications Commission Washington, D.C. 20554, October 22, 2009, https://apps.fcc.gov/edocs_public/attachmatch/FCC-09-93A1.pdf

[171] FCC Open Internet Report & Order 10-201, December 21, 2010. Paragragh 14. https://apps.fcc.gov/edocs_public/attachmatch/FCC-10-201A1_Rcd.pdf

While the notion of a virtuous cycle seems intuitive, some consider it a stretch to codify it in regulation. It is understandable that different actors in the view the FCC's interpretation of the virtuous circle differently. Debate about the FCC's definition of a virtuous circle have figured in the agency's second and third attempt to make Open Internet rules and subsequent litigation.[172]

2.4.9.1 Virtuous Circle in FCC 2010 Open Internet Report & Order

Upon release of its 2nd net neutrality order, the FCC was sued by Verizon and thereafter MetroPCS. In defense of the FCC an amicus brief[173] citing the "virtuous circle" notion was filed by the Open Internet Coalition, [174] a group representing Google, Amazon, Facebook, Twitter, along with advocacy Public Knowledge, Vonage, and the National Association of State Utility Consumer Advocates.

The brief observes that Verizon did not invest in its 4G network because it wanted to give its customers more "talk time" but rather because "these new networks are necessitated by the explosive demand for high-speed data services required to allow users to enjoy Internet content and services, particularly online video." The brief

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[172]ARGUMENT NOT YET SCHEDULED No. 11-1355, FCC, January 2, 2012. https://apps.fcc.gov/edocs_public/attachmatch/DOC-317120A1.pdf

[173] "FEDERAL COMMUNICATIONS COMMISSION, Respondent", November 14, 2012. https://www.google.com/url?sa=t&rct=j&q=&esrc=s&source=web&cd=1&ved=0ahUKEwj4npHG35TQAhVS7GMKHQTsD-sQFggjMAA&url=https%3A%2F%2Fapps.fcc.gov%2Fedocs_public%2Fattachmatch%2FDOC-317414A1.txt&usg=AFQjCNEzdIANd6RWD6IWt_faWW58kTcZRQ&bvm=bv.137904068,d.eWE&cad=rja

[174] The group's website OpenInternetCoalition.org has been removed, but the brief can be found housed on Free Press's website.

Goldberg and Michalopoulo, "Brief of Intervenors Open Internet Internet Coalition, Public Knowledge, Vonage Holdings Corporation, and National Association of State Utility Consumer Advocates.", 15 November 2012, http://www.fcc.gov/document/brief-open-Internet-coalition-no-11-1355-dc-cir

describes that Coalition members including Netflix have benefitted from investment in infrastructure.

It could be observed that if Open Internet Coalition companies benefit from such infrastructure investment that it would behoove them to see if continue, and as such, they would find common ground with operators to ensure the conditions that facilitate continued investment, for example finding efficient payments on both sides of the two-sided market. The court ultimately established that broadband is a two-sided service, one to end users and another to content providers such as the companies in the Open Internet Coalition.

Open Internet Coalition equates "openness" with what appears to be free carriage for Internet companies but a higher price for end user versus "closedness" which a two-sided model with a variety of flexible payments depending on supply and demand. Netflix calls a model in which a broadband provider collects payments from both sides of the market as "double-dipping."[175]

It is interesting to note that following the January 2014 court decision, Netflix began a campaign for "strong net neutrality". In a blog post titled, "Internet Tolls and the Case for Strong Net Neutrality."[176] CEO Reed Hastings declares,

> The Internet is improving lives everywhere – democratizing access to ideas, services and goods. To ensure the Internet remains humanity's most important platform for progress, net neutrality must be defended and strengthened. The essence of net neutrality is that ISPs such as AT&T and Comcast don't restrict, influence or otherwise meddle with the choices consumers make. The traditional form of net neutrality which was recently overturned by a Verizon lawsuit is important, but insufficient. This weak net neutrality isn't enough to protect an

[175] "The Case Against ISP Tolls," Netflix Media Center, April 24, 2014, https://media.netflix.com/en/company-blog/the-case-against-isp-tolls.

[176] "Internet Tolls And The Case For Strong Net Neutrality", Netflix Media Center, March 20, 2014, https://media.netflix.com/en/company-blog/internet-tolls-and-the-case-for-strong-net-neutrality

> open, competitive Internet; a stronger form of net neutrality is required. Strong net neutrality additionally prevents ISPs from charging a toll for interconnection to services like Netflix, YouTube, or Skype, or intermediaries such as Cogent, Akamai or Level 3, to deliver the services and data requested by ISP residential subscribers. Instead, they must provide sufficient access to their network without charge.

Hastings acknowledges that the system has worked well to date. While Hastings is pleased that Comcast has at least supported "weak net neutrality,"[177] he does not believe that this this is not enough. Hastings concedes that broadband providers want Netflix, which takes up 30% of network capacity, to share in the costs, but he says that Netflix should also be able to share some of the revenues, especially when broadband providers are selling packages of 10-50 Mbps.

The following month Netflix released a blog post the following month, "The Case Against ISP Tolls" in which it described that it's ok for Netflix to pay Level 3, XO, Cogent and Tata to transmit data, but if Netflix peers directly with Comcast using its own "Open Connect" content delivery network, then it's "double-dipping."[178] The blog concludes with a complaint about the proposed Comcast-Time Warner merger and link to its financial statement in which it notes that, "As DSL fades in favor of cable Internet, Comcast could control high-speed broadband to the majority of American homes. Comcast is already dominant enough to be able to capture unprecedented fees from transit providers and services such as Netflix."[179] Netflix's financial statement for the quarter notes it reaching 50 million

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[177] A merger condition imposed by the FCC for its acquisition of NBC: Shira Ovide, "Comcast-NBC Merger: Read the FCC Approval Letter," Wall Street Journal, January 18, 2011, http://blogs.wsj.com/deals/2011/01/18/comcast-nbc-merger-read-the-fcc-approval-letter/.

[178]"The Case Against ISP Tolls", April 24 2014 https://media.netflix.com/en/company-blog/the-case-against-isp-tolls

[179] Netflix, April 21, 2014, http://files.shareholder.com/downloads/NFLX/2851619155x0x745654/fb5aaae0-b991-4e76-863c-3b859c8dece8/Q114%20Earnings%20Letter%204.21.14%20final.pdf

customers and 18.5 percent contribution margin, far more customers and better profitability than Comcast.

Over the ensuing year, Netflix emerged as a key opponent of the cable merger which was ultimately rejected by the FCC and Department of Justice. Bloomberg reported the decision being good for Netflix's future to provide content over the Internet.[180]

It is interesting to review the events and statements more than a year later. While the $45 billion merger of Comcast-TimeWarner was not allowed, the $48 billion AT&T-Direct TV merger was. Net neutrality advocates' charge against the Comcast merger was that it would have held customers captive and keep speeds from increasing,[181] but the FCC's recent broadband report notes that both DSL and Cable speeds have increased. Comcast was not allowed by buy TimeWarner but Charter was by agreeing to significant "Open Internet" concessions such as not to add data caps or usage-based pricing to subscriptions.[182] The $66 billion deal was enabled by former leading net neutrality lawyer Marvin Ammori who explained how his new employment at Charter would make the pending merger an acceptable network provider for the Open Internet.[183]

As might be expected the BIAS providers take a different view of the FCC's virtuous circle. In addition to noting that the FCC failed to supply any evidence that broadband providers have harmed the ecosystem and base regulation on theoretical harms, Verizon suggests

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[180] "Comcast Plans to Drop Time Warner Cable Deal," Bloomberg.com, April 23, 2015, https://www.bloomberg.com/news/articles/2015-04-23/comcast-said-planning-to-withdraw-offer-for-time-warner-cable.

[181] Crawford, Susan. "We Need Real Competition, Not a Cable-Internet Monopoly," *The New Yorker*, February 13, 2014, http://www.newyorker.com/news/daily-comment/we-need-real-competition-not-a-cable-internet-monopoly.

[182] Commission Approves Charter, TWC and Bright House Merger, FCC, May 10, 2016, https://www.fcc.gov/document/commission-approves-charter-twc-and-bright-house-merger

[183] Marvin Ammori. "Here's How Charter Will Commit to an Open Internet", *Wired,* June, 25, 2016, http://www.wired.com/2015/06/heres-charter-will-commit-open-internet/

that the market is more competitive, integrated, and dynamic than the FCC's rules suggest. Responding to the FCC's NPRM in January 2010 Verizon notes, [184]

> Consumers have more choices online than they have ever had. Innovation and investment are occurring in all parts of the broadband ecosystem, whether networks (both backbone and access), applications and content, or devices. Moreover, the lines between these categories are blurring, and the distinction between "edge" and "network" providers is rapidly becoming outmoded and artificial. The result is that all members of the ecosystem increasingly collaborate and compete with one another, leading to a virtuous cycle of innovation and competition that benefits consumers. The increasing overlap within the Internet ecosystem is apparent. For example, many "edge" players have their own extensive broadband networks or take advantage of content delivery networks – which store copies of content on servers at multiple locations so as to circumvent points of congestion on the Internet in order to prioritize delivery of that content. Google, for example, now has one of the largest networks in the country that is the third-largest source of and destination for Internet traffic in the world. Google's network not only carries its own content, but also enables applications such as Google Voice which, from the consumer's perspective, provides many of the functions traditionally performed by network operators. Akamai, an operator of a content delivery network, claims to deliver upward of 15% of all Web traffic.
>
> Other examples abound. Offerings such as the iPhone and Kindle are a combination of network functions, applications, and devices. For example, the Kindle is pre-loaded with certain applications, is obviously a "device," and comes with built-in wireless connectivity for which Amazon pays rather than the user. Apple makes both devices and applications and also operates an App Store that acts in ways traditionally

[184] FCC, January 10, 2010, http://apps.fcc.gov/ecfs/comment/view?id=6015527380

> associated with networks by providing a means for other application providers to distribute their services to consumers. The development of "cloud computing" amounts to the provision of applications, connectivity, and related services in an integrated fashion. This innovation and convergence is driven by customer demand and clearly has benefited consumers by providing them more choices, new services, lower prices, and many other benefits. And the combination of technological change and innovation, investment, and competition will ensure that this evolution will continue, all with the aim of meeting consumers' needs and desires. Creating artificial "regulatory silos" – as the proposed rules would do by defining separate categories of "devices," "applications," "content," and "networks" that are subject to different obligations – would obstruct the current of Internet innovation for no good reason.

Verizon also disputes what they consider a simplistic view that demand for consumer broadband alone delivers sufficient revenue to provision infrastructure. They note that ability to earn revenue and provision network is more complex than FCC rules suggest.

> A key question for the Commission is how to ensure that it maintains and increases incentives for investment. Like any other firm, a network provider's decision to invest depends on whether the business case can justify a particular level of investment given the risks entailed. As noted above, revenues from the fees that consumers pay to use traditional Internet access services that enable consumers to go where they want and do what they want online are a critical component of the business case for broadband investments. The revenues from these fees paid by consumers for Internet access services alone, however, are not sufficient to justify the required ongoing investment. Network providers must be able to develop and offer additional innovative services – whether private network offerings or those that may be integrated with Internet content – that help differentiate themselves in the market and provide an opportunity to compete for additional revenue streams to support the business case for broadband

> deployment. The flexibility to offer such new services is critical to justify continued investment to deploy and to expand capacity.

Verizon further explains that their decision to invest in a fiber to the premises network was predicated on their ability to offer FiosTV, a proprietary content service for which they would acquire content and provide it to users. Similarly with mobile networks, Verizon observes that both Verizon and AT&T have developed their own mobile TV platforms. Verizon also offers a range of "private IP" services to companies that offer different levels of security and priority. Additionally Verizon also offers backbone, storage and CDN services to edge providers that compete with Akamai, Level 3, and others. From Verizon's perspective consumer Internet subscriptions are important for revenue, but in themselves not sufficient to justify their investment in broadband infrastructure.

The view of MetroPCS, at the time, a small wireless provider with 3 percent market share in the US, is different and shows that not all ISPs are the same. At the time of the 2010 order, MetroPCS was primarily engaged in provision of voice and SMS with its own network in a few discrete location (using roaming for the rest of the US). It wanted to transition to offer data, but faced a challenge in acquiring spectrum.

While Verizon is interested to serve both consumers and corporate markets with both wireline and wireless technologies, as well as range of related technologies such as storage, transit, and interconnection, MetroPCS was more concerned with getting critical mass of spectrum and customers. For MetroPCS the ability to compete through its marketing ("unlimited plans") is paramount. On page 16 of its January 2010 comment to the FCC as part of the rulemaking MetroPCS observes,

> The number of available Internet applications and services has exploded exponentially in recent times, showing that the current Internet marketplace is a grand success. The remarkable upshot of all of this is that the Internet is flourishing for everyone – and it is becoming more competitive, rather than less so. It is the model of the virtuous

> cycle: innovators are creating content and application products that consumers desire, which drives consumers to purchase from service and equipment providers, which in turn drives investment in infrastructure and new technology in response to consumer demand. This competition will cease if the Commission allows some applications to hog and consume the entire network capacity to the detriment of all others. Although the Commission has been focused on service providers discriminating between competing applications, the Commission must understand that, if an application consumes a disproportionate amount of capacity, it will discriminate against other applications which may not gain access to the capacity they need to compete. The only effective way to ensure nondiscriminatory access to all applications is to allow the service providers to control the nature and extent of services they will offer on the networks they have designed and built.[185]

MetroPCS sees the virtuous circle as the very reason that regulation is *not* needed (Indeed such an assertion would seem to support the two-sided markets view). For MetroPCS the very incentives that exist in the marketplace drive actors to transact in a virtuous way. Edge providers want to serve end users, and broadband providers want to sell subscriptions. Indeed the vast majority of the Internet's growth occurred without net neutrality rules in place.

But the FCC sees it differently and appropriated the the notion of a virtuous circle as an argument *for* regulation. Indeed they believed in 2010 that adopting net neutrality rules would in fact "accelerate the cycle of investment and innovation".

> This process has made clear that the Internet has thrived because of its freedom and openness—the absence of any gatekeeper blocking lawful uses of the network or picking winners and losers online. Consumers and innovators do not have to seek permission before they use the Internet to launch

[185] FCC, January 14, 2010, http://apps.fcc.gov/ecfs/comment/view?id=6015522647

> new technologies, start businesses, connect with friends, or share their views. The Internet is a level playing field. Consumers can make their own choices about what applications and services to use and are free to decide what content they want to access, create, or share with others. This openness promotes competition. It also enables a self-reinforcing cycle of investment and innovation in which new uses of the network lead to increased adoption of broadband, which drives investment and improvements in the network itself, which in turn lead to further innovative uses of the network and further investment in content, applications, services, and devices. A core goal of this Order is to foster and accelerate this cycle of investment and innovation.[186]

The FCC says that broadband providers have the ability and incentive to deter the activities from which they earn revenue. Broadband providers disagree, noting that anything they do to limit users, services, or applications reduces their revenue, so it is not in their interest to deter such openness.

Shortly after the adoption of the 2010 rules in January 2011, MetroPCS was accused of violating the net neutrality rules with its unlimited plan of talk, text, Web browsing, and YouTube for $40, according to a complaint by group of advocacy organizations.[187]

In 2011 MetroPCS was a regional a carrier in the US with a CDMA network that wanted to transition to offering 4G services. It had only 10-20 MHz of spectrum capacity and focused on a budget-conscious market segment with a set of pre-paid, no contract, “all you can eat” offerings. With the Samsung Craft phone, it was the first carrier to

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[186] Before the Federal Communications Commission Washington, D.C. 20554, FCC, December 23, 2010, https://apps.fcc.gov/edocs_public/attachmatch/FCC-10-201A1.pdf

[187] Free Press. Notice of Ex Parte Presentation: GN Docket No. 09-191 (Preserving the Open Internet); WC Docket No. 07 -52 (Broadband Industry Practices), January 10, 2011, http://www.freepress.net/sites/default/files/resources/MetroPCS_Letter_1_10_11.pdf

offer a service with CDMA and 4G capability, but this required some engineering and data compression. Because it had only a limited network and low band frequency, it attempted to differentiate on its assets, and its analytics revealed that its customers overwhelmingly visited only YouTube. Without any money changing hands, MetroPCS engineers worked with YouTube to develop a format for the video service that would produce better fidelity under the constraints.[188] According to the legal counsel of MetroPCS at the time of the complaint, the offer to optimize the video streams was made available to other content providers, but none were interested.[189]

Following the publication of the Open Internet rules in the Federal Register some months later, Verizon sued the FCC, and MetroPCS followed suit. Free Press also sued FCC saying that there were fewer net neutrality restrictions on wireless.

MetroPCS wanted to be acquired by T-Mobile so it dropped its lawsuit against the FCC. The FCC ultimately did not pursue action against MetroPCS for the 4G plan. In January 2014, three years after the petition was filed, the FCC's rules were struck down.

It is interesting that there should be such competing and opposite views of the "virtuous circle." It is perhaps emblematic of the net neutrality debate itself which has pitted telecom and cable operators against Internet companies.

2.4.9.2 Virtuous Circle in FCC 2014 Open Internet Order

During oral arguments in US Telecom v. FCC at the U.S. Court of Appeals, D.C. Circuit, FCC Counsel Jonathan Sallet defended the agency's rules saying that a world without the FCC's rules "disrupts the Virtuous Circle." Senior Judge Stephen Williams replied, "The

[188] GN Docket No. 09-191 (Preserving the Open Internet); WC Docket No. 07-52 (Broadband Industry Practices), February 14, 2011, http://assets.fiercemarkets.net/public/mdano/metropcsresponse.pdf

[189] Stachiw, Mark. Vice Chairman, General Counsel & Secretary, MetroPCS. Personal email. 24 December 2015.

plausibility of that depends on the proposition of there being a significant, non-trivial group of potential edge providers out there who are thwarted under an arrangement which does not involve the various bans imposed by the Order."[190] The judge was referring to the prohibitions against blocking, throttling, and paid prioritization.

However Sallet had earlier developed a different view of innovation called the Broadband Value Circle,[191] which he presented at the prestigious Silicon Flatirons conference in 2011, a leading institute for the study of telecom regulation. Whereas the Virtuous Circle has a defined set of actors and directional relationships, the Broadband Value Circle is a new form of economic organization in which "broadband connectivity is the glue that permits multiple firms, once walled off from one another in distinct product-market categories, to compete, cooperate, buy, and supply products and services from one another in order to satisfy customers that are able to buy from any one of them."

However in the Broadband Value Circle, broadband providers, rather than being proverbial "dumb pipes" intimated Virtuous Circle, are integral parts of a swift and dynamic marketplace with competing combinations of value changing in rapid succession. In Sallet's model broadband providers both combine, cooperate and compete with edge providers. Moreover all of the actors are shifting in their offerings in an attempt to provide value to customer who is in the center of the circle, and the customer, incidentally, is also a co-creator of content. The notion is reminiscent of co-opetition, the idea that firms both cooperate and compete in the marketplace and suggests that firms and industries converge, develop, and create value in unexpected ways.

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[190] Sound record, US courts, https://www.cadc.uscourts.gov/recordings/recordings2016.nsf/4FBB1C7586B8BB7185257F1100698E46/$file/15-1063IssueI.mp3

[191] Jonathan Sallet, "The Creation of Value: The Broadband Value Circle and Evolving Market Structures." O'Melveny & Myers LLP; Silicon Flatirons April 4, 2011

The Creation of Value: The Broadband Value Circle and Evolving Market Structures," SSRN Electronic Journal, 2011, doi:10.2139/ssrn.1821267.

Sallet describes how broadband in a positive, transformative force in driving new value in wireless services and video distribution. He provides three evolutionary diagrams to illustrate his point. He begins with the traditional vertically integrated value chain. With the emergence of broadband, the dominant mode of economic activity becomes the Broadband Value Circle. The circle then evolves to an ecosystem with a series of interdependent, and multidirectional relationships.

Sallet describes the rise and fall of various actors depending on their value proposition. However he observes that companies such as Apple, Google, and Netflix profit disproportionately from the Broadband Value Circle, to a greater degree than device manufacturers or broadband providers.

However in 2011 when Sallet was in private law practice, he observed, "For policymakers, the dynamic nature of the Broadband Value Circle means that competition and regulatory analysis must comprehend the true nature of competitive entry and market discipline. Rapid change creates uncertainty, which puts a premium on governmental oversight that is flexible and responsive, not rigid and preemptive."[192]

[192] Ibid

2.4.10 OPEN INNOVATION

The term "open innovation" was popularized by Henry Chesbrough in 2003 in a book[193] by the same name. Chesbrough argued that in the information age firms need to look beyond their own walls for the paths to new products and markets. He was particularly concerned how traditional hardware and computing firms, e.g. IBM and Xerox, could reinvent themselves by being more attune to external ideas. Chesbrough's ideas today are largely internalized and practiced by many firms through market research, business intelligence, and shared risk-reward partnerships.

Hurwitz and Layton[194] explain the downside of mandating openness,

> While it is true that openness can facilitate some types of innovation, it both precludes other forms of innovation and imposes costs of its own.[195] The key takeaway from the relevant technical and economic literatures is that "openness," in whatever forms it may take, is rarely unambiguously good or bad. It is unquestionably the case that open access can facilitate certain types of innovation. It reduces R&D and other transaction costs (especially search and negotiation costs to get permission or access to use existing infrastructure) and reduces opportunities for rent extraction by those who otherwise control an infrastructure. On the other hand, it makes some forms of innovation more expensive or difficult to implement.

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[193] William Henry Chesbrough, *Open Innovation: The New Imperative for Creating and Profiting from Technology* (Harvard Business Review, 2005).

[194] Justin (Gus) Hurwitz & Roslyn Layton, Debatable Premises in Telecom Policy, 31 J. Marshall J. Info. Tech. & Privacy L. 453 (2015)

[195] Timothy Bresnahan & Manuel Trajtenberg, General Purpose Technologies" Engines of Growth?", 65 J. ECONOMETRICS 83, 94–96 (1995).

There are substantial literatures showing the benefits of vertical integration[196] and the importance of defining proper modular boundaries.[197] Nowadays, however, this point can be made more simply by analogy: Apple's hardware and software designs are part of a tightly-controlled, vertically integrated, closed product ecosystem. Apple would not exist if we had the equivalent of network neutrality for computer hardware or software. This does not mean that either an open or a closed model is necessarily better in any given case; it does mean that a more nuanced approach than one that mandates either approach in every situation.

It should be noted that engineers employed by the Department of Defense to develop the then top secret project of the ARPANET, the forerunner of today's internet, did not work in an "open" environment. The assertion that the internet was "always open and neutral" isn't necessarily the characterizations of its founding engineers.

Historical perspectives on the Internet architecture make clear that, while it has long had an "open" character, this character is at least in part accidental, does not equate with "neutrality," and in any even

may be undesirable.[198] [199] [200] [201] [202] [203] In practice, a network neutrality rule amounts to little more than a subsidy from the

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[196] See also Brent Skorup & Adam Theirer, Uncreative Destruction: The Misguided War on Vertical Integration in the Information Economy, 65FED.COMMS. L.J., no. 2, Apr. 2013, available athttp://papers.ssrn.com/sol3/papers.cfm?abstract_id=2162623.

[197] Ibid.

[198] For a sampling of technical literature explaining that mandated network neutrality is not desirable, see the following 6 foot notes

Richard T.B. Ma et al., On Cooperative Settlement Between Content, Transit and Eyeball Internet Service Providers,19 IEEE/ACM Transactions on Networking 802, 812-813 (June 2011)
http://dnapubs.cs.columbia.edu/citation/paperfile/194/ToN_InternetEco2.pdf

consumer side of the market to the content provider side of the market.[204] Some, but not all, content providers benefit from this rule. Other content providers may be harmed by such a rule – especially those who offer, or would like to develop, services that would benefit from enhanced quality of service features or other features that may require some integration with Internet service providers.

Even more problematic, a network neutrality rule can harm consumers. It prevents ISPs and content providers from

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[199] David Clark, Network Neutrality: Words of Power and 800-Pound Gorillas, 1 INT'L J. COMM. 701, 705-706 (2007), http://groups.csail.mit.edu/ana/Publications/PubPDFs/Network-Neutrality-Words%20of%20Power%20and%20800-Pound%20Gorillas.pdf

[200] Thomas Hazlett & Joshua Wright, The Law and Economics of Network Neutrality, 45 IND. L. REV. 767, 785 (2011), available at http://mckinneylaw.iu.edu/ILR/pdf/vol45p767.pdf

[201] Jon Crowcroft, Net Neutrality: The Technical Side of the Debate, 1 INT'L J. COMM. 567, 567 (2007), available at http://ijoc.org/index.php/ijoc/article/viewFile/159/84

[202] Douglas A. Hass, The Never-Was-Neutral Net and Why Informed End Users Can End the Net Neutrality Debates, 22 BERKELEY TECH. L.J. 1565 (2007), http://scholarship.law.berkeley.edu/cgi/viewcontent.cgi?article=1717&context=btlj;

[203] S. Blake et al., An Architecture for Differentiated Services, REQUEST FOR COMMENTS 2475, at 2 (Dec. 1998), https://tools.ietf.org/html/rfc2475

K. Nichols et al., A Two-Bit Differentiated Services Architecture for the Internet, REQUEST FOR COMMENTS 2638, at 3 (July 1999), https://tools.ietf.org/html/rfc2638

R. Braden et al., Integrated Services in the Internet Architecture: An Overview, (July 1994), https://tools.ietf.org/html/rfc1633

Justin (Gus) Hurwitz, An unfounded principle: Ammori's non-neutral network history, TECH POLICY DAILY (Nov. 13, 2013, 6:00AM), http://www.techpolicydaily.com/internet/unfounded-principle-ammoris-non-neutral-network-history/ (explaining that network neutrality is not "a foundational principle" of the Internet).

[204] See, e.g., Justin (Gus) Hurwitz, Let Them Eat Cake and Watch Netflix, 8 FREE STATE FOUND. PERSPECTIVES, no. 22, 2013, available at http://www.freestatefoundation.org/images/Let_Them_Eat_Cake_and_Watch_Netflix_090413.pdf.

> working together to offer innovative new products that consumers want. More tragic, it prevents these providers from developing lower-cost service packages – packages that could expand opportunities for access to currently underserved and disadvantaged communities.[205] These rules likely increase cost of access and limit the development of potentially cheaper offerings that are more responsive to consumer demands – this is exactly the opposite of good telecom policy.

That a regulator would mandate one kind of business model or another would seem to constrain potential innovation. An Yariv, Boer and Lindgren offer a typology of business model innovation.[206] The observe that competing just on products alone is not enough to sustain competitive advantage, as products can be copied and competitors can easily capture markets. Therefore business model innovation has become even more important.

The issue of business model innovation could be important to address the cost of broadband. For online access in the developed world, the amount advertising mattered less on a broadband subscription as people connected primarily to the Internet via a desktop computer with a wireline connection. But that situation is different on mobile networks where bandwidth is constrained. Online advertising can consume up to 50% of a user's mobile subscription[207], and some reports put the number as high as 80 percent.[208] Users effectively to

[205] Supra Layton and Calderwood, 2016.

[206] Taran, Yariv, Harry Boer, and Peter Lindgren. "A Business Model Innovation Typology." Decision Sciences 46.2 (2015): 301-331. Web.

[207] Arvind Parmar et al., "Adblock Plus Efficacy Study," SFU, (June 23, 2015), http://www.sfu.ca/content/dam/sfu/snfchs/pdfs/Adblock.Plus.Study.pdf.

[208] Lara O'Reilly, "Ads on News Sites Gobble up as Much as 79% of Users' Mobile Data," Business Insider, March 16, 2016, http://www.businessinsider.com/enders-analysis-ad-blocker-study-finds-ads-take-up-79-of-mobile-data-transfer-2016-3. Suggests between 18% to 79% of mobile broadband data go to advertising. Lara O'Reilly, "This Ad Blocking Company Has the Potential to Tear a Hole Right through the Mobile Web — and It Has the Support of Carriers," Business Insider, May 13, 2015, http://uk.businessinsider.com/israeli-ad-blocker-shine-could-threaten-mobile-advertising-2015-5. Suggests 10% and 50%.

subsidize the delivery of advertising to their mobile device, which, as code, indistinguishable from the actual content the user wants.

Broadband providers have limited ability to address this issue given net neutrality. For example asking content providers to pay for the traffic through advertising is common place in radio, television, and print, but it is considered a tenet of net neutrality that the user should be the cost of broadband. Having the cost of one's broadband subscription subsidized by a third party could be a welcome development for many consumers, but in the US this is being curtailed by the FCC's new online privacy rules. This was implemented as a result of FCC's reclassification of broadband to a Title II service, a change enable to facilitate its 2015 Open Internet rules. One interpretation is that the FCC's effort is conducted as a means to protect the online advertising industry from market entry by broadband providers.[209]

Given limited options of business models in the marketplace to reduce the cost of unwanted data, consumers are increasingly turning to ad blocking. Globally in 2016 more than 400 million[210] users employ ad blocking on mobile phones, twice the rate of desktop ad blocking. Users employ ad blockers for other reasons including privacy, security, energy efficiency, and usability to speed the running of mobile apps and websites. Browser-based ad blockers are common but have limited functionality. Cloud-based ad blockers allow users more control to define settings across a larger range of parameters. Mobile operators have started to deploy ad blockers, but groups such as the

[209]Federal Communications Commission Washington, D.C. 20554, May 27, 2016, http://roslynlayton.com/wp-content/uploads/2016/05/Roslyn-Layton-FCC-NPRM-16-106-May-27-2016.pdf

[210] "Adblocking Goes Mobile" (Page Fair, 2016), https://pagefair.com/downloads/2016/05/Adblocking-Goes-Mobile.pdf.

"2016 Mobile Adblocking Report," PageFair, May 30, 2016, https://pagefair.com/blog/2016/mobile-adblocking-report/.

Interactive Advertising Bureau (IAB) Europe say that they violate the EU's net neutrality rules and demand that they are banned.[211]

Now with the literature review complete, the thesis proceeds to the empirical investigation.

[211] "BEREC Says Network-Wide Ad Blocking Illegal | IAB Europe," Iab Europe, (September 1, 2016), http://www.iabeurope.eu/all-news/news/eu-outlaws-network-wide-ad-blocking/.

3 METHODOLOGY

The research methodology incorporates techniques from data science and policy research. Data science is an interdisciplinary field incorporating analytics and statistics to extract knowledge from data. More specifically analytics is the discovery, interpretation, and communication of meaningful patterns in data. It is a multidisciplinary field incorporating mathematics, statistics, and business. Observed patterns of data are used to inform action and decision making. Statistics generally has a starting point of a wanting to solve a scientific, industrial, or social problem. In this case, the starting point is a policy question which has scientific, industrial, and social implications.

The author developed these skills over years working in the software analytics industry as well as an apprentice of Andreas Ramos, one of the first practitioners of Google paid search and author of more than a dozen books on digital marketing and analysis. Together the author and Ramos wrote *KPIs for Search Engine Marketing*[212] with the goal to help small and medium sized enterprises promote themselves online. Analytics (also called online or web analytics) is a professional discipline which emerged following the technical study of log files on the Internet.

Policy research is the methodical enquiry of the efficacy of political decisions over a period of time. Such analyses are concerned with the effects and implementation of a policy. Performance measure could include effectiveness (how does the policy address the targeted problem), unintended effects, and equity (what are the effects on different groups). The implementation considers issues such as the cost, feasibility, and acceptability.

The objective is to inquire to what degree is net neutrality policy effective to achieve the stated goal of "innovation", or "guaranteeing the Internet as an engine of innovation" as legislated in the EU or as

[212] Ramos, Andreas and Roslyn Layton. *KPIs for Search Engine Marketing*. McGraw-Hill, 2009.

the US rules assert, to "Preserve the Internet as a Platform for Innovation, Free Expression and Economic Growth."

3.1 THE RCT PERSPECTIVE

The author could not find other attempts to measure the efficacy of net neutrality rules for innovation. There is, in fact, an ideal methodology to investigate such a question called the randomized controlled trial (RCT), though in nascent stages in innovation policy. The idea of randomized trials is that subjects are placed by lottery into "treatment" and "control" groups. The impact of the program is estimated by comparing the behavior and outcomes of the two.

To be sure, the study of innovation is one of the most fertile areas of academic inquiry. There are dozens, if not not hundreds, of conferences on innovation globally, but fewer on innovation policy, and fewer still on the measurement of innovation policy. In May 2016 there was the first gathering[213] of academics attempting to study innovation policy with RCT.[214] The conference proceedings noted that little is known about what makes innovation policy work. Indeed there is little evidence, little measurement of new policy instruments, and reluctance by policymakers to implement RCT.[215]

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[213] Making Innovation and Growth Policy Work: IGL Global Conference, May 25, 2015, http://www.nesta.org.uk/event/making-innovation-and-growth-policy-work-igl-global-conference#sthash.kHnBY0et.dpuf and

Making Innovation and Growth Policy Work: IGL Global Conference, May 25, 2015, http://www.nesta.org.uk/event/making-innovation-and-growth-policy-work-igl-global-conference

[214] Making Innovation and Growth Policy Work: IGL Global Conference, May 25, 2015, http://www.nesta.org.uk/sites/default/files/igl_global_conference_agenda_13-04-16.pdf

[215] Xavier Cirera, "We know very little about what makes innovation policy work: Four areas for more learning", World Bank. June 17, 2016, http://blogs.worldbank.org/psd/we-know-very-little-about-what-makes-innovation-policy-work-four-areas-more-learning

An estimated €150 billion is spent annually by European governments in initiatives to support innovation and economic growth.[216] The UK's Innovation Growth Lab (IGL) observes that that there limited study of the efficacy of governments' innovation policies. Moreover, even if innovation evolves, whether radical or incremental, it is difficult to tell whether it was the result of a specific policy. IGL notes the report of the What Works Centre for Local Economic Growth which reviewed 15,000 policy evaluations and found that only 2.5 percent had a concrete conclusion about the effectiveness of the policy, and of those, 1 in 4 had a positive impact (about 0.06 percent of the total). The implication is clear; without evidence about what works, it's difficult, if not impossible, to allocate resources to successful programs.

This is not to say that innovation policy is not a useful effort; the point is that it can be improved with research about its effectiveness. For example, if innovation for small and medium enterprises is the goal, it would be helpful to know which policy or intervention is more effective. A nation could make a net neutrality law to support "innovation" for example, or it could offer innovation vouchers to SMEs based upon a lottery.[217]

The goal of RCT is to reduce selection bias. A perfect study RCT for net neutrality would involve randomly assigning policies across countries and then measuring the effects. However in this investigation, the set of countries with net neutrality rules is given, not random. However there is a significantly large and varied group of

[216] Firpo and Beevers (2016) 'As much as €152 billion is spent across Europe supporting businesses: but does it work?' Available at www.innovationgrowthlab.org/blog/much-%E2%82%AC152-billion-spent-across-europe-supporting-businesses-does-it-work.

[217] An RCT of innovation vouchers in which grants of €15,000 euros were given to 130 SMEs in Denmark found worker productivity 20 percent higher in firms that received the voucher versus those that did not three years after the voucher was received.
https://europa.eu/sinapse/webservices/dsp_export_attachement.cfm?CMTY_ID=0C46BEEC-C689-9F80-54C7DD45358D29FB&OBJECT_ID=19482B57-BFF0-08A8-B9CDCD0537CF7180&DOC_ID=208C1EB5-F450-3B3E-7A227F5731B73696&type=CMTY_CAL

countries without rules. This itself is worthy of study and provides a de facto control group. This investigation is not an RCT, but it attempts to capture the essence of RCT, which is study scientifically and to reduce bias.

The (IGL) offers some suggestions for how a nation could proceed to bring a scientific approach to innovation policy. Before introducing large scale programs, policymakers could conduct small-scale testing and pilot programs, and then scale up accordingly should evidence of effectiveness emerge. Moreover governments themselves could conduct R&D on their own initiatives.

But doing pilots projects is not sufficient, notes the report. A real culture of innovation must embrace experimentation. As such policymakers should be looking to conduct experiments to see what works with a rigorous framework for evaluation. RCT is one method of experimentation.

While RCT is best known for health and pharmaceutical research, it has been tried to some extent in public policy. For example the MIT Poverty Action Lab (J-PAL) has conducted some 700 RCT on poverty reduction interventions.[218] The Education Endowment Foundation has conducted over 100 RCT on different means to improve educational outcomes.[219] The French government also runs an experimentation fund that focuses on interventions for disadvantaged youth based upon projects that are crowdsourced from around the country.[220]

Moreover RCT could be utilized in different parts of the policy development process. For example, RCT can be used to test different

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[218] "Policy Lessons | The Abdul Latif Jameel Poverty Action Lab," accessed January 8, 2017, https://www.povertyactionlab.org/policy-lessons.

[219] "Site Map," accessed January 8, 2017, https://educationendowmentfoundation.org.uk/evaluation/resources-centre/setting-up-an-evaluation.

[220] "Le Fonds d'Expérimentation Pour La Jeunesse | Ministère de La Ville, de La Jeunesse et Des Sports," accessed January 8, 2017, http://www.experimentation.jeunes.gouv.fr/72-les-resultats-des-experimentations.html.

provisions of the existing policy programs. With net neutrality, there are many provisions and the understanding efficacy of the various provisions could be improved using this technique versus on the entire policy itself.

There is no doubt that RCT is imperfect. The Pearce and Raman critique takes issue with what they believe is tacit acceptance that RCT investigations constitutes "neutral evidence."[221] However peer review is the quality control for bias. In any event, it does not seem unreasonable that some amount of RCT, or some amount of empirical evaluation for that matter, could be adopted for net neutrality policy.

Though a direct RCT method could not be employed, the project attempts to measure the countries with two independent measurement tools. This is done to improve the scientific basis for the study as well as to guard against bias and overconfidence in the results.

3.2 THE POLICY RESEARCH PERSPECTIVE

The Science Policy and Research Unit (SPRU) of University of Sussex is a leading university for ICT policy research. Reflecting on SPRU's 40th annual conference in 2006, Morlacchi and Martin[222] observed that that policy research on science, technology and innovation continues to be a "somewhat heterogeneous set of activities undertaken by a community of diverse actors, each with rather different roles and aims."

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[221] Warren Pearce and Sujatha Raman, "The New Randomised Controlled Trials (RCT) Movement in Public Policy: Challenges of Epistemic Governance," Policy Sciences 47, no. 4 (December 1, 2014): 387–402, doi:10.1007/s11077-014-9208-3.

[222] Morlacchi, Piera, Martin, Ben R. Emerging challenges for science, technology and innovation policy research: A reflexive overview Research policy, Vol. 38, Issue. 4, 2009-5, p. 571–582, http://sfx.aub.aau.dk/sfxaub?ctx_enc=info%253Aofi%252Fenc%253AUTF-8&ctx_ver=Z39.88-2004&req.language=eng&rfr_id=info%253Asid%252Fsfx.aub.aau.dk%253ALinkResolver%253Atlr&rft.genre=journal&rft.issn=0048-7333&rft.object_id=954921364529&rft_val_fmt=info%253Aofi%252Ffmt%253Akev%253Amtx%253Ajournal&sfx.ignore_date_threshold=1&url_ctx_fmt=info%253Aofi%252Ffmt%253Akev%253Amtx%253Actx&url_ver=Z39.88-2004

To be sure, the central goal of activities is "helping to construct more effective policies for science, technology and innovation, which in turn will yield greater benefits for society." The authors suggest that innovation policy researchers should be concerned with the means and ends for society. They note a trend to instrumental and entrepreneurial activities at the individual and organizational level which need to be balanced with critical and independent scholarship as well as "reflexivity." Importantly they define innovation policy research as the application of social science to the study of innovation policy. It is not theory or paradigm driven, but rather problem-oriented by focusing on practical issues with specific policies and the taking account of the central role of firms in the evolution of technology and innovation.

They note that the policy research field has a multidisciplinary, empirical orientation and motivation, and when there is theory, it is generally inductive. This contrasts to the traditional social science approach in which theory comes first followed by the empirical work. Innovation policy research comes out primarily of the field of economics with a preference for the study at the firm industrial and national levels of analysis, viewing the Market and the State at its role to regulate or facilitate market interactions. Sociology, on the other hand, comes from the history and philosophy of science. The research function grew out of discussion of a variety of intellectual actors, with governments, international institutions, and research institutions starting to produce data about innovation (patent statistics, R&D expenditures etc). They summarize Ball[223] in describing the four roles of policy researchers.

The policy *engineer* who uses a set of procedures to determine best course of action to achieve a goal; the policy *scientist* who seeks the technically correct answer to the political problem with the available scientific knowledge; the policy *entrepreneur* who provides technical solutions or organizations and contexts and searches for opportunities to apply his or her favored solutions. The policy *scholar* seeks to

[223] Ball, Stephen J. *Intellectuals or technicians? The urgent role of theory in educational studies.* 1995
http://www.tandfonline.com/doi/abs/10.1080/00071005.1995.9974036

shape the way we think about society's problems. The roles may have blended or take one part of the approach or another, and there is debate to what degree the roles are influenced by politics or vice versa. Critical policy research should reflect upon these various roles and seek to find the optimal balance of the various approaches.

They use the 1970s *Limits to Growth*[224] debate to describe how the application of the assumptions of each of the roles can help produce more effective polices. The *Limits to Growth* view was evidenced through a set of computer models for population growth, resource depletion, food supply, capital investment and pollution. In particular, they examined the effects of continued economic and demographic growth in a world of finite resources, and derived various policy implications, such as the need for birth control to limit population growth. SPRU's response, called "technological optimism" was not necessarily to reject the empirical findings of the model but to highlight that the model did not account for social change and technological advances which could change the expected outcomes.

For example population growth, is desired, not deterred and now expected to reach 10 billion by 2050.[225] Crucial resources have not depleted; innovative technologies have found substitutes and new and better means of extraction; food is so plentiful that one-third of it goes to waste globally; capital investment has seen unprecedented heights; and pollution, while not totally eliminated, has much better management. Moreover mobility and internet has benefitted the people of the world tremendously. This is not to say that progress will always proceed in a linear fashion. Growth and sustainability are still key issues in the policy research field. Failing to incorporate the views of the different actors (engineer, scientist, entrepreneur, ands scholar), predictions can fall short. Indeed relying on data alone can lead to false conclusions.

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[224] *The Limits to Growth*, 1972, http://www.clubofrome.org/report/the-limits-to-growth/

[225] "World Population Projected to Reach 9.7 Billion by 2050." United Nations Department of Economic and Social Affairs, 2015. http://www.un.org/en/development/desa/news/population/2015-report.html.

The *Limits to Growth* allegory is instructive for today's net neutrality debate in which on the side, proponents suggest that the internet will essentially come to an end without net neutrality and must therefore be "preserved" versus a more holistic view that does not reject concerns but sees change and advancement as a net positive development that can address concerns and solve problems, though maybe in different way that is not yet known.

Flanagan, Uyarra and Laranja[226] attempt to foster the needed "critical reflexivity" by devising an approach that helps policy researchers conceptualize the innovation policy complexity and its various actors, levels and dynamics. Their problematization consists of policy agendas, rationales, actors, processes, instruments, and interactions.

The literature on agenda setting and advocacy critiques the view that policymaking proceeds in a linear fashion, as if there is a scientific identification of the problem followed by the proper intellectual exchange of ideas and rationales to remedy the problem, the evaluation of various options with appropriate cost benefit analysis, and selection of instrument followed by measurement and optimization. Instead agenda setting[227] is the process of creating awareness and concern on selected issues. This is achieved by leveraging the press and media (which does not reflect reality but rather shapes and filters the news) as well as the media concentration on a few issues which leads the public to believe that some issues are more important than others.

Kingdon[228] described the "policy primeval soup" as the policy process as an evolutionary one that favors "policy entrepreneurs" which can

[226] Kieron Flanagan, Elvira Uyarra, and Manuel Laranja, "Reconceptualising the 'policy Mix' for Innovation," Research Policy 40, no. 5 (June 2011): 702–13, doi:10.1016/j.respol.2011.02.005.

[227] Maxwell E. McCombs and Donald L. Shaw, "The Agenda-Setting Function of Mass Media," Public Opinion. Quarterly 36, no. 2 (June 20, 1972): 176–87, doi:10.1086/267990.

[228] John Kingdon, "How do issues get on public policy agendas? Ch. 3*Sociology and the Public Agenda*, William Julius Wilson, ed. Sage Publications, 1993.

exploit "windows of opportunity." Majone[229] describes how policymakers use theory selectively after the fact to justify favored policies; he rejects the difference between policy analysis and advocacy, simply calling the combined a "policy innovation", as all policies are a mix of objective analysis, advocacy, and persuasion.

Borras and Edquist[230] explore the selection of innovation policy instruments across three dimensions including (1) selection of the suitable instruments; (2) design and customization of the instrument; and (3) the design or mix in which the instrument is to work. They observe that while countries may have the same innovation goals, the micro-level policies may differ significantly. They cite how ICT policy in Ireland, Israel, and Taiwan manifested itself in different ways in the 1990s. Ireland focused on foreign direct investment; Israel supported R&D through government grants; and Taiwan instructed the a national institution to lead R&D efforts and diffuse them through the country. They define the key instruments as (1) regulatory; (2) economic and financial; (3) soft which are collectively the "sticks, carrots, and sermons" of public policy.

With regard to this analysis, the identification of hard and soft rules conforms to this typology in that hard rules such as bans, prohibition, and legislation such belong the the regulatory category (1) and soft rules (voluntary agreements, code of conduct, multistakeholder etc) belong to the soft instruments category (3). Using the Borras and Edquist formulation, it may be possible to see net neutrality both as regulation on one set of actors (telecom operators) and an economic transfer in the form of an "artificial subsidy" to another (internet companies or "edge providers").

The authors stress that policy instruments are not "neutral" and hence it is important to select and customize the instrument which is appropriate to address the actual problem. The highlight this as a means to identify which activity of the innovation system that the instrument is supposed to address. The key activities include (1)

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[229] Giandomenico Majone, *Evidence, Argument, and Persuasion in the Policy Process* (Yale University Press, 1989).

[230] The choice of innovation policy instruments

provision of knowledge inputs to the innovation process; (2) demand-side activities; (3) provision of constituents; and (4) support services for innovating firms.

They note that it is common for actors to disagree on the type of policy instrument and how it should be designed. They note that when contestation is fierce and widespread, that public governments and agencies should reconsider the specific contents of the instrument or even the entire instrument. They describe that instruments are frequently used to address a problem of low performance in the innovation system. This conclusion could be important for the selection of hard instruments for net neutrality, which are highly contested and litigated.

3.3 USING ANALYTICS TO STUDY MOBILE APPS

The research question investigates whether the introduction of net neutrality in a given country stimulates that country's third party application innovation in mobile apps on the internet. As net neutrality is promulgated on a national basis, the research question tests whether the introduction of net neutrality in a given country stimulates the production of apps from publishers based in that country, as measured by the number of downloads, and to what degree do apps used in that country come from other countries with net neutrality rules or not.

The investigation also characterizes the results for different types of net neutrality regimes, whether soft rules, hard rules, or no rules. The investigation compares countries with relevant socio-economic factors but with different policy regimes.

Data was collected from two enterprise market research platforms for mobile applications for activity in Apple's App Store and Google Play, the two prevailing app stores in the set of countries to be studies. These data sets are provided by AppAnnie and Apptopia. AppAnnie has been available for some time and has good historic data on rank of top downloads by country, category, and app store, but on the other hand, it provides only ranking data, not the actual number of downloads.

Apptopia offers data on downloads, usage and revenues. Its historical record of apps is shorter, but it has better aggregation ability, so reports can be made to cover longer periods of time. AppAnnie offers only a daily view, whereas Apptopia's offers an aggregate view of the last 90 days. Neither dataset is perfect, and each some deficiencies which are highlighted when relevant. However offering the results of the observations from both tools provides a more fulsome review of the mobile app market in the relevant countries.

The data is then viewed in light of variables for mobile network competition, sophistication, and penetration.

The statistical calculations have been performed in partnership with data scientist Simone Celant[231] in Rome, Italy. Celant has Ph.D. and postdoctoral degree in statistics, with a focus on the social sciences. The research is structured on multiple analytical steps.

1. First, the data is reviewed at national level among single countries having similar socio-economic features but different net neutrality rules, in order to verify whether the presence of hard or soft rules encourages the development of internal apps and the subsequent performance in the rankings. This is reviewed both across countries and time periods.

2. The second step investigates the overall data to verify whether the development and success of apps published in single countries is influenced by their net neutrality status. This is reviewed both across countries and time periods.

Both of these analytical approaches are based on the comparisons between proportions in the distributions. The key instrument to verify the statistical significance of the observed differences between values is the test on proportions, which evaluates the null that two proportions are equal against the alternative that the observed difference between them is statistically significant. The test statistic is equal to:

[231] "Simone Celant | LinkedIn," https://it.linkedin.com/in/simone-celant-4a4a4637/en accessed June 20, 2016,

$$T = \frac{\hat{p}_1 - \hat{p}_2}{\frac{\hat{p}_1 + \hat{p}_2}{2}\left(1 - \frac{\hat{p}_1 + \hat{p}_2}{2}\right)\sqrt{\frac{1}{n_1} + \frac{1}{n_2}}}$$

where $\hat{p}_1$ and $\hat{p}_2$ are the observed sample proportions; and n_1 and n_2 are the respective sample sizes. This statistic, under the null of equivalence, follows a normal distribution.

The second step is to perform a further comparison on categories of apps in order to verify whether there is statistical evidence that categories are not randomly distributed between different net neutrality statuses. This is accomplished with cross tabulation and the Chi-squared test. This test, on two-sized tables, verifies the null that there is no association between couples of categorical factors, against the null that they are dependent on each other. Note that being based on the comparison between couple of variable of all kinds, no information on the "direction" of the dependency (for instance, in the case of the correlation coefficient) is provided by the Chi-squared index. The formulation of the index is the following:

$$X^2 = \sum_{r=1}^{R} \sum_{s=1}^{S} \frac{\left(n_{rs} - \frac{n_{r.} \times n_{.s}}{n}\right)^2}{\frac{n_{r.} \times n_{.s}}{n}}$$

where n_{rs} represents the number of units showing level r of the first categorical factors and the level s in the second categorical factors in the joint distribution, $n_{r.}$ the overall number of units showing level r in the first categorical factors and n_s the overall number of units showing the level s in the second categorical factors. This statistic, under the null of no association, follows the χ^2 distribution with $(R\text{-}1)(S\text{-}1)$ degrees of freedom, being R the number of levels in the first factors and S the number of levels in the second factor.

A second analytical step is be based on rank analysis. This will attempt to determine the number of internal apps and apps from countries with or without net neutrality rules that appear among the most downloaded, used, or highest grossing mobile applications for

that country as well as a report on their performance overall. As in the previous analytical steps, two approaches are followed.

1. For the comparison between single countries, a limited number of different countries with similar socio-economic features but different net neutrality statuses are selected. The data is collected on the the significant level of apps by download, revenue and usage (generally the top 250 apps overall for each country is sufficient to characterize the market) from the publishers from different countries in specific groups. The groups include internal/local publishers for the relevant country, publishers from the USA, publishers from countries with soft rules, publishers from countries with hard rules, and publisher from countries with no rules. This will be reviewed both across countries and time periods.

2. The overall data set will be analyzed by selecting the top apps (by downloads, revenues and usage) from publishers in the same groups as in the previous case, and the compare how different groups perform, especially over time.

The comparison between the ranking structures is performed using the Wilcoxon Signed-Rank test. This test verifies the null that two ordered structures come from the same population, against the alternative that populations are statistically different; the alternative hypothesis can be both unilateral and bilateral. In other words, the Wilcoxon Signed-Rank test verifies the hypothesis that rank differences between pairs follow a random symmetric distribution around 0, against the alternative that they are not symmetrical around 0. The test is based on the computation of signed differences between rankings which is expressed as follows

$$W = \sum_{i=1}^{n} [sgn(x_{2i} - x_{1i}) R_i]$$

where *sgn()* indicates the sign function and R_i the i-th rank. Under the null hypothesis, the Wilcoxon test's mean is equal to 0 and its variance is equal to:

$$\frac{n(n+1)(n+2)}{6}$$

The value of the test statistic must be compared to the critical values from the appropriate tables. In practice, this test allows one to verify whether two sets of rankings come from the same population – hence if their differences are statistically significant, which, in the case on cross-country comparisons, would imply that the distribution of, say, apps coming from local publishers perform better or worse in a country than in another.

The research design focuses on a set of countries, coded for their type of net neutrality rules and the relevant year. The prevailing top mobile applications of each of these countries are studied using the measurement platforms of Apptopia and AppAnnie over various time periods. A list of the countries studies, the type of net neutrality rule and year of implementation follows

The analysis focuses further on two similar EU countries, Netherlands and Denmark in which Netherlands has a hard net neutrality rule (legislation) and Denmark has a soft rule (self-regulation). It is understandable that comparing some 50 nations on net neutrality rules gives rise to some measurement challenges given their heterogeneity; that is why the analysis focuses more closely on two similar nations with different policies. The Netherlands and Denmark are both highly ranked in measures for broadband and digitization, but they have chosen diametrically different approaches to net neutrality. The test observes to what degree the countries produce their own apps as a function of their net neutrality rules.

Following is a general table to compare the differences between hard and soft rules. Across the many countries, there is variation with some countries having aspects of both sets of provisions. However the key difference is that hard rules focus more on defining the forbidden activities of broadband providers whereas soft rules focus more on supporting the rights of users.

3.4 COUNTRIES AND RULES

There are 54 nations in the study. The top 250 apps for each country represent over 90 percent of the app activity for that country.

Figure 2: Provisions of hard rules vs. soft rules for net neutrality

Hard Rules

- Legally-binding rules made by legislation or regulation
- No blocking
- No throttling
- No paid prioritization
- Restrictions on pricing and zero rating
- Transparency to traffic management and contracts
- Regulators monitor, enforce, and report on violations
- Specific fines and punishments

Soft Rules

- Voluntary or non-binding rules made by multi-stakeholder model, codes of conduct, and principles
- User's right to access the content, application, and services of their choice.
- Right to attach the devices of their choice
- Right to connection with declared quality and capacity
- Transparency to traffic management and contract
- Freedom to offer differentiated services provided they do not degrade the quality of best efforts Internet access
- Regulators monitor the quality of networks

Soft rules have been used primarily in the Nordic countries, United Kingdom, Switzerland, Japan and South Korea. These rules align most closely to Wu's prescription for users' rights, and as Wu describes, the threat of regulation is effective to change behavior.

While soft rules are voluntary and non-binding, they may employ a "carrot and stick dynamic". ISPs have an incentive not be further regulated, and regulators have leverage to nudge ISPs toward desired

goals, whether spectrum purchase, infrastructure investment, network sharing, universal service contributions etc. However the regulator retains the power to impose hard rules if harmful behavior emerged. Soft rules are delivered through multistakeholder models, codes of conduct, and self-regulation. Their provisions tend to focus on the user's rights with some traffic management provisions.

It's important to underscore that soft rules are voluntary but they are backed up by the shared understanding that hard rules can follow if the soft rules are violated. At the same point, it should be noted that litigation has not emerged in soft rule countries. Moreover there is a significant record of net neutrality or complaint in soft rule countries.

Whereas soft rule regimes may suggest constructive, cooperative relationships between regulators and broadband providers, the introduction of hard rules signals a change in the relationship between regulator and ISP, from cooperative to adversarial. Hard rules are delivered through legislation or regulation and are binding and punitive. Rather than focusing on user rights, they focus on industrial regulation and controlling and restricting broadband providers' management of networks and commercial arrangements. Perhaps unsurprising, litigation has become a feature of hard rule environments, where "neutrality" can frequently be a malleable concept. Practices not considered harmful at one point become "violations" at a later stage. Consequently broadband providers have sued telecom regulators for overstepping their authority, and have won in a number of cases. Hard rules have been in place in Netherlands, Slovenia, and Chile, and have been promulgated more recently in the US and EU.

The discussion section suggests some reasons why hard rules have become more prevalent, even when countries with soft rules had a successful record with significant mobile app innovation and network investment.

Following are the countries with hard rules, either legislation or telecom regulation, pre April 2016. There are 14 countries.

Figure 3: Countries with Hard Net Neutrality Rules

Chile	2010	Argentina	2013
Canada	2010	Israel	2013
Netherlands	2012	Ecuador	2013
Colombia	2011	Brazil	2014
Peru	2012	Mexico	2014
Slovenia	2012	United States*	2015
Turkey	2012	Italy	2015

There are 9 countries with soft rules. The instruments for soft rules comprise self-regulation, codes of conduct, principles, and multistakeholder models. Note that as of April 30, 2016, the net neutrality law took effect in the 28 nations of the EU. Given the UK's vote to leave the European Union on June 23, 2016, it is not clear which regime will predominate in the UK going forward. The decision could be significant for the country, as it is a leading mobile app publisher and home to such publishers as Badoo, King Digital Entertainment (maker of Candy Crush), the BBC, and Mubaloo.

Figure 4:Countries with soft net neutrality rules

Sweden	2009
Norway	2009
Japan	2010
France	2010
Denmark	2011
United Kingdom	2011
South Korea	2011
Austria	2013
Switzerland	2014

Thirty countries in the study had no net neutrality rules on mobile networks during the period of investigation. They include

Figure 5: Countries with no net neutrality rules

Finland*	Pakistan
India*	Ireland
Russia	Saudi Arabia
Australia	Indonesia
Germany	Poland
China	Czech Republic
Spain	United Arab Emirates
Singapore	Kuwait
Taiwan	Croatia
Hong Kong	Egypt
Thailand	Vietnam
New Zealand	Hungary
Belgium	Greece
Malaysia	Romania
	Portugal

The * denotes some distinctions which need to be made for certain countries in the analysis. Attempts to make rules in the USA have been tried since 2005, but it is difficult to determine their effect as they have been litigated, twice turned down, and while a third attempt was upheld in appeals court, there may be a rehearing of the case. Under such a litigious environment it is not clear to what degree rules are either respected and/or enforced.

The provisions to wireless only came into effect in 2015, so relevant rules were not applicable for the time period studied in the US. One of the net neutrality flashpoints, zero rating, is handled on a case-by-case basis. On fixed networks, some companies have agreed to uphold certain types of net neutrality rules under merger conditions, e.g. Comcast agreed to a set of neutrality rules through 2017 as part of its

acquisition of NBC Universal.[232] The American results are listed in a separate column in the analysis because they account for an overwhelming share of the world's mobile app innovation and are thus not counted in the separate category for hard net neutrality rule countries, as the US apps would be counted twice.

Finland accounts for a large share of the world's video game publishers with the average year of founding being 2003. The country created a net neutrality law at the end of 2015, and measurements were taken in March 2016. This three month period is generally too short for a net neutrality regime to be implemented, when looking at the length of time taken in other countries.

India outlawed differential pricing and zero rating in February 2016, but does not have a net neutrality rule. Telecom Regulatory Authority of India (TRAI) conducted a consultation[233] on differential pricing in December 2015 and subsequently imposed a blanket ban[234] on the practice, reviewable in two years. However, there is no net neutrality law as such in India. Further, a "Pre-Consultation" on net neutrality only took place in May of 2016, after the differential pricing ruling. As such, it cannot be deduced that TRAI made its decision based upon incompatibility with a net neutrality law. On October 25, 2016 TRAI is reported[235] to have held an open house on free data architecture,

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[232] John Eggerton, "FCC Approves Comcast/NBCU Deal", "Broadcasting Cable." January 18, 2011, http://www.broadcastingcable.com/news/washington/fcc-approves-comcastnbcu-deal/58397

[233] Consultation Paper on Differential Pricing for Data Services, September 12, 2015, http://www.trai.gov.in/Content/ConDis/20761_0.aspx

[234] "Prohibition of Discriminatory Tariffs for Data Services Regulations," Trai, February 8, 2016, http://www.trai.gov.in/WriteReadData/WhatsNew/Documents/Regulation_Data_Service.pdf.

[235] Recommendations on Free Data Architecture Soon: TRAI, October 26, 2016, News 18, http://www.news18.com/news/tech/recommendations-on-free-data-architecture-soon-trai-1305232.html

Trai to come out with recommendation for Free Data Architecture soon, October 26, 2016, http://tech.firstpost.com/news-analysis/trai-to-come-out-with-recommendation-for-free-data-architecture-soon-343449.html

with the idea to develop a regime in which free data can be employed for a range of actors in the Internet ecosystem. This would suggest that the regulator is attempting to facilitate a pro-consumer and pro-innovation solution for zero rating and free data.

The rules for the European Union officially came into effect on April 30, 2016 but their practical implementation was not decided until August 2016, and even then the implementation rules are not binding. Thus the rules from before April 30, 2016 are used for this study, and measures are taken before this date to be consistent.

In the case of AppAnnie the reported information is based primarily on algorithms and statistical projections. AppAnnie explains,

> AppAnnie analyzes app ranks across all countries and categories by day and combines this with anonymized and aggregated transactional data from our free product App Analytics. Our advanced statistical modeling and rigorous benchmarking extrapolate the samples properly, creating accurate revenue and download estimates. Please note that we always provide estimates, we never sell actual data from a publisher!"[236]

AppAnnie has a globally comprehensive dataset for countries on a national level, is constantly refreshed, has a relatively long history (2010), and has significant depth measuring about 500 apps for each store (though the company says that only the top 200 apps are statistically significant). Note that the free, public version of AppAnnie was used for this study.

The number of downloads per app is not given in AppAnnie.com, but appearance in the top ten of the app store indicates a high level of downloads, approximately 10,000 to 25,000 per day depending on the country and app. The top 100-200 apps are significant for the market, assuming the depth of the particular category. After position 200 in AppAnnie.com, the significance falls precipitously, and below rank number 300, it ceases to matter. One can understand the phenomena

[236] "AppAnnie," AppAnnie.com, accessed June 20, 2016, http://www.appannie.com.

from Google's search engine in that the first three results get the lion's share of clicks, followed by the remaining 7 results on the first page, but generally users never go past the first page.[237] Thus appearing in the top 10 for the category is important for adoption in app stores as it is in search engines.

In the case of Apptopia, 180,000 publishers report their data to the company which then aggregate the information into an interface.[238] A series of algorithmic predictions are applied to estimate the performance of apps not included among those which directly report to Apptopia. Thereafter the company verifies its results against publicly available information for which the app providers themselves report. Apptopia notes 75 percent accuracy in its measurements.

Both Apptopia and AppAnnie are considered enterprise-level, commercial grade software tools. The selection of these tools was the appropriate, if not the only choice, to perform the analysis. While this information may not be perfect, the author believes it to be the best available information,

The overall method, developed over 2 years of review and testing of various data sets, represents the author's best attempt to create the relevant framework to test Wu's paradigm in light of net neutrality rules around the world. It would have been desirable to have analyzed a set of impact assessments or cost benefit analyses undertaken by telecom regulatory authorities before implementing net neutrality policies, but those investigations have not been conducted. As such, this approach represents a preliminary way to test net neutrality policy with the best available information.

Following are important assumptions, limitations, definitions for the analysis.

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[237] Andreas Ramos and Stephanie Cota, *Search Engine Marketing*, 1 edition (New York: McGraw-Hill Education, 2008).

[238] "How accurate are Apptopia's estimations?" Apptopia.com https://apptopia.uservoice.com/knowledgebase/articles/610773-how-accurate-are-apptopia-s-estimations

3.5 ASSUMPTIONS

1. The effects of net neutrality rules can be measured by studying the mobile app environment

This departure point of the analysis is that the regulation is accepted at face value, that is to say, it assumes that rules perform in the way that regulators and advocates describe and deliver the purported policy goals. It also assumes that rules have a measureable impact over time. To be sure, there are pitfalls in any measurement. Decisions on how to ensure controls and validity can have material impacts. As such, the analysis attempts to be as neutral and objective as possible, but it recognizes that the quality of measurement may be somewhat dependent on the assumptions.[239]

It may be the case that net neutrality has an impact that cannot be measured with this methodology. Given rational expectations, firms may adjust behavior under regulation either to conform with rules, to appear to conform with rules while not conforming to rules, or to change strategy to avoid or minimize the effect of regulation.

The author does not preclude that this method is the best; it was the best that could be done under the circumstances.

2. There is a set of directional relationships related to innovation which is supported by net neutrality

In addition to the ability to measure the effects of rules, the study assumes that there is a set of relationships that drive innovation which are supported by net neutrality rules. That is to say, according to net neutrality, the BIAS, ISP, or telecom provider must be restrained from interfering in the ecosystem so that the edge provider can flourish. As such the expectation is that the promoted policy can be applied and a positive effect can be observed.

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[239] Pedhazur, Elazar J.; Schmelkin, Liora Pedhazur. *Measurement, Design, and Analysis: An Integrated Approach (*1st ed.). Hillsdale, NJ: Lawrence Erlbaum Associates., 1991 pp. 15–29. ISBN 0-8058-1063-3.

3. Countries have a similar capability to produce apps

The study assumes that countries each have a similar capacity to produce mobile apps and the main differentiating factor is the degree to which they implement a "neutral platform" by creating net neutrality rules. Some attempt is made later in the analysis to account for important differences in countries such as the install base of devices and the number and types of mobile networks, but networks and devices are not are not theorized as such in net neutrality literature.

4. All apps are equal

The notion that al data is considered equal under net neutrality is extended to all apps being considered equal. Thus having more apps is better than less, without any qualitative judgement about the value of any one app. To be sure, users will make judgements about apps, for example game A may be better than game B, or a society may say that it prefers a health care app over a gaming app, but such distinctions are not part of the net neutrality theory, as all applications, whether fundamental or derivative, are considered equal. To be sure, an innovator may create an app for a niche audience which will only garner a small number of downloads but have a relatively high value for that particular audience. To account for locally developed apps that may appear in the "long tail" of distribution, measurements were taken with Apptopia which cover up to 2000 apps downloaded over a 90 day period. However the author recognizes that there may be apps in the marketplace, which because of limited downloads, were not included in the measurement.

5. Focus on downloads, not revenue

The focuses on app downloads, not revenue, was chosen as the preferable way to account for both for profit and non-profit apps. However this does skew the analysis in favor of advertising-supported over fee-based apps. The Apptopia measurements allow some analysis based on revenue.

6. Does not account for role of intellectual property rights

The analysis does not account for the particular rules for intellectual property in the given country. It could be that governments restrict apps because they violate the copyright rules of the country, however the author is not aware of instance of this.

7. Other issues not mentioned

The author recognizes that there could be a number of conditions which could impact the ability to access and run mobile apps from the user perspective which have not been included in the analysis, e.g. device type, friction, transaction cost, taxation and other conditions

3.6 LIMITATIONS

This method of analysis has a number of limitations. As will be described, there is limited data to measure Internet innovation. Moreover there is not a dataset that conforms directly to Wu's conception of the Internet, that of "edge providers" creating innovation. Though there are firm and sector level datasets, prevailing theories of innovation suggest that an ecosystem creates innovation, in other words that the parts of a system work together in symbiotic ways. Net neutrality contradicts that view in that it suggests that one actor (broadband internet access providers) need to be controlled so that another (edge providers) can flourish. As such, the ability to measure only the edge providers required finding such a dataset. A number of adjustments were made, and data has been taken from two data sets from competing vendors to avoid selection bias.

Moreover it is recognized that simply counting the number of apps as a proxy is an imperfect measure of innovation. The author could hypothesize that some set of social benefit apps may be more important than entertainment apps for example, but that would be introducing the author's bias rather than focusing on what net neutrality suggests should be the outcome: "the best innovations".

It is also recognized that users may download apps via wifi networks and then use them on mobile networks. There was not systematic way

to account for wifi, so it is assumed that wifi is a constant and countries are instead noted for the type and number of mobile networks present.

The measurement tools while powerful still had limitations in their flexibility and specificity.

It is also not clear to what degree actors know about net neutrality and whether the presence or absence of rules changes behavior. For example, would app developers move to markets with hard net neutrality rules? Do users download more apps because they know net neutrality rules are in place? This could be important questions but were outside the scope of this study.

Teece suggests that the level of mobile network infrastructure has something to do with the level of innovation, for example the Siri App on the iPhone can't work unless the phone runs on a 4G network. For example, the FCC's virtuous circle theory posits that the level of innovation (and associated traffic) will increase the level of investment.[240] It believes that a state of neutrality will lead to innovation and then to investment. That particular theory was not modeled for this study. However, a cursory investigation was made to the level of mobile infrastructure by looking at a set of indicators[241] prepared by the GSM Association in the global mobile connectivity report.[242] This data set was used because it covered the largest numbers of countries with a number of relevant indicators for mobile infrastructure which were normalized so that meaningful comparisons could be made across countries.

[240] See later discussion of FCC's Virtuous Circle.

[241] "Mobile Connectivity Index", accessed November 16, 2016, http://www.mobileconnectivityindex.com/

[242] Mobile Connectivity Index Launch Report, GSMA, June 24, 2016, http://www.gsma.com/mobilefordevelopment/programme/connected-society/mobile-connectivity-index-launch-report

3.7 DEFINITIONS

Following are the definitions used for study.

3.7.1 APPLICATION

An application, or app, is a specialized software program downloaded to a mobile device. An app generally offers a key feature, functionality or use case. The use of mobile apps on the internet is different from web browsing in which browsed the web to find pages of information. With an app, a developer creates an app to focus on a use case, uploads the app to the app marketplace, and then the users download the app. The process of placement and discovery for apps is different than for websites. The emergence of mobile applications is a paradigm shift from web browsing; forcing companies to change their formats and allowing the emergence of "mobile-first" companies. Consider the app Uber, an online transportation network with competes with traditional taxis. Users submit a trip request via mobile phone. Using the phone's geolocation abilities, the driver and user are informed of each other's location. The app is integrated with a payment system so when the ride is complete, the payment is automatically added to the user's account. Both user and driver can rate the experience which is then displayed within the app's interface. Having a mobile app offers the user flexibility of requesting a ride regardless of location and does not require that the use sit a computer with a fixed line network connection, the earlier paradigm of the Internet.

3.7.2 INNOVATION

Innovation is generalized in Wu's article to a set applications from edge providers, so for the purposes of the research, innovation needs to be defined in order to be measured. In this research, innovation is any kind of content, application, or service created by a third party edge provider. For the purpose of this analysis, the presence of an app is counted as a single observation. While innovation could theoretically emerge from a broadband provider or user, this is not part of the analysis per the priorities defined by Wu. By his definition

and Lessig's, innovation happens at the edge of the network by edge providers. Innovation does not occur in the network itself.

3.7.3 LEGAL INSTRUMENTS USED FOR NET NEUTRALITY RULES

The author has collected links to the net neutrality rules for a set of countries. The rules of each country were categorized in one of three ways: no rules, soft rules, or hard rules. Countries with no rules may have net neutrality debates and proposals, but the relevant authorities have not created an official regime. The 28 nations of the EU must conform to the net neutrality law as of April 30, 2016, but implementation guidelines are pending. As much as possible, measurements are taken prior to April 30, 2016 to avoid confusion.

Countries with soft rules use a variety of measures such as multi-stakeholder models, principles, codes of conduct, and self-regulation. Multistakeholder models are common in internet governance to allow for the participation of many actors in emergent ecosystems. They are proven to be effective means to address conflicts through dialogue.[243] Principles, codes of conduct and self-regulation are initiated either by regulators, operators, or other actor, or in cooperation as a proactive means to protect users rights. Countries with soft rules take a carrot and stick approach, a reward to operators for avoiding hard regulation at the outset, but at the same time, the understanding that hard rules can follow if abuse occurs. It's important to note that this group of rules represents the longest running regime for net neutrality. Some of the leading countries with this approach are Denmark, Sweden, United Kingdom, and Switzerland. According to Luca Belli, head of the Dynamic Coalition on Net Neutrality and author of the Model

[243] Layton, Roslyn. "Test of the FCC's Virtuous Circle: Preliminary Results for Edge Provider Innovation and BIAS Provider Investment by Country with Hard Versus Soft Rules", Chapter 13. Net Neutrality Compendium Springer, 2016 http://www.springer.com/us/book/9783319264240

See also

Mark Jamison and Roslyn Layton, "Beyond Net Neutrality: Policies for Leadership in the Information, Computing, and Network Industries", June 2016, https://www.aei.org/wp-content/uploads/2016/06/Beyond-net-neutrality.pdf

Framework on Net Neutrality,[244] hard rules are not a requirement for net neutrality. In his opinion, the soft rules of the Danish and Norwegian regimes have been successful.[245]

Given that mobile contract complaints is a common consumer issue, it begs the question why the regulator does not focus more on transparency requirements. Such an approach was taken by the Swedish regulator (PTS) in 2009, establishing guidelines in 2009[246] in lieu of making a net neutrality law. In the Swedish perspective, net neutrality is about ensuring transparency in pricing, service offerings, network quality, as well as upstream and downstream capacity so that consumers are clear in what they purchase and can easily switch providers. PTS claims its consumer-centric, transparency-focused approach is successful and has improved operating norms so much that adopting to the EU's new solution is a step backward. [247]

Whereas soft rule regimes focus on promoting users rights (right to access content, applications and services of one's choice and the right to use devices of one's choice), the rules in countries with hard regimes have a starting point of the prohibitions on operators, for example, no blocking, throttling, or paid prioritization. Countries with hard rules use either legislation or regulation to create binding, punitive regimes. Countries with legislation on net neutrality include Netherlands, Slovenia, and countries in Latin America such as Chile, Brazil, Mexico, and Argentina. The US and Canada are two countries which take the unique approach in which telecom regulators unilaterally create rules. Rules in both countries have been litigated.

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[244] "Dynamic Coalition on Network Neutrality," Network Neutrality Coalition, accessed June 20, 2016, http://networkneutrality.info/sources.html.

[245] EuroDIG Association, "Embracing the Digital (R)evolution," EuroDIG, June 20, 2016, http://www.eurodig.org/eurodig-2016/. Luca Belli. Personal interview, 10 June 2016. Brussels. EuroDIG

[246] Post-och Telestyrelsen (PTS), "Nätneutralitet", http://www.pts.se/sv/Bransch/Internet/Oppenhet-till-internet/

[247] ETNO, "Ola Bergström, Director at Swedish Post and Telecom Authority - PTS, Gives an Interview at ETNO-MLex Summit 2014," viEUws, July 7, 2014, www.vieuws.eu/etno/etno-etno-mlex-summit-2014-interview-with-ola-bergstrom-director-for-international-affairs-swedish-post-and-telecom-authority-pts/

Countries with no rules may be in process of making rules but such promulgations were not concluded by the time of this writing. To be sure, there has been heated debate on the topic in India. Policymakers in Russia and China have had deliberations but no formal policies have been issued.[248]

3.7.4 ACTORS

For the purpose of this analysis some general categories are created. Broadband providers are the operators of networks, whether they are owners or resellers. In this analysis they are the mobile network operators, whether incumbents or challengers. They build and run networks and deliver broadband service. Telecom regulatory authorities are a single entity within each country which oversees net neutrality rules. Edge providers offer third party content, services and applications, for example Google, Netflix, or Wikipedia. End users are people who buy internet subscriptions to access third party data. App developers, whether an individual working in a garage or a publicly traded company that makes mobile games, are "publishers."

It bears mention that with regard to the data, two actors have enormous influence. Google develops the lion's share of the world's mobile operating systems, Android and its platform Google Play are dominant systems. Apple is second with its proprietary iPhone, iOS operating system, and AppStore marketplace. The market power and concentration of "edge providers" is evident when studying the data, but that seems of limited concern to most net neutrality advocates. To be sure, Wu wrote his article before the emergence of the mobile Internet, but he did not discuss how edge providers would come to

[248] Rob Powell, "The Curious Case of WeChat and Net Neutrality in China," April 8, 2013, http://www.telecomramblings.com/2013/04/the-curious-case-of-wechat-and-net-neutrality-in-china/
https://gettingthedealthrough.com/intelligence/28/article/3741/telecoms-media-russia

dominate the ecosystem. Wu has since written a paper about Google's search dominance.[249]

3.7.5 TYPES OF NETWORKS

While the author would have preferred to study both wireline and wireless, this method was abandoned because no appropriate data set could be found to cover both networks. Thus the study instead focuses on 2G-4G mobile wireless networks where mobile devices are deployed. While tablets are used on these networks, this study only focuses on the app innovation related to traffic on handsets, primarily smartphones. This decision to focus on mobile networks is important for a number of reasons.

Broadband connections are growing on mobile networks both in developed and developing countries, whereas wireline subscriptions are essentially flat.[250] The current flashpoints on the debate on net neutrality frequently have to do with mobile pricing models. Going forward the growth of the Internet will largely be through mobile broadband in developing countries, as most developed countries are saturated on broadband subscriptions, Many people have multiple mobile broadband subscriptions. Wu's concept was predicated in a world of just two networks: DSL and cable, where speeds of 3-6 Mbps prevailed. However today in developed countries, multiple 4G mobile broadband networks exceed the 2003 speed threshold 2-3 times. Even developing countries have 4G networks. In addition there are a range of fixed wireless options.

Mobile broadband was not commercially available in 2003 when Wu wrote his article. Today's mobile broadband subscriptions are faster than the cable subscriptions Wu described in his article and offer more bandwidth. An investigation of the types of Apple and Android smartphones deployed, while important, has not been included in this

[249] Michael Luca et al., "Does Google Content Degrade Google Search? Experimental Evidence," SSRN Scholarly Paper (Rochester, NY: Social Science Research Network, September 29, 2015), http://papers.ssrn.com/abstract=2667143.

[250] "OECD Broadband Statistics Update - OECD," February 19, 2016, http://www.oecd.org/sti/broadband/broadband-statistics-update.htm.

analysis, as the data set did not offer this information. However an interesting topic for future research could be to what degree pre-loaded apps on smartphones get an advantage over downloaded apps which are ostensibly found in a "neutral" fashion, at least in the Wu paradigm.[251] It is suggested that preloaded apps on smartphones are four times more likely to be used than the corresponding app one downloads from the Internet in what is called "default bias" or "consumer inertia" toward preloaded apps.

Importantly there is a dynamic in that mobile users may also have access to fixed networks.[252] They may download apps on fixed networks such as wifi and then use them on mobile networks. Such behavior was not modeled for this research as the author is not aware of data that reports whether an app is downloaded via wifi or mobile network. In any case, the net neutrality rules would likely apply equally to both networks.

3.8 SOME BACKGROUND ON THE GLOBAL APP MARKET

AppAnnie develops some helpful reports based on its data. Some points are helpful to characterize the global app market. [253] This section briefly reviews the mobile app maturity model, app stores, and the market shares of different regions for mobile apps.

The life cycle of innovation is not discussed in Tim Wu's article, but it may have bearing on the situation experienced today. AppAnnie offers the following diagram of an App Market Maturity Model. For a typical free mobile app, the goal is maximize downloads at the time of launch. Once downloaded, the goal is maximize revenue and usage.

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[251] Vitaly Dianov, "Russia: Google Abused Android Dominance," September 17, 2015, http://gblplaw.com/news/articles/81535/.

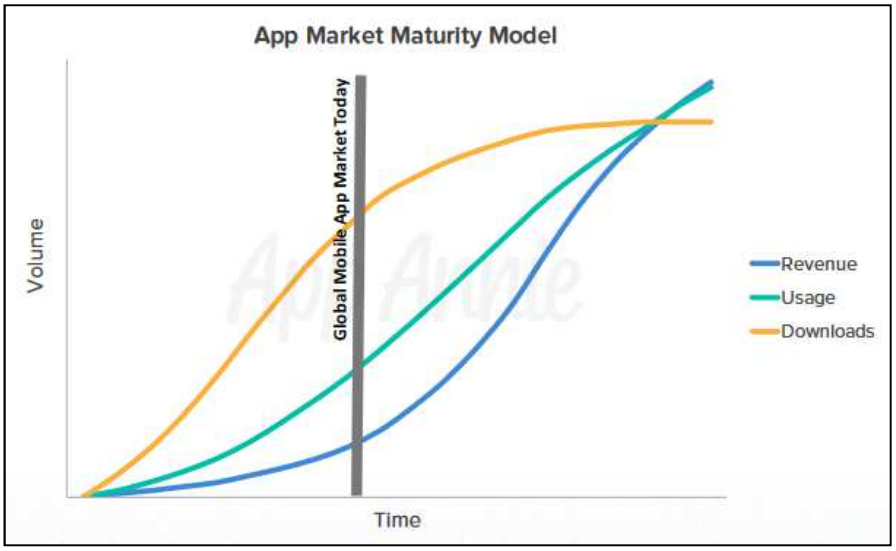
[252] Lehr, William and L.W. McKnight "Wireless Internet access: 3G vs. WiFi?" Telecommunications Policy 27 (2003) 351–370 http://people.csail.mit.edu/wlehr/Lehr-Papers_files/Lehr%20Wifi%203G.pdf

[253] "App Annie Mobile App Forecast: The Path to $100 Billion." AppAnnie.com http://files.appannie.com.s3.amazonaws.com/reports/App-Annie-02-2016-Forecast-EN.pdf?aliId=93311051

Once an app is in the marketplace, its level of downloads becomes less important than its level of usage and revenue. The investigation in this project tries to capture all of these measures for a holistic view of the app market, but recognizing that different apps will be different stages in their life cycle, and some apps may not be revenue generators, but rather apps designed for customer service, egovernment, and so on. But most important for testing net neutrality should be the level of new apps and their associated downloads. Following the logic of net neutrality, the goal of delivering rules is that net new innovation should emerge

Separately, there is an industry observation that the world of mobile apps is saturated. Observers say that few developers are interested to create apps because the market is already dominated by the American players, and even if apps emerge, the developer's goal is to sell the app to an established player rather than to create a new entity.

Figure 6: App Market Maturity Model (AppAnnie)



Another point that is evident from this study but it rarely mentioned in net neutrality debates is the market power of the Apple and Android

app stores. Each store has a process and criteria for an app to be considered. Moreover there can be a certain degree of curation by the app store owner to make certain apps available. In practice on a set number of apps may be visible at one time. The store also takes a percentage of the revenue earned by the app.

iOS and Android differ in their install base. Apple mobile operating system has about 463 million installations with Google's having more than three times that at 1.8 billion. AppAnnie offers some further statistics about the two mobile app stores on July 5, 2016.[254]

Figure 7**:** Comparisons of Apple and Google App stores, July 2016 (AppAnnie)

	Apple iOS	**Google Play**
Total Apps	2,544,368	3,054,046
Percentage of Non-Games and Games	76.2 % non-games 23.8% games	80.1 % non-games 19.9% games
Submissions to app store/week (previous week)	39,642	21,711
Number of publishers	1,015,149 (2.51 apps per publisher)	1,164,204 (2.62 apps per publisher)
New Publishers added (previous week)	3065	5065

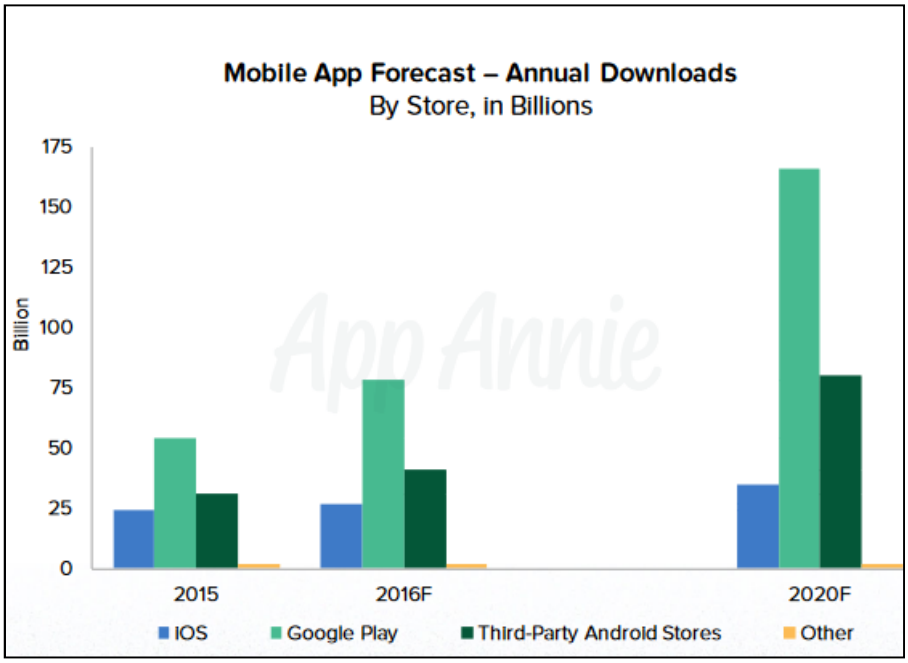
[254] "Apptopia AppStore Market Overview." Apptopia.com https://apptopia.com/market_overview Accessed 5 July 2016

A number of industry practitioners suggest that the greatest barrier for mobile application adoption is app discovery,[255] not the threat that a telecom operator would block an app. Net neutrality holds that that consumers and edge providers blithely traverse the Internet without the need of marketing strategies or platforms to find what they are looking for.[256] On a more prosaic level, that edge providers must invest significant resources in the practices of SEO (search engine optimization) and ASO (app store optimization) to be findable calls into question the neutrality of intermediaries and suggests that users are not engaging in purely neutral platforms. However intermediaries provide the benefit of an interface in which to organize information. Without such tools, users might be required to have significant computer science skills to find information. As such, apps stores provide a valuable clearinghouse for apps. For example, to be preloaded on a phone, app makers generally need to pay a fee to the device maker.

[255]Personal Interview with mobile application developer Babar Baig, creator of the WriteReader iPad application for educators, August 26, 2015.

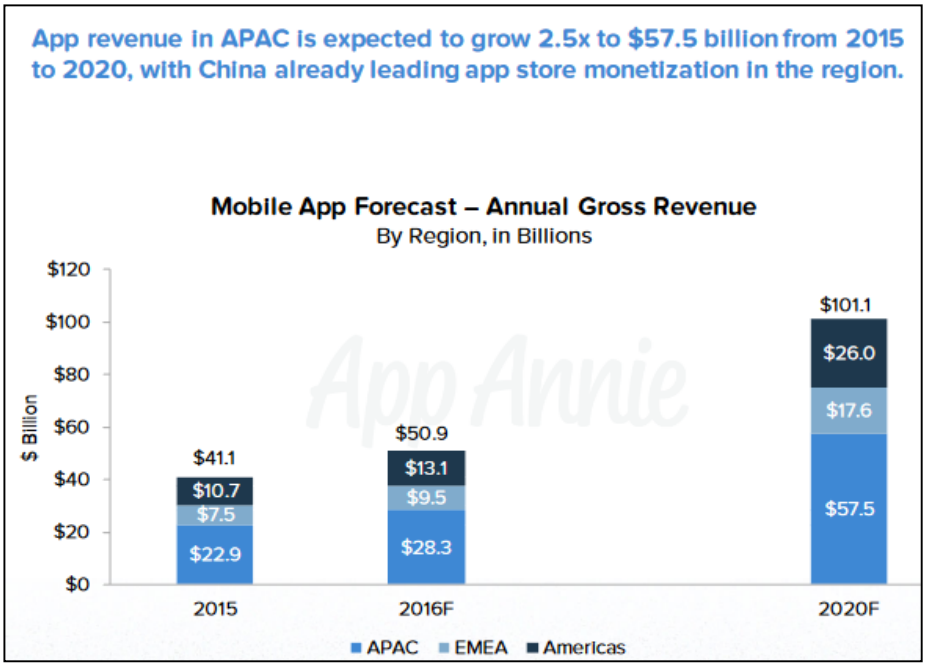
[256] Christopher Yoo, "Free Speech and the Myth of the Internet as an Unintermediated Experience," George Washington Law Review, Vol. 78, Pg. 697, 2010 University of Pennsylvania, Inst for Law & Econ Research Paper No. 09-33 University of Pennsylvania Law School, Public Law Research Paper No. 09-26 TPRC 2009, September 2009, 77.

Figure 8: Mobile App Forecast 2020, Downloads (AppAnnie)



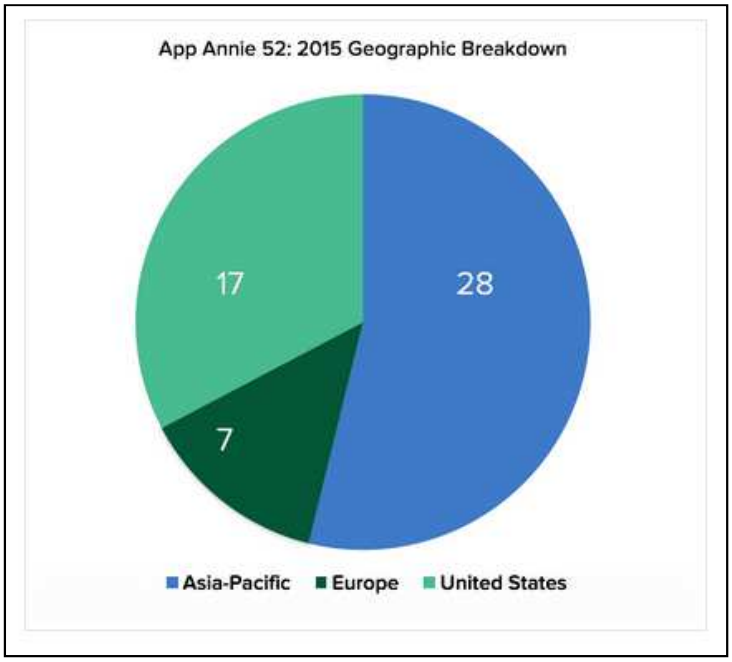
AppAnnie describes the current and projected downloads and revenue for mobile applications, a market of just over USD $50 billion. Publishers in the Asia Pacific region account for approximately 54 percent of all revenue, with that share projected through 2020. It reports that already in 2016, Chinese apps alone have surpassed the USA in revenue and downloads.

Figure 9: Mobile App Forecast 2020 Revenue (AppAnnie)



AppAnnie also provide the 2015 breakdown for the location of the publishers for most downloaded apps. Asia Pacific accounts for 28 of the top 52; the USA 17; and Europe, 7.

Figure 10: Where most downloaded apps come from, 2015 (AppAnnie)



It's important to recognize the distinction between game and non-game apps. The vast majority of revenue in the app market comes from games. However downloads are higher for non-game apps.

Figure 11: Mobile App Forecast 2020, Downloads, Games vs. Non-Games (AppAnnie)

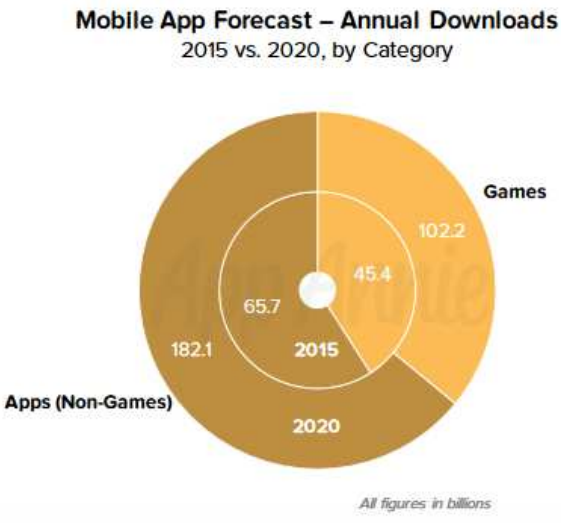
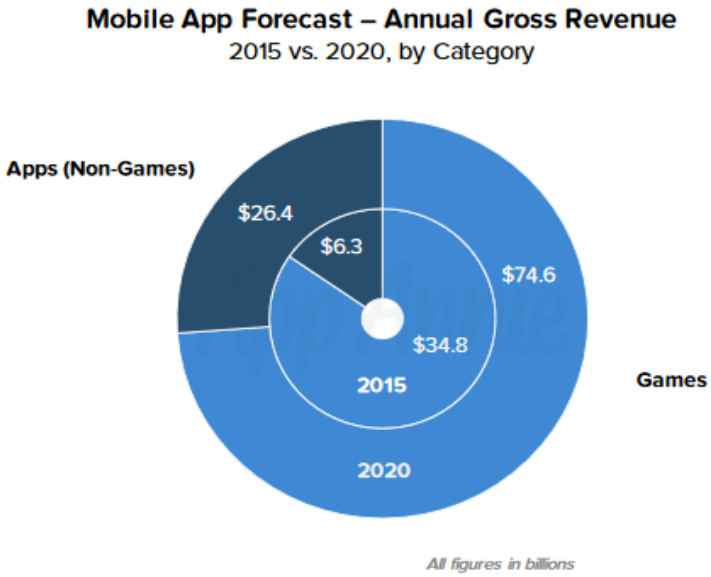


Figure 12: Mobile App Forecast 2020, Revenue, Games vs. Non-Games (AppAnnie)



AppAnnie also reports the top 10 app for revenue and downloads for the last 4-5 years for both Apple iOS and Google Play.

Figure 13: Top Apps Worldwide, iOS, Downloads, all time (AppAnnie)

Top Apps by All-Time Worldwide Downloads

iOS App Store

Rank	App	Company	Release Date
1	Facebook	Facebook	Jul. 2008
2	Facebook Messenger	Facebook	Aug. 2011
3	YouTube	Google	Sept. 2012
4	Instagram	Facebook	Oct. 2010
5	Skype	Microsoft	Mar. 2009
6	WhatsApp Messenger	Facebook	May 2009
7	Find My iPhone	Apple	Jun. 2010
8	Google Maps	Google	Dec. 2012
9	Twitter	Twitter	Oct. 2009
10	iTunes U	Apple	Jan. 2012

App Annie

Figure 14: Top Apps Worldwide, iOS, Revenue, all time (AppAnnie)

Top Apps by All-Time Worldwide Revenue

iOS App Store

Rank	App	Company	Release Date
1	Pandora Radio	Pandora	Jul. 2008
2	LINE	LINE	Jun. 2011
3	Zoosk	Zoosk	Jan. 2010
4	Pages	Apple	Apr. 2010
5	Spotify	Spotify	Jul. 2011
6	Badoo	Badoo	Nov. 2010
7	Skype	Microsoft	Mar. 2009
8	MLB.com At Bat	MLB	Oct. 2008
9	Grindr	Grindr	Mar. 2009
10	LINE PLAY	LINE	Nov. 2012

App Annie

On iOS from 2010-2015, the top downloaded apps come from Facebook (three messaging apps), Google (YouTube in the entertainment category and Maps), Microsoft (Skype, a communications app), Apple, (Find my Phone utility and iTunes U), and Twitter, the social media app. All of the release dates are from 2012 or earlier. As for revenue, the only top performers that excel in both downloads and revenue are Skype (Microsoft) and Apple (Pages app). Other top revenue earners are Pandora (music), Line (music and games), Zoosk (dating), Badoo (dating), Spotify (music), Major League Baseball (sports), and Grindr (dating). All of the apps are US based except Line (Japan), Badoo (UK), and Spotify (Sweden)

Looking at Google Play from 2012-2016,[257] Facebook, Skype and Twitter are top-rated as they are in iOS but other top downloaded apps include Instagram, the Japanese LINE, the Chinese Clean Master utility, the Japanese Viber (LINE competitor), and Flashlight by Surpax, an American publisher.

For top earners in revenue, a different set of players emerge. Line takes the top three spots with messaging and games followed by Pandora; then the South Korean, KakaoTalk messenger tool; the Japanese GREE (social mobile game company based on "degrees" of separation among connected mobile users); the Japanese Pokémon game app; the Japanese Dragon Quest game; LOVOO, the German dating app, and Tinder, an American dating app.

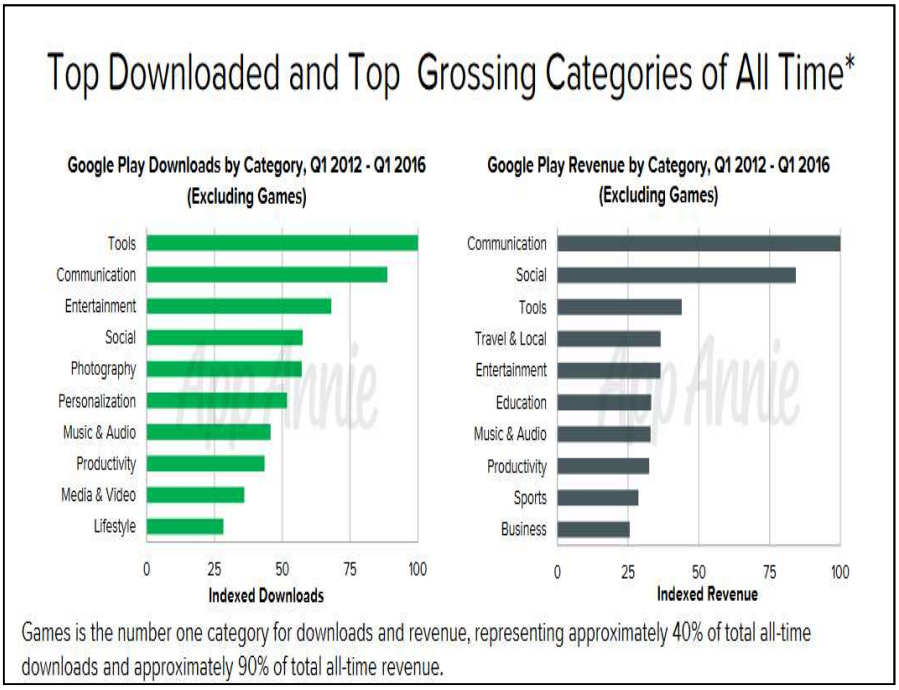
[257] "The Popular Google Play Apps of All Time." AppAnnie.com http://files.appannie.com.s3.amazonaws.com/reports/Top-Google-Play-Apps-All-Time-EN.pdf?mkt_tok=eyJpIjoiWlRZMk5qRTNaV014WlRSaiIsInQiOiJEa1wvVTc2S1VmYTZZQWJmUHo0aWFCSlhqMk53ZVNQVDlhZ2pFenBKUXZtWmowTWo0TW8rbkxJNzQ5VUJwOXpjeUJrYVIrSmlKUGthNDQwRkdlc3Z2dDhBMEhXNndGeWNleVdWbjQ3R2tiK2s9In0%3D

Figure 15: Top Apps all time, Downloads, Google Play (AppAnnie)

Figure 16: Top Apps, All Time, Revenue, Google Play (AppAnnie)

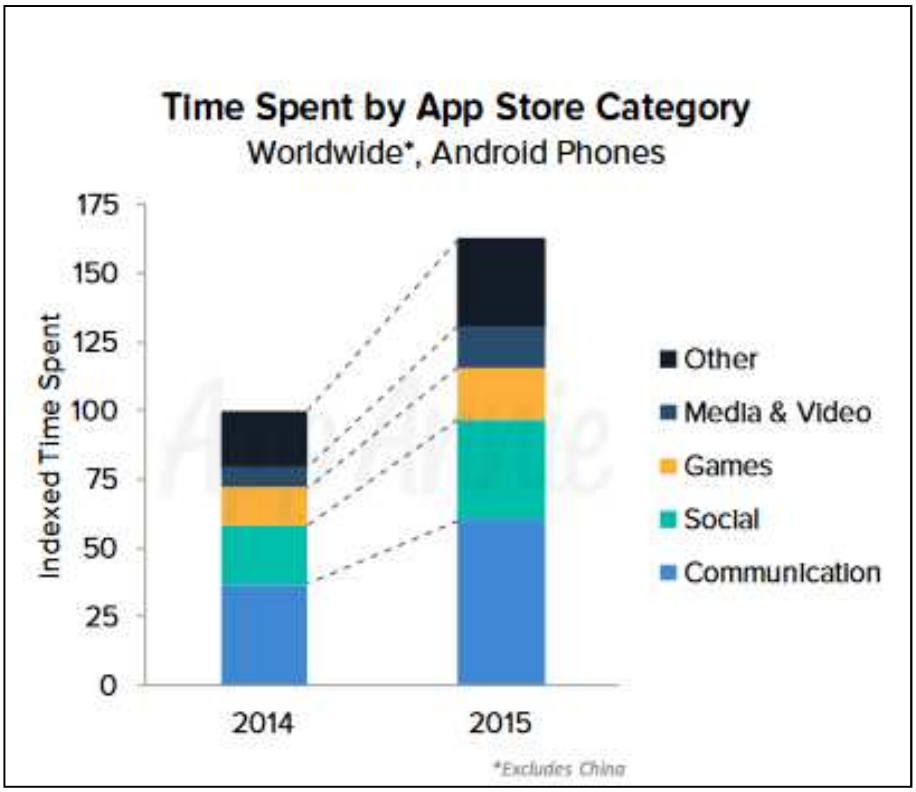
AppAnnie also offers a summary of the top downloaded and grossing categories of all time, after games. The top categories among both downloads and revenue are communication, social networking, and tools.

Figure 17: Top Non-Game Categories, Downloads, Revenue, Google Play (AppAnnie)



When looking at time spent on an Android device, social network and communication are the primary activities, followed by games.

Figure 18: Time Spent by App Store Category, Android (AppAnnie)



While US apps may have historically dominated downloads and revenue, that is already changing. China has already become the world's largest app market by downloads 2016, with a projected 50 billion downloads.[258] App revenue for China in 2015 was close to USD $9 billion.[259] While revenue on Apple devices is strong and growing (also significantly high per device), comprising USD$3.4

[258] "App Annie Mobile App Forecast: China to Surpass the US in 2016." AppAnnie.com March 4, 2016. http://blog.appannie.com/mobile-app-forecast-china-to-surpass-us-in-2016/

[259] Ibid

billion in 2015, Android is proliferating as ever better quality smartphones come to market at lower prices.

As described by Mary Meeker in her annual Internet Trends report,[260] the Chinese app market is also significant in that an individual app performs multiple functions. For example the Ctrip travel app offers users the ability to buy accommodation, airfare, local transport, tours, attraction tickets in addition to providing information on sightseeing, shopping, restaurants, travel insurance, visa, and wifi. The Priceline app by comparison only offers hotel, airfare, and rental cars. The Chinese Tencent offers instant messaging, ecommerce, and games in a single app. Tencent recently acquired the world's largest game company, Finland's Supercell for USD$8.6 billion.[261] Going forward, Chinese, Japanese, and South Korean app makers will be able to use prioritization technologies in their game apps, technologies banned by Open Internet rules in the US and EU.

[260] Mary Meeker, "Internet Trends 2016- Code Conference.". June 1, 2016 http://www.kpcb.com/blog/2016-internet-trends-report

[261] Osawa, Juro and Sarah E. Needleman. "Tencent Seals Deal to Buy 'Clash of Clans' Developer Supercell for $8.6 Billion." *Wall Street Journal*. June 21, 2016. http://www.wsj.com/articles/tencent-agrees-to-acquire-clash-of-clans-maker-supercell-1466493612

Figure 19: Comparing US and Chinese app, Priceline vs. Ctrip (Mary Meeker, KPCB)

AppAnnie data on the 500 top-ranked apps in both the "Top Grossing" and "Top Downloads" categories in 2015 for both the iOS and Android was used in a research project on mobile apps published in 2016 by Mozilla Foundation and Caribou Digital. Called "Winners & Losers in the Global App Economy",[262] the study investigated 37 national markets, app developers, and their revenue. The goal was to identify which countries produced apps and to where apps are exported. A simplified power law curve was employed to estimate

[262] Caribou Digital, Winners & Losers in the Global App Economy, Farnham, Surrey, United Kingdom: Caribou Digital Publishing, 2016.

value capture across all developers. Though the study did not focus on net neutrality policy, it critiqued the notion that the Internet is an inherently neutral network observing, ". . . the app market, like all markets, is a socially constructed system with policies, architectures, and intrinsic biases that govern participation and outcomes. That this governance is largely defined by two firms, Apple and Google, whose platforms control the vast majority of the global market, further concentrates power in the industry and amplifies the effects of those policies and biases on app developers."

The study notes the pre-eminence of the US, Japan, and China and that 95% of the estimated industry value is being captured by just the top 10 producing countries. Of the top ten countries ranked for their number of app developers (US, China, UK, South Korea, Japan, Russia, Germany, India, Taiwan, and Spain),[263] none had hard net neutrality rules. The US rules were adopted in February 2015 but not yet published in the Federal Register in June 2015, when the measurements were taken.

3.9 DATA COLLECTION AND ORGANIZATION

Before settling on the Apptopia and AppAnnie measurements, the author has attempted to find measures of innovation across countries, but it was difficult. For example she investigated the patent database at the World Intellectual Property Organization. There is no Internet category as such, and the patents in the categories of electronic communications and computer science don't necessary cohere to Internet edge providers. This data does not include the significant open source innovations, as there is not an owner as such. Another attempt involved reviewing the innovation index studies such as the Global Innovation Index (INSEAD, Cornell),[264] Bloomberg Innovation Index,[265] and the OECD Innovation Indicators[266], which

[263] Ibid p. 23

[264] "The Global Innovation Index | Leading Innovation Reference," Global Innovation Index, accessed June 20, 2016, https://www.globalinnovationindex.org/content.aspx?page=GII-Home.

[265] "The Bloomberg Innovation Index," Bloomberg.com, accessed June 20, 2016, http://www.bloomberg.com/graphics/2015-innovative-countries

are composite scores related to general economy, level of education, overall regulatory regime government policies, investment in research and development and so on. While these inputs could be important, they do not figure into Wu's paradigm.

As such, Apptopia and AppAnnie emerged as the best, if not only, choice for data. They provide data about mobile apps (rank, category, revenue) for the leading app stores Google Play and Apple's AppStore.

A glance at the top mobile apps for a set of countries shows—perhaps counterintuitively—a similar picture across countries. One might assume that net neutrality would drive more diversity in the kinds of apps people choose across countries, but instead the same few set of apps dominate the ranking in almost all countries. Internet traffic is highly disproportionate to the same location. While on hand Wu says that a neutral internet give users the "best applications", one might predict that neutrality would at least provide a more differentiated picture. One might expect the more neutral environment to have more diverse apps, for example. Instead a few publishers account for the lion's share of traffic.

Amongst online analytics practitioners, this concentration is called the 99/1 rule;[267] 99 percent of traffic goes to the 1 percent of the websites. It's a variation on Pareto's 80/20 rule, also called the law of the vital few or the principle of factor sparsity in network engineering.[268]

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[266] "Innovation Statistics and Indicators," OECD, accessed June 20, 2016

[267] Ramos, Andreas. "Can We Just Build It and They Will Come?" Andreas.com. http://andreas.com/can-we-just-build-it-and-they-will-come/ Accessed November 16, 2016.

[268] Kiremire, Ankunda R. The Application of the Pareto Principle in Software Engineering. October 19, 2011 http://www2.latech.edu/~box/ase/papers2011/Ankunda_termpaper.PDF

Figure 20: Screenshot AppAnnie.com, top grossing apps overall in Netherlands for 1 day on May 12, 2016

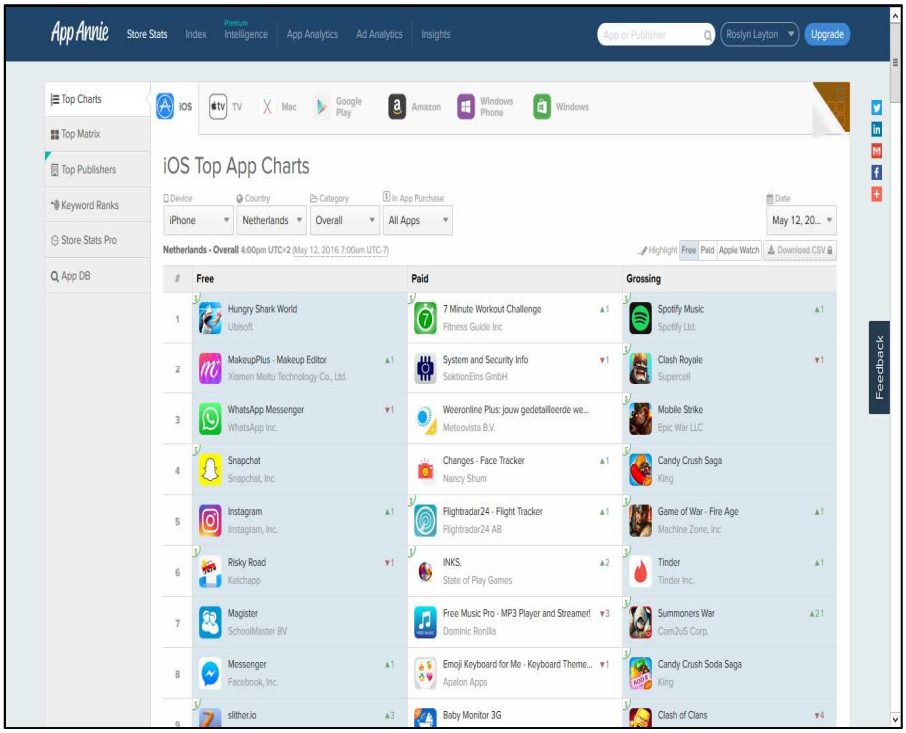
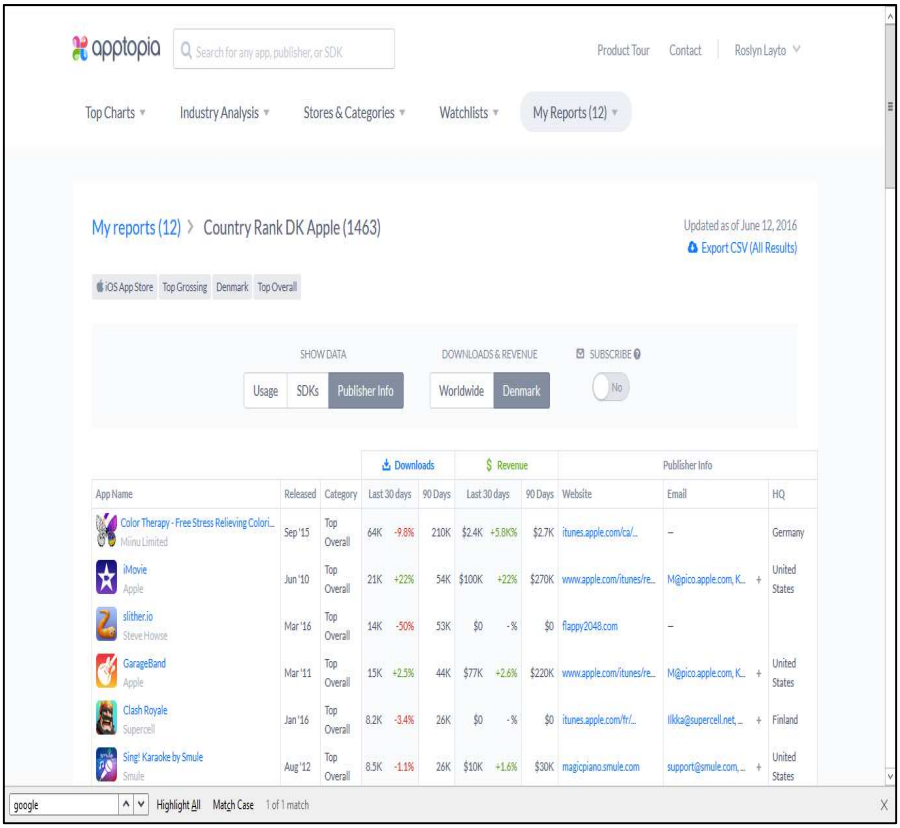


Figure 21: Screenshot from Apptopia, custom report for top grossing apps in Denmark in Apple AppStore for last 30 days from June 12, 2016.



The data collection consists of transcribing the results for the apps for the set of countries along with their relevant characteristics (rank, app name, publisher, publisher location, category of app, revenue etc), assembling them in a spreadsheet, and then analyzing hem. Specifically the analysis attempts to measure the diversity of applications, where the apps creator (publisher) is based, how well the app ranks, how many downloads it earns, and if available, what amount of revenue it earns. The analysis also attempts to characterize to what degree a particular nation can produce its own unique apps and export those apps. Essentially it investigates whether net neutrality rules in a country is a factor for creating “the next Google”.

Two sets of measurements were made, one in AppAnnie and another in Apptopia.

3.10 APPANNIE MEASUREMENTS

The measurements come from software platforms that measure iOS and Google Play stores. Two data sets have been used, AppAnnie and Apptopia. AppAnnie has been in the marketplace for a few years, is considered the leading enterprise tool, and has good historic data about app downloads by country, category and app store, but on the other hand it mainly produces rankings rather than the actual amounts. Moreover its premium version is cost-prohibitive, so this project only uses the free, public version. AppAnnie does produce regular reports summarizing its data on regional and global levels. These are helpful for a macro perspective, and those discussions have been included where relevant. However this data is not directly downloadable. All of the data from AppAnnie was transcribed by hand into statistical tools and spreadsheets for further analysis.

Given the time consuming and cumbersome nature of data collection from AppAnnie, the measurements only cover two points in time for both app stores for a single day, 5 years apart. Thus data has been downloaded from March 1, 2016 and March 1, 2011 for Netherlands, and March 1, 2016 and March 1, 2012 for Denmark. The 2012 date is used for Denmark because it is the first year that Google Play data is available for the country.

The competing platform Apptopia is newer and offers 90 days of of historic data, but offers better data for downloads, usage and revenues, in addition to chronological aggregation capability. AppAnnie's numbers are based on statistical extrapolations whereas Apptopia's are based upon reports on downloads, revenue, and advertising from 180,000 app providers in addition to estimation models, checks with the publicly available information in app stores every hour of the day across 35 parameters (rank, ratings, reviews, price, version history

etc).[269] This information creates 40 billion data points to characterize the respective app marketplaces.[270]Apptopia is competitively priced to win new customers. Apptopia reports 70-90 percent average accuracy in its reporting, with accuracy higher for top performing apps than lower performing ones, which tend to be more volatile.[271]

For both countries, the top 100 downloaded free apps and the top 25 downloaded paid apps have been observed with reference to the iOS system and to Google Play on March 1, 2011 and March 1, 2016. When the data was not available for the selected date (because not all data sets cover the same time period on AppAnnie), data collection has been switched to one year later. For each app, the publisher's location needed to be verified and noted, as this information was not available in AppAnnie. In a few cases, the location of the publisher could not be verified.

Some 1000 records were collected from AppAnnie and then computed separately for past and present observations, as well as jointly to have an overall idea of how app features are distributed across time and space. Following are the quantities collected and compared in the analysis for the two countries and two time periods.

1. Number of apps (all recorded entries);
2. Number of distinct apps (as identified by the same ID – note that the same app on the same store in different years has the same ID, while the same app in different stores has different IDs). For example WhatsApp for Google Play and WhatsApp for iOS are each distinct apps;
3. Number of unified apps (this is the grouping of the different version of the same app from the same publisher, for example WhatsApp for Play and WhatsApp for iOS are distinct apps

[269] "Where does Apptopia get its data from?" Apptopia.com. Accessed November 16, 2016 https://apptopia.uservoice.com/knowledgebase/articles/610779-where-does-apptopia-get-its-data-from

[270] Ibid

[271] "How accurate are Apptopia's estimations." Apptopia.com. Accessed November 16, 2016 https://apptopia.uservoice.com/knowledgebase/articles/610773-how-accurate-are-apptopia-s-estimations

but together they are a "unified" app offered by the publisher Facebook);
4. Number of publishers.

The total number of entries equals 1000 (500 in 2011-12 and 500 in 2016; 500 for Denmark and 500 for the Netherlands; 500 downloaded from the iOS store and 500 from Google Play; 800 entries are free apps, 200 are paid apps). The total number of distinct apps is equal to 737; the total number of unified apps is equal to 637; the total number of publishers is equal to 589.

The number of distinct apps is equal to 449 in 2011-12 and to 367 in 2016 (-18.26%; the difference is 99% statistically significant); the number of unified apps is equal to 402 in 2011-12 and to 296 in 2016 (-26.37%; the difference is 99% significant); the number of publishers is equal to 371 in 2011-12 and to 276 in 2016 (-25.61%, the difference is 99% significant). Therefore, over the last 4-5 years, in Denmark and in the Netherlands the variety among the top downloaded apps has significantly dropped. This is true at both the national and aggregated level: in Denmark a significant decrease in the number of distinct apps (-1.2%, 90% significant), of unified apps (-7.8%, 95% significant) and publishers (-10.2%, 95% significant) has been observed; in the Netherlands, a significant decrease has been observed only in the number of unified apps (-8.3%, 95% significant). The differences between the amount of the decrease in the variety in the single countries and in the two markets combined imply that over the last 4-5 years a relevant overlapping between the top downloaded apps has taken place: the markets tend to become more standardized across countries. Note that this first cut does not yet address the location of the publisher. That will follow.

The P-values and Z-values of each table were then calculated. The p-value is a statistical measure of the extremity of the observed data. The z-value or standard score is the number of standard deviations an observation appears above the mean. For example, it was needed to be determined that the increase or decrease of a line item over the period was significant. These measures are provided to guard against over-interpreting nominal results.

Statistical tests on proportions have been run, in order to verify whether the observed distributional differences across time and space are statistically significant or not. For instance, tests have been run to verify whether the observed differences in the percentages of downloaded apps developed from publishers based within the considered country (specifically, Denmark and Netherlands) are significant or not. Furthermore, the same tests have been run to verify whether the observed differences in the percentages of downloaded apps developed by publishers based in countries with soft net neutrality rules across time are statistically significant.

The tests are presented by displaying three numerical outputs: the observed proportions, the Z-statistics (which are the numbers resulting from the practical formulations of the tests) and the P-values, which are a measurement of the statistical support awarded by the test's null hypothesis – in this case, that proportions are equal. Typically, a null hypothesis is rejected if the associated P-value is less than 0.05 (95% significance).

In this case, the null hypothesis is thus rejected.

3.10.1 METHODS FOR UNIVARIATE ANALYSIS

The first step focuses on distributional features. After downloading ranking data on downloads, usage and revenues, the presence of apps published by countries with net neutrality rules was noted according to the two subsequent approaches:

First, the presence of locally made apps in the relevant rankings for the respective countries was analyzed. The date and type of net neutrality rule was noted for the country. These evaluations have been done on both cross-country and time-related comparisons.

Second the overall data was studied to verify whether the development and success of apps published in single countries is influenced by their net neutrality status. These evaluations have been done on the overall data set and through time comparisons.

Both these analytical approaches are based on the comparisons between proportions in the distributions. The key instrument to verify the statistical significance of the observed differences between values is the test on proportions, which evaluates the null that two proportions are equal in two populations against the alternative that the observed difference between them is statistically significant. The test statistic is equal to:

$$T=\frac{\hat{p}_1-\hat{p}_2}{\hat{p}(1-\hat{p})\sqrt{\frac{1}{n_1}+\frac{1}{n_2}}}$$

Where

T equals the test statistic,

p equals the proportion, and

n equals the respective sample size.

$$\hat{p}=\frac{\hat{p}_1+\hat{p}_2}{2}$$

In this formula, $\hat{p}_1$ and $\hat{p}_2$ are the observed sample proportions, $\hat{p}$ is their average, n_1 and n_2 are the respective sample sizes. This statistic, under the null of equivalence, follows a normal distribution.

3.10.2 RESULTS FOR UNIVARIATE ANALYSIS

The total number of apps from publishers with known headquarter location is equal to 912 (742 free apps and 170 paid apps); the number of distinct apps is equal to 661 (540 free apps and 122 paid apps); the number of unified apps is equal to 548 (452 free apps and 110 paid apps); the number of publishers is equal to 471 (396 related to free apps, 97 related to paid apps); a total of 390 apps (307 free apps, 83 paid apps) allow for in-app purchases. The geographical distributions of the countries in which the publishers of these apps are based, according to six different levels (Denmark, Netherlands, USA, countries with soft net neutrality rules, countries with hard net neutrality rules, countries with no net neutrality rules) are displayed in the following figure.

Figure 22**:** App distributions across countries and groups of countries

	Country	Apps	Distinct Apps	Unified Apps	Publishers
All apps	DK	13.60%	15.13%	15.51%	15.07%
	NL	13.05%	14.83%	14.05%	17.62%
	USA	36.40%	32.83%	32.12%	29.51%
	Soft Rules	18.53%	18.31%	18.61%	17.41%
	Hard Rules	1.54%	1.82%	2.01%	2.12%
	No Rules	16.89%	17.10%	17.70%	18.26%
Free apps	DK	15.09%	16.48%	16.81%	15.91%
	NL	14.69%	16.85%	15.71%	19.44%
	USA	36.52%	31.85%	30.97%	28.54%
	Soft Rules	16.17%	16.48%	17.04%	16.67%
	Hard Rules	0.94%	1.11%	1.33%	1.52%
	No Rules	16.58%	17.22%	18.14%	17.93%
Paid apps	DK	7.06%	9.02%	8.18%	9.28%
	NL	5.88%	8.20%	5.45%	6.19%
	USA	35.88%	37.70%	38.18%	35.05%
	Soft Rules	27.65%	24.59%	24.55%	24.74%
	Hard Rules	4.12%	4.92%	5.45%	5.15%
	No Rules	19.41%	18.03%	18.18%	19.59%

In general the relative majority of apps are published in the US, that there is a slight difference between the percentage of apps published in Denmark and those published in the Netherlands, and that the number of apps published in countries with hard net neutrality rules is virtually insignificant. It has to be stressed that the difference between Denmark and the Netherlands does prove to be statistically relevant according to the test on proportions. The differences observed between 2011-2012 and 2016 in the distributions of all apps are displayed in the following figure.

Figure 23: App distributions across time and groups of countries, 2011-12, 2016

	Country	Apps	Distinct Apps	Unified Apps	Publishers
2011-12	DK	12.30%	13.53%	14.24%	14.80%
	NL	13.20%	14.29%	14.53%	17.76%
	USA	38.03%	35.84%	34.30%	31.58%
	Soft Rules	18.34%	18.55%	18.60%	17.76%
	Hard Rules	1.12%	1.25%	1.45%	1.64%
	No Rules	17.00%	16.54%	16.86%	16.45%
2016	DK	14.84%	19.41%	19.56%	18.73%
	NL	12.90%	16.47%	15.50%	18.73%
	USA	34.84%	29.41%	28.41%	25.50%
	Soft Rules	18.71%	17.35%	18.08%	17.53%
	Hard Rules	1.94%	2.06%	2.21%	1.99%
	No Rules	16.77%	15.29%	16.24%	17.53%

In the two previous tables there are two specific types of time differences: first, the share of apps released in USA is decreasing (differences range from -0.5% to -6%); second, the share of apps released in Denmark tend to increase (differences range from +2.5% to +6%) while that of apps released in the Netherlands tends to remain approximately constant (differences range from -2.2% to +1%). The differences in the shares of apps from USA and Denmark are more evident in the distributions related to the whole app market than in that related only to free apps.

It has to be stressed that the only statistically significant differences as measured using the test on proportions are observed in the distinct apps (95% significance) and in the unified apps (90% significance)

from publishes based in Denmark both in the general distributions and in the free apps distributions.

In other words, the observed variations across time seem suggest that Danish publishers are increasing their market shares, publishers from USA are losing market shares, and publishers from the rest of the world do not show substantial variations. However, from a statistical point of view, the Danish publishers have been gaining market shares over the last 4-5 years with reference to distinct apps and unified apps. It has to be noticed that the analysis on the global market has shown that the overall number of apps in the top rankings has declined over the last years, which implies that the absolute number of apps released by publishers from USA, Netherlands and the rest of the world has definitively declined. In absolute terms, the largest platforms have become bigger and more consolidated. For example, Google as a publisher has some 70 apps in the 2016 observation. Facebook the publisher has 25 apps.

In the following figure that analysis is performed just for free apps.

Figure 24: Distribution of free apps across time and groups of countries

	Country	Apps	Distinct Apps	Unified Apps	Publishers
2011-12	DK	13.37%	14.72%	15.28%	15.95%
	NL	15.32%	16.56%	16.32%	19.84%
	USA	36.77%	34.05%	32.64%	29.96%
	Soft Rules	16.43%	16.87%	17.01%	16.34%
	Hard Rules	1.11%	1.12%	1.39%	1.56%
	No Rules	16.99%	15.17%	17.36%	16.34%
2016	DK	16.71%	21.40%	21.97%	20.28%
	NL	14.10%	17.89%	17.04%	20.28%
	USA	36.29%	30.18%	28.70%	26.42%
	Soft Rules	15.93%	15.09%	15.70%	15.57%
	Hard Rules	0.78%	0.70%	0.90%	0.94%
	No Rules	16.19%	14.74%	15.70%	16.51%

The results are then reviewed within the single markets. The results of the computations related to the rankings observed in Denmark and in the Netherlands separately are presented in the figure below.

The apps released by Danish publishers observed in the top rankings of the Netherlands are included in the Other Soft rules category, since Denmark has introduced soft net neutrality rules in 2011. Conversely, the apps released by publishers based in the Netherlands observed in the top ranking of Denmark are included in the Other Hard Rule category since the Netherlands have introduced hard net neutrality rules in 2012. This is simply to say that the Dutch use Danish-made apps. By contrast there are limited Dutch-made apps in Denmark.

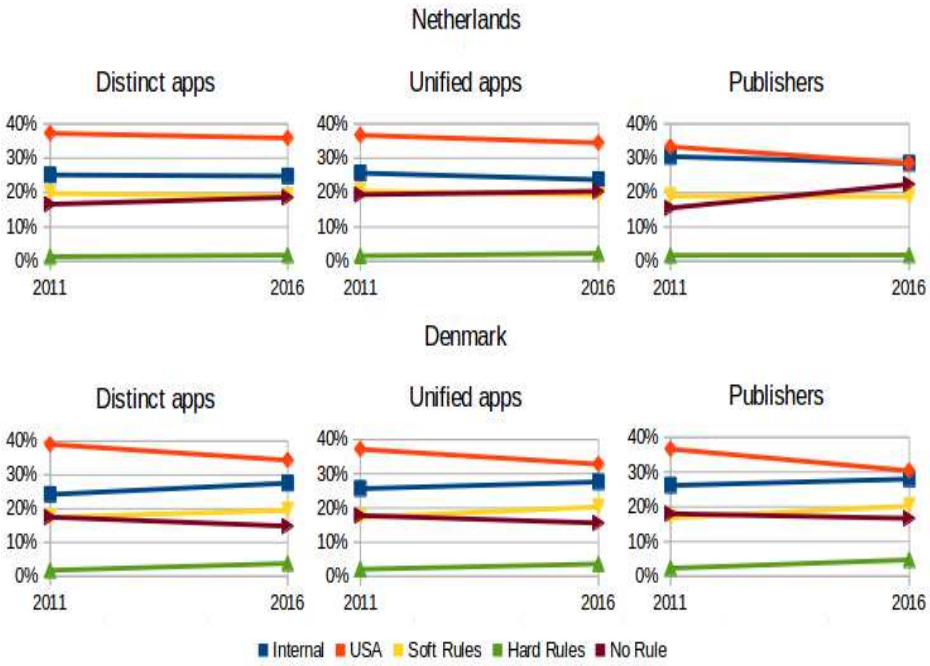
There are some interesting things that can be observed. The first (and quite obvious) one is that the rankings of the most downloaded apps have very similar profile in Denmark and in the Netherlands, in terms of composition with reference to the publishers' headquarters. With reference to Distinct apps and Unified apps, the presence of apps developed by internal publishers ranges from 24% to 28%; the internal publishers in the Netherlands have a slightly higher percentage. It bears mention that Netflix chose the Netherlands as it European headquarters, and the app features at the top of the ranking for entertainment for the app.

Figure 25: Comparisons between Netherlands' and Denmark's app distributions across time and groups of countries

		Distinct Apps		Unified Apps		Publishers	
		2011-12	2016	2011-12	2016	2011-12	2016
Netherlands	Internal	25.11%	24.78%	25.65%	23.73%	30.46%	28.48%
	USA	37.22%	35.84%	36.65%	34.46%	33.33%	28.48%
	Soft Rules	19.73%	19.03%	20.42%	19.21%	18.97%	18.79%
	Hard Rules	1.35%	1.77%	1.57%	2.26%	1.72%	1.82%
	No Rules	16.59%	18.58%	19.37%	20.34%	15.52%	22.42%
Denmark	Internal	24.22%	27.54%	25.65%	27.60%	26.16%	27.98%
	USA	39.01%	34.32%	37.17%	32.81%	36.63%	30.36%
	Soft Rules	17.49%	19.49%	17.28%	20.31%	16.86%	20.24%
	Hard Rules	1.79%	3.81%	2.09%	3.65%	2.33%	4.76%
	No Rules	17.49%	14.83%	17.80%	15.62%	18.02%	16.67%

The following figure is a graphical representation of the results of the prior figure.

Figure 26: Comparisons between app distributions across groups of countries and time



Apps developed by publishers from the rest of the world also appear to have similar distributions: USA shows percentages ranging from 33% to 39%, countries with soft net neutrality rules show percentages ranging from 17% to 20%, countries with no net neutrality rules range from 15% to 20%, while the countries with hard rules are residual.

The similarities in the profiles of Denmark and Netherlands are more evident at the beginning of the period (2011-12) than at the end (2016). It has to be stressed that in both countries net neutrality rules have been introduced around 2011-2012 – soft rules in Denmark, hard rules in the Netherlands. After that, some differences have started to

become visible: over the last 4-5 years, an increasing tendency is visible in the presence of internal apps among the top downloaded apps in Denmark, while a decreasing tendency can be observed in the Netherlands. Simultaneously, the presence of apps released in countries with no net neutrality rules has declined in Denmark and increased in the Netherlands, while the opposite has happened with countries with soft net neutrality rules.

Note however that none of these differences is significant from a statistical point of view. The test on proportion has shown the no presence of structural differences between countries and between time periods. This means that in order to check for these differences more thoroughly, there must be focus on development over time for a longer period and analysis to bigger, more complete, and less "noisy" data – for instance monthly, or even yearly, data on downloads and usage – to reach more stable conclusions.

Another interesting aspect is the distribution of the dismissed apps across countries and group of countries. The results of this computation are displayed in Table 5 and shown in Figure 4. Dismissed apps are those that may have appeared in 2011 or 2012 but are no longer found in 2016.

The dismissal rate is much higher for apps from the Netherlands than for apps from Denmark. This difference is 90% statistically significant for all apps and 95% statistically significant for free apps: apps from Netherlands are actually more likely to be dismissed over a period of 5 years. It has to be stressed that the overall number of dismissed apps is equal to 92 (91 of which before March 2016), which means that these computations and tests are run on a very limited number of units.

Figure 27*:* Dismissed apps

	All apps	Free apps
DK	9.78%	8.97%
NL	18.48%	21.79%
USA	31.52%	29.49%
Soft Rules	21.74%	21.79%
Hard Rules	1.09%	1.28%
No Rules	17.39%	16.67%

Figure 28: Dismissed apps by country (internal circle: Free apps; external circle: All apps)

3.11 RESULTS ON CATEGORIES

It is also interesting to review the categories of apps as reported by iOS and Google Play, with the latter providing more detail. As a consequence, the apps form both stores were studied using the Google

Play taxonomy. Sixteen categories were collapsed into 12 categories (including a residual one named "Other") to assure more significance to the analysis. The 12 categories are the following:

- Games
- Entertainment
- Music
- Photo and Video
- Travel, Shopping
- Lifestyle, Health and Fitness
- Social Networking
- Utilities
- Productivity, Business
- Finance
- News and Weather
- Other

In the secondary analysis, the categories were collapsed into 6 main groups (including a residual one named "Other"). The groups are the following:

- Games
- Leisure
- Social Networking
- Finance (including Shopping), Health
- Info, Utilities
- Other

The overall number of apps sorted into a category is 889 (The dismissed apps category is not indicated on AppAnnie), of which 708 are free apps and 151 are paid apps. The number of distinct apps sorted into categories is equal to 628 (505 free apps and 124 paid apps). The number of unified apps sorted into categories is equal to 530 (430 free apps and 113 paid apps). The total number of publishers involved in this analysis is 495.

The distribution of apps in the considered top rankings is displayed in the following figure. The majority of the top downloaded apps are

games. Other significant categories are represented by Utilities (which includes the tools to expand the phone's functions, such as ringtones, maps and so on), that involves more than 10% of top downloads, and Social Networking apps, which represent over 9% of all apps' top downloads, but it only sums app to 5.3% of distinct apps, suggesting that there is a strong degree of overlap between different countries, years and operating system – social networking is a category where Internet giants like Facebook, Whatsapp and Instagram represent a relevant percentage of total downloads.

Figure 29: Distribution of apps by category

	Apps	Distinct Apps	Unified Apps	Publishers
Games	34.42%	37.58%	37.36%	33.54%
Entertainment	6.30%	7.32%	7.92%	8.28%
Music	4.50%	3.50%	3.21%	3.84%
Photo and Video	6.30%	6.37%	6.98%	6.67%
Travel, Shopping	8.55%	8.28%	7.74%	8.48%
Lifestyle, Health and Fitness	6.41%	7.32%	6.98%	7.47%
Social Networking	9.34%	5.25%	4.34%	4.85%
Utilities	10.57%	11.15%	11.89%	12.73%
Productivity, Business	6.19%	5.10%	5.09%	4.85%
Finance	2.70%	2.39%	2.45%	2.22%
News and Weather	2.47%	3.18%	3.40%	4.04%
Other	2.25%	2.55%	2.64%	3.03%

Given that many categories show very low percentages (which might be problematic for statistical tests), the comparisons across time and countries have been performed on the 6 collapsed categories. The following figure presents a summary of time comparisons between the distribution across the collapsed categories.

Figure 30**:** Distribution of apps by collapsed categories compared over time

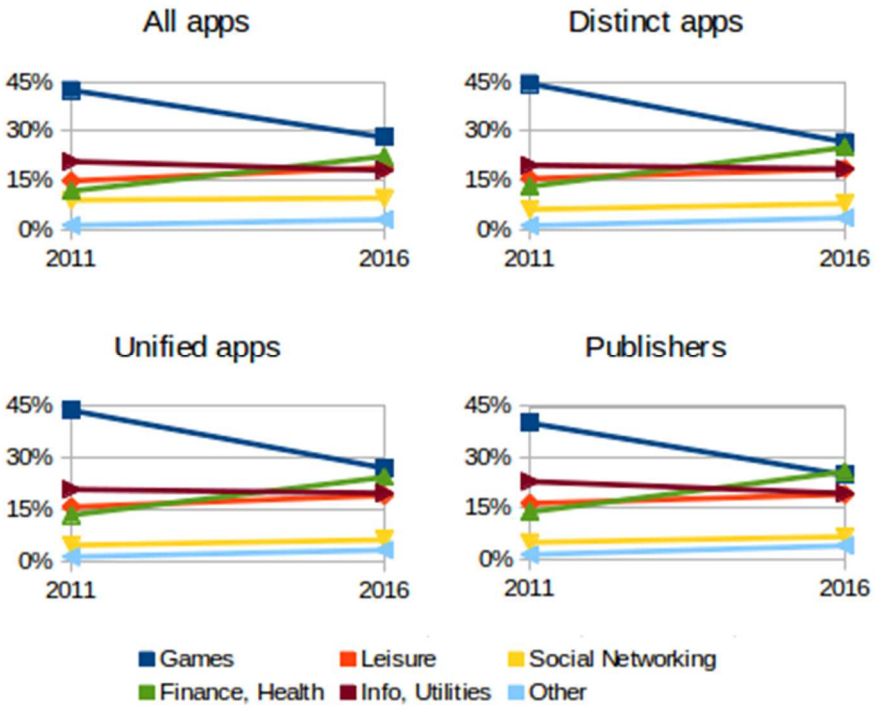
		Apps	Distinct apps	Unified apps	Publishers
2011-12	Games	42.46%	44.44%	43.77%	40.14%
	Leisure	14.83%	15.50%	15.82%	16.49%
	Social Networking	8.95%	6.14%	4.71%	5.02%
	Finance, Health	11.76%	13.16%	13.47%	13.98%
	Info, Utilities	20.72%	19.59%	20.88%	22.94%
	Other	1.28%	1.17%	1.35%	1.43%
2016	Games	28.11%	26.63%	27.06%	24.83%
	Leisure	18.88%	18.48%	19.14%	19.13%
	Social Networking	9.64%	7.88%	6.27%	6.71%
	Finance, Health	22.29%	25.00%	24.42%	25.84%
	Info, Utilities	18.07%	18.48%	19.80%	19.46%
	Other	3.01%	3.53%	3.30%	4.03%

When considering the markets of Denmark and Netherlands combined over the last 4-5 years, there has been a strong decrease in the share of games, while the shares of apps related to finance (banking and shopping) and health (including fitness) have increased (the differences are 99% statistically significant in all four considered distributions). A statistically significant increase is observable in the

residual category as well, but this category involves an irrelevant amount of traffic. A slight increased values in the categories Social Networking and Leisure (photo, video, music and entertainment) is observable in tables and charts, but is not statistically significant, as well as the slight decrease of Info (including news and weather) and Utilities.

A graphical summary of the figure from the prior page appears here.

Figure 31: Distributions of apps by collapsed categories, compared over time

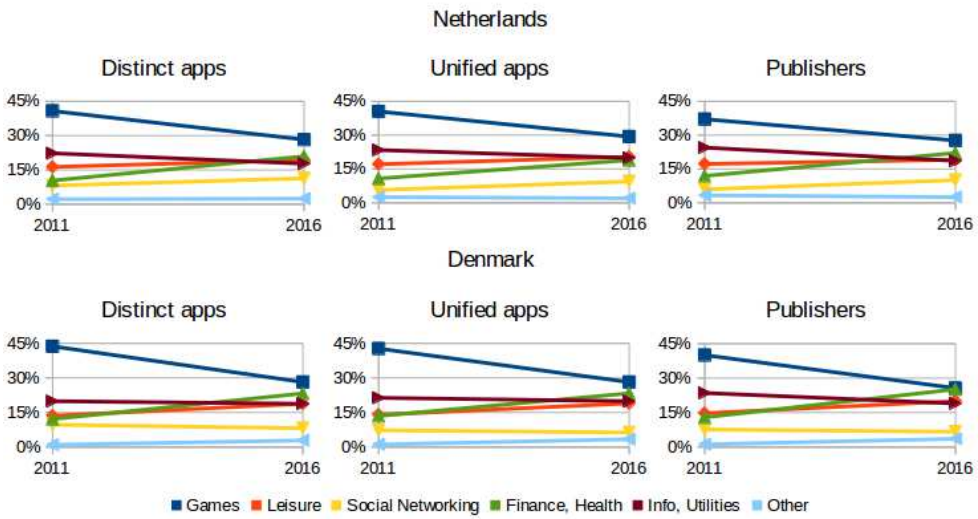


In the following displays the distributions of apps in the collapsed categories is reported by time and country.

Figure 32: Distribution of apps by collapsed categories compared by time and country

		Distinct Apps		Unified Apps		Publishers	
		2011	2016	2011	2016	2011	2016
Netherlands	Games	40.76%	28.23%	40.51%	29.35%	37.09%	27.64%
	Leisure	16.30%	19.35%	17.09%	20.40%	17.22%	19.10%
	Social Networking	8.15%	11.29%	5.70%	9.45%	5.96%	10.05%
	Finance, Health	10.33%	20.97%	10.76%	18.91%	11.92%	22.11%
	Info, Utilities	22.28%	17.74%	23.42%	19.90%	24.50%	18.59%
	Other	2.17%	2.42%	2.53%	1.99%	3.31%	2.51%
		2011	2016	2011	2016	2011	2016
Denmark	Games	43.69%	28.16%	42.70%	28.16%	40.00%	25.64%
	Leisure	13.59%	18.78%	14.04%	18.93%	14.71%	20.00%
	Social Networking	9.71%	8.16%	7.30%	6.31%	7.65%	6.67%
	Finance, Health	12.14%	23.27%	13.48%	23.30%	12.94%	25.13%
	Info, Utilities	19.90%	18.78%	21.35%	19.90%	23.53%	18.97%
	Other	0.97%	2.86%	1.12%	3.40%	1.18%	3.59%

Figure 33: Distributions of apps by collapsed categories, compared over time and country



The distributional features are pretty similar across countries. There are some minor differences, especially in the case of Games (the market quota of games was higher in 2011-12 in Denmark than in the

Netherlands, which was followed by a stronger decrease) and of Social Networking (the presence of apps belonging to this category among the most downloaded apps has experience a slight drop in Denmark and an increase in the Netherlands). A quite interesting feature is that the category Finance, Health (which includes banking, shopping and fitness) shows an increasing trend both in Denmark and in the Netherlands.

3.11.1 METHODS FOR BIVARIATE ANALYSIS

In the second step involved further comparison on the apps' categories, in order to verify whether there is statistical evidence that categories are not randomly distributed between countries with different statuses of net neutrality. This was performed with cross-tabulations and the Chi-squared test. This test verifies the null that there is no association between couples of categorical factors, against the alternative that they are dependent on each other. Note that, being based on the comparison between couples of variable of all kinds, no information on the "direction" of the dependency (for instance, in the case of the correlation coefficient) is provided by the Chi-squared index. Assuming that there are two categorical factors, ***A*** and ***B***, having R and S categories respectively, observed on a total of n statistical units, the formulation of the index is the following:

$$\chi^2 = \sum\sum \frac{(n_{rs} - \hat{n}_{rs})^2}{\hat{n}_{rs}}$$

where

$$\hat{n}_{rs} = \frac{n_{r.} \times n_{.s}}{n}$$

In this formula, n_{rs} represents the number of units showing category r of ***A*** and category s of ***B***, $n_{r.}$ the overall number of units showing level r of ***A*** and n_s the overall number of units showing the level s of ***B***. This statistic, under the null of no association, follows the χ^2 distribution with $(R\text{-}1)(S\text{-}1)$ degrees of freedom. The quantity $\hat{n}_{rs}$ represents the theoretical frequencies of the joint distribution that would be observed if the null of no association is true;

the value of χ^2 index increases when the differences between the observed and the theoretical frequencies increase.

3.11.2 RESULTS FOR BIVARIATE ANALYSIS

The results of the cross-tabulation of the 819 apps for which are available information on both category and country in which the publisher is based are reported in the figure below. As a reminder, this data reflects the apps consumed by users in Denmark and Netherlands. To put the numbers in perspective, consider that 8 countries with soft rules (not including Denmark) produced 150 apps (approximately 16 apps per country); the 12 countries with hard rules (not including Netherlands) produced 20 apps (approximately 1.7 app per country, several have produced no apps in the observed data set); and the 24 observed countries with no rules produced 137 apps (approximately 5.7 apps per country). However we can see that not all country produce apps equally.

Figure 34**:** Cross-tabulation of the most downloaded apps in Denmark and the Netherlands in March 2011-12 and March 2016 by category and by country

	Denmark	Netherlands	No NN	Hard Rules	Soft Rules	USA	Total
Entertainment	15	8	5	0	5	13	46
Finance	10	11	0	0	1	2	24
Games	10	7	80	14	83	87	281
Health, Lifestyle	21	21	5	1	12	6	66
Music	7	0	3	0	13	10	33
News, Weather	5	15	1	0	1	0	22
Photo and Video	1	4	5	4	3	36	53
Productivity	5	5	3	0	3	37	53
Social Networking	0	1	6	0	9	65	81
Tools	14	9	14	1	11	28	77
Travel, Shopping	25	21	8	0	8	12	74
Other	2	0	0	0	1	6	9
Total	115	102	130	20	150	302	819

While some distributional features are immediately evident (for instance almost 63% of apps published in countries with no net neutrality rules are games, that 80% of apps belonging to the Social Networking category are published in USA and that there are some categories that mainly include apps developed by local publishers,

such as Entertainment, Finance, Health and Lifestyle, Travel and Shopping), we can also see some potential problems: first, only 20 apps out of 819 have been developed in countries with hard rules (8 of them are games); second, there are many cells with null or irrelevant values.

Figure 35**:** Breakdown of apps by country from cross-tabulation of the most downloaded apps in Denmark and the Netherlands in March 2011-12 and March 2016

Soft Rules	**Apps**
Austria	6
France	21
Japan	7
Norway	11
South Korea	5
Switzerland	11
Sweden	37
United Kingdom	52
Total	**150**
Average	18.75
Denmark	115

Hard Rules	**Apps**
Argentina	4
Brazil	1
Canada	7
Israel	6
Italy	1
Turkey	1
Total	**20**
Average	3.33
Netherlands	102
USA	302

No Rules	**Apps**
Australia	22
Belgium	3
Belarus	2
Bulgaria	1
China	21
Czech Republic	4
Egypt	1
Finland	21
Germany	26
Hong Kong	2
India	3
Ireland	2
Croatia	2
Lebanon	3
Liberia	1
Lithuania	2
New Zealand	4
Russia	5
South Africa	1
Spain	1
United Arab Emirates	1
Vietnam	2
Total	**130**
Ave	5.91

Total apps	819

These have been collapsed into the categories of both factors: as for countries, the modality Hard Rules has been integrated to “No NN”,

thus forming the Other modality; as for categories, we have considered the collapsed levels introduced above.

- Games
- Leisure
- Social Networking
- Finance (including Shopping), Health
- Info, Utilities
- Other

Since only 9 apps belong to the residual category “Other”, these apps have not been considered in the following analysis. The results of the same cross-tabulation presented in Table 10 on collapsed categories and countries are displayed in Table 35. The χ^2 computed on this table is equal to 329.8. The χ^2 test, with the corresponding 16 degrees of freedom, has a p-value less than 0.001. This implies that the null of no association is rejected at any level of significance: apps sorted into different categories are developed in different countries or groups of countries.

Figure 36: Cross-tabulation of the most downloaded apps in Denmark and the Netherlands in March 2011-12 and March 2019 by collapsed categories and by country

	Denmark	Netherlands	Soft Rules	USA	Other	Total
Finance, Health	56	53	21	20	14	164
Games	10	7	83	87	94	281
Info and Utilities	24	29	15	65	19	152
Leisure	23	12	21	59	17	132
Social Networking	0	1	9	65	6	81
Total	113	102	149	296	150	810

Many interesting aspects can be observed in this table. We can see that social networking apps are virtually entirely developed in the United States, as well as the majority of leisure apps, which include Entertainment, Photo and Video and Music apps. The proliferation of certain categories from the US may suggest some features about the US, for example presence of a global entertainment industry, property rights, presence of existing Internet companies etc.

Soft rules countries do not appear to be specialize in producing apps for any particular category: around 56% of the apps released by publishers based in countries with soft rules are games; on the other hand, less than 30% of the overall number of games come from soft-rules countries, while more than 33% comes from countries with hard or no rules. Given that the market shares of soft-rules countries and of other countries are virtually identical (18.4% against 18.5%), there is no evidence that games are a specific feature of any of the two.

Conversely, there is one category in which the demand seems to be specifically satisfied by internal apps: this category is Finance, Health – where Finance includes both banking and shopping and Health includes fitness. Publishers based in Denmark and in the Netherlands cover 66.5% of the whole amount of top downloads for this category. Moreover, around 50% of apps belonging to this general category downloaded in Denmark and the Netherlands in March 2011 and in March 2016 is developed in Denmark and almost 52% is developed in the Netherlands. This can probably be explained by the fact that banks which are chartered to serve the residents of a particular country

have a monopoly of sorts on the users of that country. Similarly with health, in that some health app providers may be associated with nationally chartered entities, or at least that some health information may be linked to national records and institutes. This is an interesting result that did not figure into Wu's analysis, that of national institutions making apps for the local population, perhaps to the exclusion of better apps from other countries.

As shown in the previous section, over the last 4-5 years there has been an increasing demand for apps belonging to this group of categories, which has been primarily satisfied by internal publishers. However, no evidence can be provided that this has happened as a result of the introduction of net neutrality rules.

3.11.3 METHODS FOR RANK ANALYSIS

Another analytical approach is rank analysis. Indeed, it is not only of great interest to know how many internal apps and apps coming from countries with or without net neutrality rules appear among the most downloaded or used mobile applications, but also how they perform in the rankings.

As in the previous analytical steps, two approaches have been followed.

The first one is a comparison between single countries: based on the data downloaded from AppAnnie on Denmark and the Netherlands, the rank analysis is performed on the single data sets, after sorting the apps into different categories according to the country in which the publisher's headquarter is based according to the countries' net neutrality status; as in the previous analysis, the categories are – Denmark and the Netherlands, USA, countries with soft net neutrality rules, countries with hard net neutrality rules, and countries with no net neutrality rules.

The second one is a set of comparisons on the basis of the overall data set: based on the subdivision of the countries according to their net neutrality status, time comparisons were performed on the combined data set of Denmark and Netherlands.

Future interesting developments of these analytical approaches will be based on the use of different data sets, involving a higher number of markets, characterized by different types of net neutrality statuses, possibly on the basis of time-aggregated data (for instance, monthly or even yearly observation), in order to account for the inevitable noise that affects data based on single days, and for the disturbing effects of seasonality.

The comparison between the ranking structures has been performed using the Wilcoxon Signed-Rank test. This test verifies the null that two ordered structures come from the same population, against the alternative that populations are statistically different; the alternative hypothesis can be both unilateral and bilateral. In other words, the Wilcoxon Signed-Rank test verifies the hypothesis that rank differences between pairs follow a random symmetric distribution around 0, against the alternative that they are not symmetrical around 0. The test is based on the computation of signed differences between rankings:

$$\mathrm{W}=\sum[\mathrm{sgn}(x_{2\mathrm{i}}-x_{1\mathrm{i}})R_i]$$

Where W equals the test; *sgn*() indicates the sign function and R_i the i-th rank. Under the null hypothesis, the Wilcoxon test's mean is equal to 0 and its variance is equal to:

$$\sigma_W=\frac{n(\mathrm{n}+1)(\mathrm{n}+2)}{6}$$

The value of the test statistic must be compared to the critical values from the appropriate tables. In practice, this test allows the verification of whether two sets of rankings come from the same population – hence if their differences are statistically significant, which, in the case on cross-country comparisons, would imply that the distribution of, say, apps coming from local publishers perform better or worse in a country than in another.

Note that, even though the Wilcoxon test does not require that the samples are paired, it still requires that they are of the same size.

3.11.4 RESULTS FOR RANK ANALYSIS

There are two reasons why the rankings to compare using Wilcoxon test must be of equal size: first, because the formulation of the test requires it; second, because if one had to compare the positions of a number of elements in a ranking, there would be no sense in including more elements in just one ranking out of two, because the extra element would obviously be added below the last recorded element, thus making the summary statistics of the ranking worsen – the average, median and quantile values would increase.

Rank analysis has been performed on the countries where publishers are based. In the first analysis, where disaggregation by time and country (Denmark and Netherlands) has been taken into account, the top 30 elements have been considered. It has to be stressed, though, that the number of apps coming from publishers based in countries with hard net neutrality rules is never greater than 5 – not enough to allow for any specific analysis.

Figure 37: Rank comparisons across time and country

		Denmark		Netherlands	
		2011	2016	2011	2016
Means	Internal	41.97	26.50	31.17	42.57
	USA	21.37	20.03	18.37	14.43
	Soft Rules	42.29	53.20	47.80	43.13
	Hard Rules	-	-	-	-
	No Rules	37.80	53.93	51.86	41.97
Medians	Internal	43.50	27.00	34.00	46.00
	USA	23.00	21.00	16.50	13.50
	Soft Rules	40.00	59.00	48.50	38.50
	Hard Rules	-	-	-	-
	No Rules	42.00	53.00	49.00	45.50

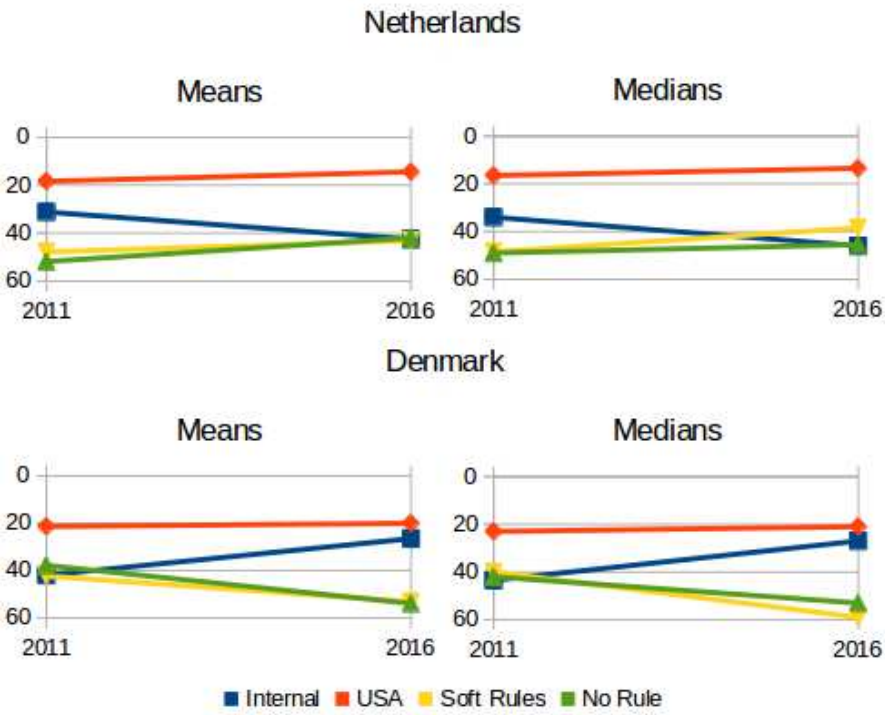
The average and median rankings of the top 30 downloaded apps developed by publishers based in each considered country or groups of countries and downloaded in each considered year are reported in the figure. A graphical summary follows on the next page.

The time evolutions in Denmark and Netherlands are symmetrical: in Denmark the average and median ranks of the top 30 local apps increase, while the top 30 apps from the Netherlands decrease. Apps

from countries with soft and no net neutrality rules decrease. Apps from USA hold steady.

The time variations in rankings of internal apps are 99% significant in both Denmark and Netherlands; in Denmark, the decrease in the rankings of apps from countries with soft and no net neutrality rules are statistically significant, respectively at 90% and 95% level. All other comparisons show no statistical significance.

Figure 38: Rank comparisons across time and country



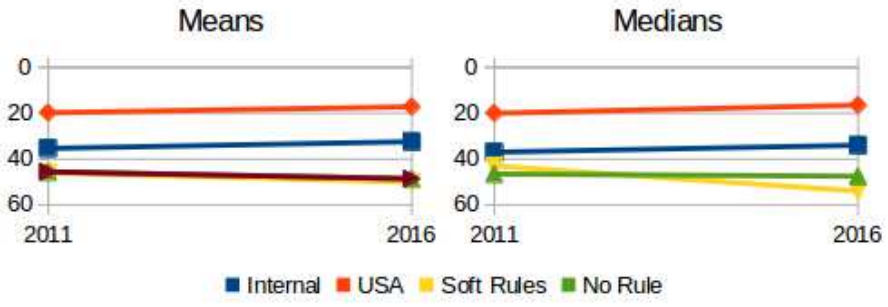
A further analysis has been run on the overall data set of Denmark and the Netherlands combined. In this case, the analysis has been run on the top 60 downloaded apps for each year. The results are displayed in the figure below; a graphical summary follows on the next page.

Figure 39**:** Rank comparisons of the overall data set across time and country

		2011	2016
Means	Internal	35.33	32.42
	USA	19.80	17.20
	Other SR	46.05	50.07
	Other HR	-	-
	Other No NN	45.57	48.58
Medians	Internal	37.00	34.00
	USA	20.00	16.50
	Other SR	43.00	54.00
	Other HR	-	-
	Other No NN	46.50	47.50

Looking at the analyses of data aggregated over countries (hence, where the rankings of Denmark and Netherlands are considered together), there is virtually no statistical significance observable in any of the comparisons. The lines in the charts summarizing time comparisons are virtually horizontal. The symmetry of the situations observed in the disaggregated data leads to virtually no observed difference when analyses on aggregated data is run. This is the specific reason why this kind of analysis requires to have access to even more disaggregated data: for instance, it is possible that similar symmetries between regional data, or between municipality-based data, will not allow us to identify significant relationships between the same variables at the, say, country level.

Figure 40: Rank comparisons of the overall data set across time and country



This symmetry is also interesting for a different, and very practical, reason: the country where local companies seem to show poorer performances in the rankings is the same country where a decline in the number of total apps has been observed. This country is the Netherlands, where hard net neutrality measure have been introduced in 2012; however, the Netherlands may have other factors which could reduce local app development, for example that American companies such as Netflix establish European headquarters in Netherlands. The presence of an American giant in the country could either support or deter the emergence of video streaming app competitors. But this question can't be answered by looking at the AppAnnie data.

3.11.5 RESULTS FOR SOFT RULE AND NO RULE COUNTRIES

While the analysis is consistent for Denmark and Netherlands, the performance of countries with soft rules, show a decline in rank over time. However countries with no rules, show an increase in rank over time. These results shed doubt the premise that net neutrality has an observable impact. It is clear that the set of countries with hard rules do no better, but the set of countries with no rules at all, do, in fact, do better over time. It could be that net neutrality is not related to innovation, or is not an observable driver. This suggests that other factors may be more important drivers for innovation.

3.12 APPTOPIA MEASUREMENTS

3.12.1 TOP LOCALLY-MADE APPS FOR 90 DAYS ENDED JUNE 14, 2016

This measurement reviews the apps developed in the respective countries of Denmark and Netherlands. The report was built in the Apptopia platform to focus on top ranking free apps for the Apple AppStore on June 14, 2016 with a lookback of three months. The Apptopia measurements are helpful to find a pure, rather than relative, number of downloads and to gather financial information about the app (revenue, monetization etc). Unfortunately the Apptopia measurements cannot be matched for 2011-2012 period from

AppAnnie, but they are applicable for the 2016 measurements. Apptopia shows information an app globally and for a given country.

The Apptopia data for Denmark and Netherlands shows many more locally made apps being issues on Apple's AppStore rather than Google Play. For example, there are may be more than 100 local apps for each country in Apple's AppStore, but just 1 for the respective country in Google. This is a strange outcome, and it's not clear whether this is just a reflection of Apptopia's reporting or that in fact local country innovators don't use Google Play, or their apps can't be found in it.

So the analysis proceeds only with measurements based on Apple's AppStore.

Denmark

The Denmark reports that in the top grossing free apps there are 10 apps in the game category produced by 6 publishers. There are 4 apps in the health category produced by 2 publishers. There are 3 apps in the kids category produced by 1 publisher. There is 1 app in the lifestyle category produced by 1 publisher. The average year of launch for the app is 2013, two years after the country's soft net neutrality rule took effect.

Denmark has produced 18 apps which have delivered globally 8,215,943 downloads and $5,583,680 revenue for the period which delivers an average monetization of $1.47.

It is not surprising that games count for a large portion of downloads and revenue. Games makes us almost 87 percent of downloads and revenue for all of the top grossing apps.

Kiloo is one of the world's leading game companies, and it is based in Denmark. It's Subway Surfers game registered 4.5 million downloads in the prior 90 days. It's revenue for the period is $3.6 million, significantly 75 percent of the revenue for the category. As a related point, in Google Play, the Kiloo Subway Surfers was downloaded 15

million times worldwide in the prior 90 days, earning $3 million in revenue.

In addition to games, Denmark has another global leader in apps, Endomondo in the Health category. Endomondo is a mobile digital personal trainer. The Running and Walking app from Endomondo earned over 1 million downloads in the prior 90 days and $704,760 in revenue. That is to say that monetization happens once the app is downloaded. Endomondo accounts for almost 99 percent of the revenue and downloads for the category.

Egmont, based in Denmark, is a company offering Nordic content across a number of countries. It has 4 apps in the report, 3 for children and 1 for women. This company leverages its content holdings in a variety of digital formats and succeeds to produce modest revenue and downloads by marketing in a variety of channels. Egmont also partners with Danish mobile operators for bundled content offers.

Figure 41: Top Danish-Made Apps for 90 Day Ended June 14, 2016 (Apptopia)

App Name		Publisher Name		Downloads Last 30 Days	Downloads Last 90 Days		Revenue Last 30 Days	Revenue Last 90 Days	
Subway Surfers	Games	Kiloo	2012	1,561,075	4,525,800	64%	$1,106,692	$3,625,042	75%
MovieStarPlanet	Games	MovieStarPlanet	2012	304,001	830,427		$110,372	$360,595	
Cookie Cats - a singi	Games	Tactile Entertainm	2016	195,354	477,423		$86,423	$110,932	
Skyline Skaters	Games	Tactile Entertainm	2014	76,109	226,093		$68,085	$201,217	
Bee Brilliant	Games	Tactile Entertainm	2014	45,811	184,613		$55,713	$211,338	
Yatzy	Games	Spigo ApS	2011	20,921	63,207		$36,988	$114,941	
Disco Ducks	Games	Tactile Entertainm	2015	28,046	84,472		$22,425	$131,713	
Hugo World	Games	Hugo Games A/S	2014	6,810	25,040		$12,459	$40,867	
Hugo Retro Mania	Games	Hugo Games A/S	2011	8,835	35,227		$10,032	$40,455	
Hugo Troll Race 2.	Games	Hugo Games A/S	2010	100,921	664,305		$2,365	$9,063	
			2013	**2,347,883**	**7,116,607**	**86.62%**	**$ 1,511,554**	**$ 4,846,163**	**86.79%**
Running and Walkin	Health	Endomondo.com	2009	333,086	1,040,257	98%	$240,202	$704,760	99.5%
Hypnose	Health	Human Progress	2010	2,289	5,936		$514	$2,061	
Sov godt - fÃ¥ en go	Health	Human Progress	2013	4,361	13,733		$354	$843	
Stressfri	Health	Human Progress	2012	679	3,820		$279	$892	
			2011	**340,415**	**1,063,746**	**12.95%**	**241,349**	**708,556**	**12.69%**
My Little Pony - Cuti	Kids	Egmont Kids Medi	2015	721	6,071		$3,030	$25,016	87.23%
Rasmus Klump	Kids	Egmont Kids Medi	2011	4,955	15,622		$1,075	$3,662	
Sophie's Friends	Games	Egmont Kids Medi	2014	407	1,574		$17	$42	
			2013	**5,676**	**21,693**	**0.26%**	**$ 4,105**	**$ 28,678**	**0.51%**
Hendes Verden	Lifestyle	Egmont Magasine	**2015**	**5,031**	**13,897**	**0.17%**	**$141**	**$283**	**0.01%**
		AVE	2013	256,828	781,884		$ 167,342	$ 531,768	
		TOTAL		**2,699,005**	**8,215,943**		**$ 1,757,149**	**$ 5,583,680**	

Netherlands

The Dutch report shows 7 apps by 5 publishers in the game category; 4 apps by 3 publishers in the kids category; 3 apps by 2 publishers in the news category; 3 apps by 3 publishers in the Productivity category; and 1 app in the Utilities category. The average year of launch for the app is 2012, the same year that the Dutch net neutrality law was passed.

The Netherlands has 18 apps in the report, producing 2,699,763 downloads and $3,641,002 for the period for an average monetization of $0.47 per app. Significantly the Dutch downloads equal just one-third of that of Denmark while the revenue equals two-thirds. The Dutch monetization is half that of Denmark.

Like Denmark, Games is the largest category for downloads (45.76%) and revenue (40.28%). In the kids category, one app My Dolphin show by the Spil Games publisher accounts for more than 90 percent of the downloads and revenue for the category. De Telegraaf app accounts for the lion's share of downloads and revenue, perhaps the leading Dutch newspaper. Interestingly calendars are a downloadable app in Netherlands with 2 publishers, but WeekCal accounting for the majority of downloads and revenue.

Some Dutch apps do stand out for high monetization, the LetterSchool app by Sanoma Medical in the kids category garners almost $7 per download and the EQu sound equalizer app by elephantcandy earns almost $6; and two of the Youda Games which delivered over $4 per download.

Figure 42: Top Dutch-Made Apps for 90 Day Ended June 14, 2016 (Apptopia)

App Name		Publisher Name	Release Date	Downloads Last 30 Days	Downloads Last 90 Days		Revenue Last 30 Days	Revenue Last 90 Days	
Online Soccer Manager (O:	Games	Gamebasics BV	2010	220,729	587,226	47.53%	$104,734	$461,158	31.45%
WordOn HD	Games	Huckleberry BV	2012	23,647	75,509		$82,536	$254,353	
Governor of Poker 3 â€“ Fr	Games	Youda Games Hc	2014	51,674	163,854		$42,429	$259,560	
Governor of Poker 2 HD - T	Games	Youda Games Hc	2012	12,159	32,410		$50,994	$155,594	
City Island 2 - Building Sim:	Games	Sparkling Society	2014	36,749	113,159		$73,850	$234,412	
Governor of Poker 2 Premi	Games	Youda Games Hc	2014	7,795	20,604		$30,171	$82,664	
Troll Face Quest Unlucky	Games	SPIL GAMES	2015	86,627	242,604		$16,635	$18,735	
			2013	439,380	1,235,366	45.76%	$401,349	$1,466,476	40.28%
My Dolphin Show - sea ani	Kids	SPIL GAMES	2013	253,449	741,516	99.01%	$141,449	$473,121	94.31%
LetterSchool - letters en cij	Kids	Sanoma Media N	2012	935	3,262		$6,541	$22,807	
Miffy flies	Kids	Sanoma Media N	2012	1,441	3,397		$1,433	$3,384	
Transport Photo Jigsaw Pu	Kids	Banana Apps Kid	2013	235	752		$744	$2,373	
			2013	256,060	748,927	27.7%	$150,167	$501,685	23.1%
De Telegraaf krant	News	De Telegraaf B.V.	2010	112,414	359,846	71.31%	$305,908	$1,006,732	97.23%
De Telegraaf	News	De Telegraaf B.V.	2010	17,275	53,040		$8,498	$25,498	
NRC Handelsblad digitale e	News	NRC Media	2011	30,201	91,730		$1,248	$3,169	
			2010	159,890	504,616	18.69%	$315,654	$1,035,399	28.44%
Week Calendar	Producti	WeekCal B.V.	2010	56,901	163,782	85.16%	$208,870	$469,372	88.96%
Easy Calendar	Producti	T. van Zummerer	2011	8,225	22,358		$21,364	$57,031	
CalCube - Quick, Slick & Ea	Producti	Appsuperb	2014	2,280	6,178		$525	$1,239	
			2012	67,406	192,318	7.12%	$230,759	$527,642	14.49%
EQu - the quality equalizer	Utilities	elephantcandy	2010	7,591	18,536	0.69%	$72,864	$109,800	3.02%
		Ave	2012	84,230	244,590		$ 103,124	$ 326,009	
		Total		490,947	2,699,763		$ 769,444	$ 3,641,002	

3.12.2 TOP LOCALLY-MADE APPS FOR 90 DAYS ENDED NOVEMBER 7, 2016

The Apptopia functionality to identify apps by country headquarters was not available until November 2016, so there was limited time to perform additional analysis on the supplementary dataset. In addition there was incomplete information on the location of the publishers. As such the results are provided advisedly. However the report is interesting in that is gives a greater depth of information over a longer period of time.

Reports for the top overall free apps were run for Denmark and Netherlands for the Apple AppStore and Google Play for the last last 90 days ended November 7, 2016. The report for Denmark noted 1461 apps downloaded in the country; Netherlands, 1466 apps. As for locally made apps, Denmark reported 298; Netherlands, 205.

The reports were scrutinized to ensure that all Dutch and Danish apps were included. In the results in which Apptopia did not include the location of the publisher's headquarters, an attempt was made to identify the location of the app's publisher, and the sheets were subsequently updated. This still left a many apps without a headquarters location, so those apps were added to their own category. It is unfortunate that these apps could not be identified (and also speaks to the issue that analytics platforms can have gaps in data, making assessment difficult). I expect that many of the unidentified apps are game companies and/or publishers based in Russia and China, as these are typically the apps and locations which can be hard to identify.

Following are some observations for iOS for the last 90 days. For Denmark, locally made apps account for 24.8% of all of the apps downloaded. That the Danish apps for the top 250 apps appear at a slightly higher rate, shows that Danish apps tend to perform well among other publisher countries when it comes to top downloads. American apps account for a significant portion of the downloads, slightly more than a third of the top 250 apps in the country for the period. Apps from soft rule countries account for about 16-18% of all downloads. Apps from no rule countries are about 10% of the top 250 apps. Apps from hard rule countries are the minatory at roughly 5%.

The Netherlands has a lower level of locally made aps for the relevant period, 14.2%. The origin of the apps from the other publishers is lower than what is observed in Denmark, but follow a similar distribution. Given the high level unidentified apps, it is expected that many of these would come from China, Russia, Ukraine, and Belarus.

Figure 43: Top free apps overall by downloads, Denmark and Netherlands, 90 days ended November 7, 2016 (Apptopia)

Denmark	**iOS**		**Play**	
	All entries	Top 250 last 90 days	All entries	Top 250 last 90 days
Denmark	20.41%	24.80%	1.67%	2.80%
USA	22.45%	34.40%	18.59%	22.00%
Soft rule countries	18.16%	16.80%	9.85%	12.40%
Hard rule countries	5.65%	6.00%	2.23%	0.80%
No rule countries	14.15%	11.60%	8.55%	9.20%
No publisher info	19.18%	6.40%	59.11%	52.80%
Netherlands	**iOS**		**Play**	
	All entries	Top 250 last 90 days	All entries	Top 250 last 90 days
Netherlands	10.21%	14.20%	1.49%	1.20%
USA	22.89%	34.40%	18.22%	24.00%
Soft rule countries	14.74%	12.40%	10.41%	11.60%
Hard rule countries	3.26%	3.60%	1.86%	1.20%
No rule countries	9.44%	9.60%	8.36%	9.60%
No publisher info	39.46%	25.60%	59.67%	52.40%

The particular Apptopia report does not provide category information in this particular report. However the Danish apps were individually reviewed and organized in categories based on similar types of apps. There was not time to conduct the analysis for the Dutch apps.

Figure 44: Categories of Danish apps from Apptopia report, author's grouping

39	Games
34	Ecommerce
30	Banking and finance
27	Health and lifestyle
26	News
25	Travel
24	Food
24	Egovernment
21	Entertainment
17	Productivity and utility
9	Education
7	Sports
3	Dating
3	Employment
9	Other
298	

3.13 MOBILE BROADBAND PENETRATION IN DENMARK AND NETHERLANDS

There is one other factor which might explain the observed differences in Denmark and Netherlands, that of penetration of mobile broadband. Though Netherlands has four mobile networks and Denmark has

three, the Danes have a higher overall percentage of mobile broadband (3G and 4G networks). Moreover the Danes have a higher rate of postpaid subscriptions, suggesting higher data purchase and use. Netherlands has a higher percentage of prepaid subscriptions, suggesting that users tend to buy smaller data packages. In general a smartphone and 3G subscription is necessary to access most apps, so the fact that Netherlands has a higher proportion of 2G users than Denmark is significant. To be sure, the Netherlands has a larger overall population than Denmark, but the fact that Denmark is a concentrated market for smartphones with postpaid contracts on 3G and 4G appears to be important for Danish app developers when creating apps and for mobile operators in marketing subscriptions. Note that the figures for 2013-2015 are actual while 2016 and after are projected. Table is prepared on data by Ovum.[272]

[272] Mobile Subscription Revenue and Forecast 2016-21. Ovum. August 2016 https://www.ovum.com/research/mobile-subscription-and-revenue-forecast-2016-21/

Figure 45: Denmark and Netherlands, Mobile Broadband Penetration by subscription and Prepaid and postpaid subscriptions (Ovum)

Denmark	**2013**	**2014**	**2015**	**2016**
2G % of Total Subscriptions	26.3%	22.0%	17.9%	14.3%
3G or 4G % of Total Subscriptions	73.7%	78%	82.2%	85.6%
Netherlands				
2G % of Total Subscriptions	41.4%	32.8%	23.8%	16.8%
3G or 4G % of Total Subscriptions	58.7%	67.2%	76.3%	83.2%
Denmark				
Prepaid % of Subscriptions	17.2%	17.7%	17.6%	17.1%
Postpaid % of Subscriptions	82.8%	82.3%	82.4%	82.9%
Netherlands				
Prepaid % of Subscriptions	37.3%	39.1%	38.8%	37.6%
Postpaid % of Subscriptions	62.7%	60.9%	61.2%	62.4%

3.14 ROLE OF FLAT RATE PRICING FOR VOICE AND DATA IN DENMARK AND NETHERLANDS

An important and related point is that the Danes were early to use flat rate pricing or free voice/SMS in mobile data packages. Telia started a flat rate program for SMS as early as 2003[273] (a DKK 120 package generally purchased by parents who wanted a flat rate product for youth who messaged a lot with their friends). This was not the case in Netherlands, where voice and SMS were still sold individually, even as late as 2010. It is not surprising that there was a financial incentive to switch to free messaging substitute WhatsApp when it came on the Dutch market.

But while Dutch mobile operators are painted as sinister actors in the net neutrality debate, the banal reality is that they were delayed to update their business models. This also suggests that what is perceived as a net neutrality violation may just be the question of the speed of marketplace evolution. Dutch operators cannot change their tariff without pre-approval from regulators, a condition not required of Danish operators which have long enjoyed the ability to experiment with different offers as a means to promote adoption of mobile broadband.

But it bears mention that WhatsApp usage in Denmark is significantly less than Netherlands. Ironically some apps may enjoy higher adoption is countries with outdated pricing models. Even today use of WhatsApp in Denmark is significantly lower than in Netherlands, and notably WhatsApp use is lower in US where mobile operators were also early sellers of voice/SMS inclusive packages.[274]

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[268] Engels, Ryming. "Telia lancerer gratis SMS." Computerworld 21 March, 2003. http://www.computerworld.dk/art/125139/telia-lancerer-gratis-sms and NPInvestor, 21 March 2003 http://npinvestor.dk/nyheder/telia-lancerer-sms-til-0-kr

[274] "WhatsApp: mobile usage penetration in selected countries 2014." Statistica.com https://www.statista.com/statistics/291540/mobile-internet-user-whatsapp/

3.15 ANALYSIS OF MOBILE INFRASTRUCTURE INDICATORS

The GSMA's Mobile Connectivity Index looks at four key inputs to connectivity: Infrastructure, Affordability, Consumer Readiness and Content. This study focused on the indicators associated with Infrastructure, which itself as a category makes up 25 percent of the country's score on the connectivity index. The following image displays the 13 indicators, their grouping, and their weight in the overall index.

Figure 46: Mobile Connectivity Index Indicators (GSMA)

Table 1: Mobile Connectivity Index Indicators
Source: GSMA Intelligence

Enabler	Dimension	Indicator	Unit	Source
Infrastructure	Mobile infrastructure	2G network coverage	% Population covered	ITU
		3G network coverage	% Population covered	GSMA Intelligence
		4G network coverage	% Population covered	GSMA Intelligence
		Years since 3G network launch	Years	GSMA Intelligence
	Network performance	Mobile download speeds	Mbps	OpenSignal
		Mobile latencies	Milliseconds	OpenSignal
	Other enabling infrastructure	International bandwidth per user	Bits per second	ITU
		Number of servers	Secure servers per 1 million people	World Bank
		Access to electricity	% of population with access	World Bank
		Fixed broadband take-up	Subscriptions per 100 inhabitants	ITU
		Fixed download speeds	Mbps	Measurement Lab
		Fixed latencies	Milliseconds	Measurement Lab
	Spectrum	Spectrum <1 GHz (a)	MHz	GSMA Intelligence
		Spectrum >1 GHz	MHz	GSMA Intelligence

GSMA compiled the information for the world's countries in 2015 and normalized each measure on a 1-10 scale or with a logarithmic transformation so that it would be consistent with the other measures.

While the numbers are static, they are indicative of infrastructure policy and investment over time, particularly in the area of mobile network coverage, level of network innovation (2G, 3G, 4G) and spectrum allocation. These indicators where then analyzed for each of the countries in the study and their type of net neutrality rule to see whether any relationships emerged.

The variable which proved significant was the "Number of Internet Servers per Million Inhabitants", so this variable was investigated further. The company Netcraft[275] measures the number of servers globally and provides its figure to the World Bank, which GSMA used in the study. Netcraft has a set of measurement tools in place across nearly 6 million computers and 1.1 billion Internet locations. It does not provide information on the level of sophistication of the server. While these measurement locations are not confined to mobile applications, they include traffic to mobile devices and locations. There is not a separate measure of servers associated with mobile apps. Moreover all mobile networks have some amount of fixed infrastructure, e.g. wires from the mobile tower to a backhaul location. The measure of servers reflects any server at all, whether deployed in an individual home, at a developers work location, or within the operators network.

To be sure, this variable will be influenced by Internet penetration. In fact, the correlation coefficient between this variable recorded in 2015 and the contemporary variable measuring the percentage of people having access to the Internet is equal to 0.709. As a consequence, by the definition of the squared correlation coefficient, which is equal to 0.503, the percentage of people having access to the Internet determines about 50% of the number of server's variability.

The conditional mean of Number of Internet Servers per Million Inhabitants based on the contemporary country net neutrality status is the following:

[275] October 2016 Web Server, Netcraft, 2016, Surveyhttps://news.netcraft.com/archives/category/web-server-survey/

Figure 47: Country type of net neutrality rule and servers per million inhabitants

Net Neutrality Rules	Servers per million inh.
Soft Rules	1760.5
Hard Rules	529.7
No Rules	491.2

The Servers per Million Inhabitants in the countries with Soft Rules are in average more than three times those in the countries with Hard Rules and with no Net Neutrality rules; moreover the difference between countries with Hard Rules and countries with no rules is almost irrelevant. An ANOVA assures that the differences determined by the Net Neutrality status account for around 35% of the differences observed in the target variable, and that these differences are statistically significant at any level of significance.

Figure 48: ANOVA calculation of significance of a net neutrality rule

	Sum of Squares (DoF)
Net Neutrality Rule 2015	11460279 (2) ***
Residuals	21235127 (48)

Computing a linear regression model on the target variable using Internet Usage and Net Neutrality Status in 2015, gives the following results.

Figure 49: Regression on target variable using Internet Usage and Net Neutrality Status for 2015

Coefficient	Estimate (Std. Error)
Intercept	-1001.43 (306.55) **
Internet Usage 2015	2257.16 (427.74) ***
Net Neutrality 2015 – soft rules	716.55 (225.40) **
Net Neutrality 2015 – Hard rules	43.03 (178.46)

Fit Statistic	Value
Residual Standard Error	532.7 (47 DoF)
Multiple R-Squared	0.592
Adjusted R-Squared	0.566
F-Statistic	22.75 (3 and 47 DoF) ***

The model explains almost 60% of the outcome, and both employed regressors have a significant impact. This suggests that the model with the selection of the number of servers variable is appropriate, and that is it effective to explain the outcome. However, the presence of Hard Rules by itself is not statistically relevant. Therefore, only a binary variable indicating the presence of Soft Rules – hence, that is equal to 1 when Soft Rules in 2015 are observed, 0 otherwise.

Updating the model for the binary variable yields the following results.

Figure 50: Updated regression with binary variable

Coefficient	Estimate (Std. Error)
Intercept	-982.2 (293.0) **
Internet Usage 2015	2248.2 (421.9) ***
Net Neutrality 2015 – S.R.	705.4 (218.4) **

Fit Statistic	Value
Residual Standard Error	527.4 (48 DoF)
Multiple R-Squared	0.592
Adjusted R-Squared	0.575
F-Statistic	34.77 (2 and 48 DoF) ***

The observed slopes suggest that in the observed countries there are 22.48 Internet servers per million inhabitants more for each extra 1% of people having access to the Internet and that countries with Soft Net Neutrality Rules have in average 705 Internet servers per million inhabitants more than countries with other net neutrality regulation.

A comparison between the presented model and a simpler model where the indicator on Soft Rules is not included has been performed using the Likelihood Ratio Test. The results are the following.

Figure 51: Likelihood Ratio Test

	Model	Base model
Degrees of Freedom	4	3
LogLik	-390.49	-395.5
Difference DoF		-1
Chisq		10.029 **

This implies that the models are not equivalent, thus that the one with Soft Rules indicator performs better than the simpler one. This means that Net Neutrality status includes significant information in the model matrix. It has to be stressed that the inclusion of a variable measuring the country economic dimensions – such as per capita GDP in 2015 – does not change the overall result. Per Capita GDP is not a significant regressor.

Figure 52: Calculation adjusted for per capita GDP

Coefficient	Estimate (Std. Error)
Intercept	-853.5 (316.5) **
Internet Usage 2015	2257.0 (645.2) ***
Per Capita GDP 2015	0.0065 (0.0064)
Net Neutrality 2015 – S.R.	716.0 (220.3) **

Fit Statistic	Value
Residual Standard Error	527.3 (45 DoF)
Multiple R-Squared	0.603
Adjusted R-Squared	0.577
F-Statistic	23.31 (3 and 46 DoF) ***

It would seem that the number of Internet servers per million inhabitants would depend more on the number of Internet subscriptions than merely on a person's ability to access the Internet. As a matter of fact, the correlation coefficient between the target outcome and the Number of Broadband Connection per Inhabitant in 2015 is equal to 0.818, which means that the number of broadband connections explains 66.9% of Number of Internet Servers per Million Inhabitants variability.

Computing a linear regression model on the target variable using Broadband Connections per Inhabitants and the indicator of Soft Net Neutrality Rules in 2015, gives the following results.

Figure 53: Regression with Broadband Connections per Inhabitants and the indicator of Soft Net Neutrality Rules in 2015

Coefficient	Estimate (Std. Error)
Intercept	-386.5 (140.0) **
Broadband Connections 2015	4530.9 (607.7) ***
Net Neutrality 2015 – Soft Rules	431.8 (198.8) *

Fit Statistic	Value
Residual Standard Error	452.9 (48 DoF)
Multiple R-Squared	0.699
Adjusted R-Squared	0.686
F-Statistic	55.69 (2 and 48 DoF) ***

The Soft Rule indicator is still 95% significant in the model, which means that it still has an impact on the number of servers. In this model, slopes tell us that there are 45.31 servers per million inhabitants more for each extra 1% in the number of broadband connections per inhabitants and that countries with Soft Rules have on average 431.8 servers per million inhabitants more than countries with other approaches to net neutrality. This model explains almost 70% of the response variable's variabilities across countries.

The Likelihood Ratio Test comparing this model to a simpler one where the indicator for Soft Rules is not included but provides the following results.

Figure 54: Updated Likelihood Ratio Test

	Model	Base model
Degrees of Freedom	4	3
LogLik	-382.72	-385.11
Difference DoF		-1
Chisq		4.784 *

This suggests that the model with Soft rules provides a better fit, which in turn implies that the presence of Soft Net Neutrality Rules has a significant impact on the number of Internet servers per million inhabitants. In other words, Soft Rules seem to have a significant impact on investments on network infrastructure such as servers. From a network provider perspective, this is intuitive. Soft net neutrality rules are the ideal combination of carrot and stick. Network providers have incentives to continue investing in their network without rules that unduly constrain their ability to manage the network, earn revenue by offering innovative services, and maximize the users and apps on the network.

As shown by the models, the number of servers is not determined only by the number of persons who access the Internet (and not directly by side variables like per capita GDP). It bears mention that Soft Rules have been mainly introduced in richer countries with better network infrastructures. To be clear, the number of servers does not explain everything, and there may be some anomalous countries, but the average number of servers per inhabitants for each given set of countries (soft rules, hard rules, and no rules) proved to be statistically significant.

3.16 RELATED FINANCIAL INFORMATION

Leading internet innovation and capital markets journalist Om Malik described[276] the Nordic ecosystem for its preponderance of high value startups and exits, proportionately higher than any region in the world. It bears mention that these countries all enjoyed soft net neutrality rules during the period under study. It remains to be seen whether the results will change going forward. While there is a European law, member states have some leeway to implement the rules and the BEREC guidelines are non-binding. Outside of Norway's Frode Sorensen,[277] one of the world's most activist regulators on net neutrality, the Nordic regulators do not want to pursue more net neutrality monitoring and adjudication.[278] Malik observes,

> Sweden, Denmark, Norway and Finland account for 2% of the world's GDP but 9% of global billion dollar exits. 2015 was the best year yet for the Nordic region as it saw three $1B exits and more than $13B in total exit value. Past 5 years have seen more than one billion dollar exit per year. Sweden accounts for over 50% of the Nordic Region's number of exits and exit value. Our analysis showed that the Nordic Region was greatly outperforming the rest of Europe and China, with a multiple of 4.78x compared to 2.39x for China, 1.89x for the UK Region, and 1.33x for the Germanic Region.

[276]Malik, Om. "Where the Great Startups Are. The Nordics." September 9, 2016. http://om.co/2016/09/14/where-great-startups-are-the-nordics/

[277] Sorensen, Frode. "The Norwegian Model for Net Neutrality." Nkom.no March 5, 2013. http://eng.nkom.no/topical-issues/news/the-norwegian-model-for-net-neutrality

[278] Supra Winding

Another report[279] by Startup Europe notes similarly of Denmark,

> Collectively, the 96 Danish scaleups raised $1.3B (capital raised since inception), specifically$1.1B (85%) through venture capital funds, while an additional $0.2B (15%) was raised on the stock market through the IPO channel. This is about one fifth (20%) of the total capital raised by scaleups in the Nordic countries and the 0.49% of the GDP of Denmark, in line with the average in the Nordic region (0.5%), slightly higher than in the UK (0.42%), 3 times higher than Continental Europe and 8 times higher than Southern Europe.

[279] "Startup Forge in the Nordics: Denmark2. StartUp Partnership Europe. SEP Monitor. September 2016. http://startupeuropepartnership.eu/wp-content/uploads/2016/09/SEPMonitor_Denmark_A-Scaleup-Forge-in-the-Nordics_DIGITAL.pdf

4 RESULTS SUMMARY

The investigation offered a preliminary view of mobile apps from countries with different net neutrality regimes, with particular attention to Denmark and Netherlands. The data offers snapshots from Denmark and Netherlands in 2011, 2012, and 2016, with two 90 day overviews in 2016. The data was then supplemented with information about mobile networks. It is by no means comprehensive. However some important trends and changes were observed.

4.1 COUNTRIES WITH HARD NET NEUTRALITY RULES DID NOT REPORT A HIGHER INCIDENCE OF MOBILE APPS THAN OTHER COUNTRIES

One of the key findings of this investigation is that no country which has adopted hard rules for the period (US excluded) experienced an increase in mobile app innovation. As a group the countries with hard rules produced just 20 mobile apps. The results are definitive when looking at Netherlands and Slovenia, countries which have declined in mobile app production since the rules were implemented.

At the same point, there is nothing in Tim Wu's article which suggests "hard" net neutrality regulation. The provisions of hard net neutrality rules, such as bans on zero rating, limits on the ability of telecom operators to provide specialized services, and price controls on interconnection, were not items discussed in Tim Wu's article. Rather they form a growing miscellany of regulatory actions justified under the rubric of "net neutrality", most recently privacy regulation in the USA.[280] Indeed Tim Wu wrote that operator's should "police what they own" so the current EU attempts[281] to limit the ability of operators to develop specialized services on the non-Internet portions

[280] FCC Releases Proposed Rules to Protect Broadband Consumer Privacy, April 1, 2016, https://www.fcc.gov/document/fcc-releases-proposed-rules-protect-broadband-consumer-privacy

[281] Specialised Services, accessed November 16, 2016, http://berec.europa.eu/eng/net/specialised_services/

of their networks also seems inappropriate under the rubric of Tim Wu's net neutrality.

4.2 COUNTRIES WITH SOFT RULES PRODUCED MORE APPS THAN COUNTRIES WITH HARD RULES

Countries with soft net neutrality rules have provisions more closely aligned with with the user rights that Tim Wu described in his article, users having the right to access the content, application, and services of their choice with the device of the their choice. The investigation showed clear support for the self-regulatory regime of Denmark, at least in comparison to the hard regime of Netherlands. Other countries with soft rules have also produced new mobile app innovation, notably Sweden, UK, South Korea, and Japan. In fact, if indexed for population, the soft rule countries have produced more apps per capita than the USA.

4.3 COUNTRIES WITH NO NET NEUTRALITY RULES PRODUCED A SIGNIFICANT NUMBER OF APPS

When looking at the many countries with no rules, there is a divergent mix of countries. A significant amount of new mobile app innovation comes from Russia, China, Hong Kong, and Germany whereas many of the small European countries which did not adopt formal rules during the period did not produce significant mobile app innovation. It may be that countries with large populations have a propensity to develop more mobile apps, but that does not explain Denmark, a country with just 5.5 million which increased its app production significantly during the period.

While not advocating the path of China, the fact of the matter is that China's internet policy, which might be termed a "closed" approach, has resulted in significant economic development and innovation for the country. China blocks many American applications and content providers, while it nurtures its own home grown and government-approved versions of Google (Baidu), Facebook (Renren), Twitter (Sina Weibo, QQ Weibo), WhatsApp (Weixin, also known as WeChat), and Amazon and Ebay (Taobao, Aliaba), not to mention YouTube (Sohu.com and Youku).

The Chinese internet is formidable, including four of the world's largest internet companies. In fact the revenues of Alibaba are higher than eBay and Amazon combined. According to a *Boston Consulting Group*[282] report, the Chinese internet accounted for 5.5% of the country's gross domestic product in 2012, even higher than the US at 5%.

The study of the Chinese internet is worthy of a dissertation in itself, but it can be observed that China has developed its own set of apps for its own economy. While many of these appeared to be "knock-offs" of American apps at the start, that is no longer the case today. Chinese apps are forces in their own right and are increasingly adopted outside China. While it is worthy of empirical investigation, one anecdotal observation is that China pursued a strategy of "blocking" American apps as a means to protect is local app economy and foster local innovations. This is not a statement of support for such a practice, but it does show that innovation can occur in "closed" environments. "Openness" does not appear to be prerequisite for innovation in this case. Indeed from the perspective of China, pursuing a "closed" strategy to develop the local internet economy appears to have worked.

4.4 THE PERFORMANCE OF THE USA IS HARD TO EXPLAIN

The US was measured separately because it accounts for an overwhelming portion of the world's mobile app innovation and its net neutrality litigation is ongoing. The level of mobile app innovation from the US has always been high and has not experienced a significant change over the period studied. Moreover the rules on wireless networks only came into effect in 2015, though are still being challenged in court

[282] David Dean et al., "The Internet Economy in the G-20," The Boston Consulting Group Perspectives, March 19, 2012, https://www.bcgperspectives.com/Images/The_Internet_Economy_G-20_tcm80-100409.pdf.

Van Schewick asserts that net neutrality has been the norm since 2005 in the US and is responsible for innovation on the Internet.[283] However if in fact net neutrality is the norm, then it suggests that the market anomie is working without specific FCC rules. Each successive FCC attempt at rules has proposed more strict rules, but there is no correlation of stricter rules with higher app innovation. Moreover the more strict the rule, the more likelihood of litigation, which has the potential to strike down rules all together. The soft rule countries evidence that an awareness and voluntary agreement to the rules, backed up by a regulator to intervene if and when violations occur, is sufficient to maintain openness.'

An important point is that net neutrality provisions have been imposed on Comcast from 2009-2017 as part of the conditions to approve its purchase of NBC. Comcast has had to adhere to rules even when courts struck down rules on its competitors. This raises a number of questions, for example whether net neutrality rules are needed on all ISPs or just those with market power; whether the imposition of rules on Comcast, a cable provider, has any impact to the mobile app industry; the efficacy of rules imposed as part of merger condition (whether they are justified in the economic analysis or simply a means for political expediency); and whether net neutrality is a subterfuge to facilitate rent extraction from mergers. On the other hand, agreeing to rules as part of a merger condition could be preferable for a company. This quid pro quo, as it were, ensures that the party can complete its transaction. When rules are imposed on the industry as a whole all at once, ISPs are not in a position to negotiate a win for themselves. It is interesting to observe that net neutrality has no become an additional lever which American regulators in the merger process whereas edge providers which seek similar mergers do not have to satisfy neutrality or Open Internet conditions.

The American rules, voted 3-2 partisan lines, are precarious in that they could be reversed with one member of the commission. A new President could possibly vacate the rules with an executive order, if they are not turned down on a rehearing. This goes to heart of the question of which legal instrument is appropriate. To have a lasting

[283] Supra van Schewick, personal interview.

"hard" net neutrality regime, a county needs to promulgate legislation. In the US, net neutrality have been proposed and turned down more than two dozen times. While this has frustrated advocates and driven them to make rules via the FCC, this also suggests that there may not be popular support for such Internet regulation. This also impugns the political process; if advocates can pressure the regulator to make rules, what does it mean to be an expert, independent agency?

It may be that net neutrality does not explain why innovation happens on mobile networks. Given the results of the investigation, it appears that Wu's prescription for innovation is too simple and monolithic to explain the actors and forces of innovation.

4.5 THE ROLE OF INTELLECTUAL PROPERTY RIGHTS

While it is not the focus on the paper, it is possible that the intellectual property rights regime has a relationship to Internet innovation. For example, one interpretation is that apps are developed in the US because it is a country which affords strong intellectual property protections. While the conventional wisdom is that China does not protect intellectual property, the success of companies such as Baidu, Tencent, and Aliaba clearly show that intellectual property rights exist in China.

It bears mention that the net neutrality movement has some philosophical foundations in Lawrence Lessig's "Free Culture"[284], a movement critical of copyright and seeks to promote the free modification and distribution of works over the Internet. This view is consistent with the requirement of "no blocking", that users can get access to whatever content they want regardless of the rights regime.

It may also be significant that a number of the early disputes about net neutrality had to do with peer to peer file sharing for pirated works. It was not that the telecom operators had a problem with the illegal transfer of works, but rather that the peer to peer programs used took

[284] Lessig, Larry. *Free Culture*, accessed November 16, 2016, http://www.free-culture.cc/

up a large amount of bandwidth, e.g. BitTorrent degraded the experience for other network users.

While many associate net neutrality with rules to ensure that content is delivered unimpeded, a number of governments see this as an opportunity to block content, not just that which is illegal but that which violates copyright.[285] Governments in a number of countries summarily block child pornography; websites of illegal activities such as gambling and firearms; as well as political or cultural content. Interestingly that some net neutrality rules countries are frequently written in such a way that only "legal" content is protected from being blocked, implying that illegal services can be blocked and throttled.[286] Indeed net neutrality can double as a backstop to ensure that only copyrighted materials can enjoy unblocked access. A number of organizations have pointed out this issue, called the copyright loophole"[287][288][289], but support net neutrality nonetheless. Yet Lessig's prophesy may be self-defeating with increased monitoring and inspection of packets to enforce copyright undertaken to instrument net neutrality.

In any case, Wu's view is informed by his interpretation of Edmund Kitch in which Wu finds abuse by patent holders in not sharing their

[285] Thomas Newton, "EU net neutrality crusade could roll back the UK's internet porn filters," July 14, 2015, https://recombu.com/digital/article/eu-net-neutraility-cancel-uk-porn-filters

[286] Ibid

[287] Ernesto Van der Sar, "U.S. Net Neutrality has a Massive Copyright Loophole," TorrentFreak, March 15, 2015 https://torrentfreak.com/u-s-net-neutrality-has-a-massive-copyright-loophole-150315/

[288] Fred Von Lohmann, "MPAA and RIAA Seek Net Neutrality Copyright Loophole," Electronic Frontier Foundation, January 20, 2010, https://www.eff.org/deeplinks/2010/01/mpaa-and-riaa-seek-net-neutrality-copyright-loopho

[289] Joint Comments of Computer and Communications Industry Association, Consumer Electronics Association, Electronic Frontier Foundation, Home Recording Rights Coalition, NetCoalition, and Public Knowledge on the Matter of Copyright Infringement in the Open Internet Rules, January 14, 2010, https://www.publicknowledge.org/pdf/joint-comments-copyright-nn-20100113.pdf

innovations with others. There is no doubt that patent debates continues in many fields. Wu's view is that patent holders are network resources of sorts that need to free open to any innovator. The counter view is that if innovators cannot capture some amount of wealth from their invention, they will cease to invent, or invent less.

4.6 THE ROLE OF PRICING FLEXIBILITY FOR MOBILE SUBSCRIPTIONS

An important difference between Denmark and Netherlands which may explain why Denmark produces more apps is that Danish mobile operators enjoy more pricing and marketing flexibility for mobile subscriptions. Denmark's net neutrality rules do not restrict mobile operators in their ability to partner with content and application providers whereas strict rules in the Netherlands make such partnerships and pricing flexibility more difficult.

For example zero rating has long been used in Denmark as an incentive to users to try data packages for their smartphone. At least as early as 2012 Telenor used offers for free and zero rated Facebook as an incentive for users to purchase mobile subscriptions. All of the Danish mobile network operators have their own proprietary music service and incumbent TDC zero rates its service. Hutchinson 3 offered a smartphone training page early on to support users in trying new devices.

Danish newspapers and content companies, which have experienced digital disruption, embrace working with Danish mobile operators. A leading example is Telmore,[290] the world's first MVNO (now owned by Danish incumbent TDC). One of its typical packages offers unlimited calling, SMS, and MMS; 12 GB of data, and unlimited access to content services including HBO Nordic (Netflix competitor), TV2/Play (local TV), C More (local film), MinBio (kids),Telmore Musik (Musik), Mofibo (Danish books), Premium News sites

[290] "The mother of no frill MVNOs, Denmark's Telmore, sets a new standard for bundled mobile traffic and content. A package of premium content worth €127 goes for €11/month." Strand Consult. June 12, 2014.
http://strandreports.com/sw6174.asp

(Politiken, Ekstra Bladet), and premium magazines (Euroman, Eurowoman, Fit Living, Rum, and Gastro).

This kind of partnership is welfare enhancing for all parties, and naturally it is allowed—indeed encouraged--under Denmark's soft net neutrality rules. No content is throttled or blocked, and offers are fully transparent in a competitive marketplace. Consumers get a variety of local content at a competitive price. Content companies earn revenue on advertisements and pay royalties to creators. Mobile operators are forced to bring more competitive and compelling offers to their customers. Additionally the Danish government earns much needed tax revenue which it would otherwise not be realized, as many firms practice tax arbitrage in Ireland to avoid the local 25 percent VAT.

Another important feature is that Denmark stimulates its public sector to produce apps and make data and tools available which app develops can freely use to produce apps. Both Denmark and Netherlands are top nations for egovernment according the European Commission,[291] but Denmark has a slight edge which may be significant for this analysis. A forthcoming section on the digital policy of Denmark describes how the egovernment services helped to drive adoption of 3G mobile broadband. Denmark has a number of apps developed by the public sector in addition to private sector apps that build upon public sector tools.

Some assert that bans on zero rating are implicit in net neutrality, even though Wu never talked about that. On the other hand zero rating would seem to produce a demand subsidy for apps, so there could be app growth, especially for home grown apps. The internet is an experience good, that is the value cannot be ascertained until it is consumed.[292] In markets with heterogeneous products, consumers with different preferences and information make it costly, if not

[291] "eGovernment - Digital Agenda Scoreboard 2015" (EU, 2015), http://ec.europa.eu/newsroom/dae/document.cfm?action=display&doc_id=9937.

[292] Nelson, Phillip. "Information and Consumer Behavior." Journal of Political Economy Vol. 78, No. 2 (Mar. - Apr., 1970), pp. 311-329 http://www.jstor.org/stable/1830691?seq=1#page_scan_tab_contents

impossible, for consumers to identify the attributes of the products or the fit with their preferences before they have been consumed. Similarly the provider cannot accurately match the offer to the consumer without some amount of trial and error. This process of the user switching, learning and adjusting comprise a user's "search costs". The larger are the search costs, and the smaller is the expected benefit of the second product over the first, the less likely it is that the consumer will try to find a better match, even though there is definitely a better one out there. Thus, high search costs lead to suppliers having some market power over their existing customers – akin to monopoly – even though there are many different variants of the product -competitors – available. Zero rating may be helpful to reduce the user's search costs to find alternative applications and to lower entrance barriers for entrant applications.

The markets for internet application adoption and usage are monopolistically competitive. Customers make investments in using specific applications (learning costs, emotional investments etc) that make them reluctant to try new variants. When a new application enters a market where customer preferences are already well-established, overcoming these high search costs is likely one of the most significant barriers to be faced. The more mature is the application market, the more established are these preferences and the harder it will be to overcome them. Even if the new product is superior to all others in the market, customers will be reluctant to try it, because they do not know that it is better for them until they have tried it. If the same price is charged for the new and existing products, the new product will not attract any new customers, because of the high search costs customers face. In this case, the only way that the new product will attract new customers is by charging less than the existing products – that is, undertaking to meet the search costs incurred by the customers. For this reason, new products in this market are typically introduced with free trials.

However, if a new internet application is offered free of charge to consumers, because the costs are recovered from advertising or other sponsored revenues (e.g. donations, tax funding), it is not possible to discount the application cost to encourage switching. The only way that potential customers' search and switching costs can be reduced is

by reducing the internet access charge. Hence, zero-rating may be the only viable way of inducing existing consumers to try a new product. Not being able to offer zero-rating thus constitutes an entry barrier to new applications seeking to compete with established ones. In these instances, it will be existing applications providers, and not new entrants, who would prefer that zero rating not be allowed.

Net neutrality puts an implicit value on the edge in favor of the core, but it is not clear that this should be the case. Also one can argue about the relative value of different innovation, the latest game might not be so important as the health care app. On the other hand, if there are social benefits to such games as PokemonGo (users interacting, travelling to new locations etc), then zero rating, if in fact it encourages socially beneficial behaviors, should not be banned, as some net neutrality advocates desire.

In general this data does not lend itself to bright line rules against a single actor but an updated, informed perspective of how different actors come together in dynamic networks.

5 DISCUSSION

5.1 BACKGROUND ON COUNTRIES

Some discussion[293] to the political context of net neutrality rulemaking is helpful, particularly to find whether there are common trends and features with drive rulemaking. For example in both Chile and Slovenia restrictions on zero rating were driven by a single actor and dissatisfaction by activists that regulator were not doing enough to enforce net neutrality. In Netherlands, the advocacy Bits of Freedom was instrumental in rulemaking and the Ministry of Economic Affairs has been the authority to drive the strengthening of rules. In Denmark, however, there has been a long process to deregulate telecommunications, even to dismantle the regulator itself. In the Danish case operators took the imitative to propose a self-regulatory regime on net neutrality which was in place for 5 years until the EU rules were implemented.

5.1.1 CHILE

In 2010 Chile was the first country in the world to make a net neutrality law.[294] The effort was an outcome of five years of regulation and subsequent litigation between operators and the telecom regulator Subtel. To make rules, the country's communications laws needed to be updated to vest the proper authority within the telecom regulator, a situation which parallels the US in which ISPs claim that the FCC does not have the authority to create net neutrality rules. The D.C. Circuit upheld the FCC's third

[293] Layton, Roslyn, and Silvia Elaluf-Calderwood. "Zero Rating: Do Hard Rules Protect or Harm Consumers and Competition? Evidence from Chile, Netherlands and Slovenia." Arlington, Virginia, USA, 2015. http://ssrn.com/abstract=2587542.

[294] Consagra el Principio de Neutralided en la Red Para Los Consumidores y Usuarios de Internet, General de Telecomunicaciones Ley 18.168 (August 26, 2010), http://www.leychile.cl/Navegar?idNorma=1016570&buscar=NEUTRALIDAD+DE+RED

attempt to make rules, but the decision has been appealed and awaits an en banc review by the full court.

Virgin Mobile launched an MVNO on Movistar network's in Chile in April 2012. Because virtual operators resell network access, they cannot differentiate on speeds or quality, so they must differentiate on marketing, customer service, and other non-network parameters. As such zero rating can be an important tool for MNVOs.

Virgin Mobile Chile used a common marketing strategy employed by MNVOs: paint the established operators as dinosaurs and celebrate customers as "rock stars". "Chileans can now get fair flat rate calling and great Data bundles and "Anti-Plans"[295] with everything they need. And Virgin Mobile Chile throws in extra goodies like Unlimited Whatsapp when you buy data. The Rock Star customer support team has brought a new level of care to the Chile market, and customers are the most satisfied in the market," notes the operator's Chilean website.[296]

A year after launch, the company had 200,000 customers which the CEO owes to "a simple offer, without asterisks, flat rate data, convenient bags of minutes, and a call center."[297] Over three years, the company earned 1% of the Chilean market and is on track to have 400,000 customers by the end of 2015, half of which are post-paid.[298] Other explanations for its success include laws in 2012 that allow

[295] Anti-plan was the idea of an offer that is not constrained to the traditional telecom contract, e.g. long contract life, termination fees, extra charges etc

[296] "Virgin Mobile Chile," Virgin.com, accessed August 5, 2015, http://www.virgin.com/company/virgin-mobile-chile.

[297] "Virgin Mobile Cuenta En Chile Con Más de 200.000 Clientes," CIOAL The Standard IT, April 17, 2013, http://www.cioal.com/2013/04/17/virgin-mobile-cuenta-en-su-primer-ano-en-chile-con-mas-de-200-000-clientes/.

[298] Markus Zallman, "Virgin Mobile Chile Targets 400,000 Mobile Subs by End-2015," MVNO Dynamics, April 22, 2015, http://www.mvnodynamics.com/2015/04/22/virgin-mobile-chile-targets-400000-mobile-subs-end-2015/.

number portability and unlocking of phones.[299] Virgin Mobile has extended its concept to Mexico and Colombia and has a goal of winning 5% of the Chilean market.[300]

To be sure, with 70 percent of its customers aged 15-35, of which 70% have data plans and 85% have smartphones, WhatsApp would likely be a popular app. In response to Subtel's decision to ban zero rating, the CEO explained,

> Well, certainly it had an impact because we had to revise our offer. We have not eliminated the promotion, but we had to change it. Back when you bought a package of data, we gave free Whatsapp for the 30 day duration of the package, and if a customer left without any balance, the customer could continue using WhatsApp to the end of the period. Now we continue offering this service for free, that is, that the use of data Whatsapp not count toward the package, but the moment in which the client runs out of contract data, he cannot continue using WhatsApp. That is, customers have Whatsapp free while having data package.[301]

However the CEO asserts that zero rating has less importance in light of other activities, which include its distribution strategy through the large retail chains Ripley and Falabella and wholesaling with small shops. Virgin Mobile operates its own distribution channels with kiosks in subway stations and its website. The country also adopted a framework to support MVNOs[302] and made a law to ensure number

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[299] "Virgin Mobile Chile's MVNO Signs up 36,000 Subscribers," MVNO Dynamics, July 24, 2012, http://www.mvnodynamics.com/2012/07/24/virgin-mobile-chiles-mvno-signs-up-36000-subscribers/.

[300] Leticia Pautasio, "'Queremos Alcanzar 300.000 Clientes Al Cierre de 2014,'" Telesemana, April 13, 2014, http://www.telesemana.com/blog/2014/08/13/queremos-alcanzar-300-000-clientes-al-cierre-de-2014/.

[301] Ibid

[302] Ibid

portability. The success of Virgin Mobile cannot be attributed directly to its zero rated offer.

Two net neutrality advocacies Neutralidad Sí! and CivicoONG complained to the regulator that Virgin Mobile's offer of free WhatsApp was an attack on the law of net neutrality. They asserted that Virgin Mobile is creating a disincentive to use competing messaging services such as Line and Telegram. Correspondence between Neutralidad Sí and the regulator was reviewed. The original complaint, No. 324923 posted on January 29, 2013, has been removed, [303] but the rest of the exchange remains.

In the correspondence, the regulator reiterated that the Chilean rules state that operators cannot arbitrarily block, interfere, discriminate, hinder or restrict the right of any Internet user to use, send, receive or offer any content, application, or legal service. Offers cannot arbitrarily distinguish content, applications, or service based on source or owner. The legislation still allows operators to manage traffic within a set of constraints, provided that the actions do not impact competition. The purpose of the law is to ensure that services, applications, and content are offered without discrimination to the time the user access is allowed without arbitrary restrictions and that access be provided in a competitive way.

The offer by Virgin Mobile and WhatsApp did not prevent access to other applications, according to the regulator. It only releases metering for the one application for the period of the offer, and therefore does not constitute a breach of net neutrality. The user can also access the application even when he has no balance.

Neutralidad Sí! responded the same day. They extrapolate that it will lead to situations in which users are coerced with rebates and discounts to use "search engine X" or "video provider Y". Secondly they object to the idea that "traffic management and network management" do not harm competition. They note that if access to

[303] Civico ONG, "Denuncia Por 'Whatsapp Gratis' En SUBTEL," Storify, accessed August 5, 2015, http://storify.com/ongCivico/denuncia-por-whatsapp-gratis-en-subtel.

WhatsApp is free then it effectively harms other competitors because to access to them must be paid.

The regulator replies that it has revisited the net neutrality law and reiterates the points. As for the threat described, that an operator is favoring one application over another, this is not case because the offer is not restricting the right of users to access the Internet, which is the point of the law.

Neutralidad Sí! responds with a reference to Article 19 of the Civil Code: "When the meaning of the law is clear, its wording be disregarded under the pretext of consulting its spirit." They reiterate the words “discriminate” and “offer” that exist in the net neutrality law and the Royal Academy of the Spanish Language definition of discrimination being “select excluding”. They suggest that if other services receive the same treatment as WhatsApp, the arbitrary nature of the discrimination will be eliminated.

The complaint was brought to the Secretariat of the Regulator and then closed with the explanation that the regulator had provided an adequate explanation. The Neutralidad Sí! blog says that the regulator’s response was “awkward” and did not rule on the merits.

It appears that the issue gets no further attention until a new chair comes to the telecom regulator. Pedro Huichalaf, former head of related net neutrality advocacy organization ONGMeta, took office in March 2014.[304] The marketing of “free social networks” is pronounced illegal the following month.[305] However this is not a ban on zero rating or price discrimination as some conclude. Some free access is offered though it is not marketed as such.

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[304] “Renuncia de Pedro Huichalaf Por Nominación Como Subsecretario de Telecomunicaciones,” ONG META, accessed August 5, 2015, http://ongmeta.cl/renuncia-de-pedro-huichalaf-por-nominacion-como-subsecretario/.

[305] Zero Rating of Such Social Media as Pronounced Illegal, 2014, http://www.subtel.gob.cl/transparencia/Perfiles/Transparencia20285/Normativas/Oficios/14oc_0040.pdf.

The official decision notes that companies are not punished for offering zero rating, but are invited to end the practice, or to provide the benefits to all traffic of the same class. Some confusion emerged once the decision was released as to nature of the word "arbitrary", whether traffic is treated an an "arbitrary" or deliberate way. At the time of the ruling, Wikipedia Zero was not yet available, but the rule ostensibly outlawed it. Wikipedia noted the Chilean decision is "example of when net neutrality — which is an important principle for the free and open internet — is poorly implemented to prevent free dissemination of knowledge."[306] The regulator relented and allow Wikipedia to be an exclusive zero rated service, noting that there is a clear difference between Wikipedia Zero and unlimited social messaging. [307] Neutralidad Sí called the exception for Wikipedia, the "last unicorn of the 'good Internet'", a double standard.

Neutralidad Sí appeared to be dissatisfied because the regulator while pronouncing the offer illegal, does not do enough to prosecute or punish telecom providers for the practice. The organization says that the situation is contradictory and calls on the regulator to clarify. The comments under the blog blame Neutralidad Sí for making the zero rating complaint in in the first place. The commenter notes that the ban hurts poor people who can't communicate with their family through WhatsApp. Another comment refers to the slippery slope of ill-defined rules such as the ban on zero rating, what may be legal today will not be tomorrow and vice versa. Additionally he faults the organization for not recognizing how internet companies (Facebook) take advantage of users' information with free services. Another commenter criticizes the net neutrality rhetoric of "free Internet" because technically a zero rated offer is free access.

Earlier heads of the Chilean regulator criticized the ruling. On Twitter, one called it "populist idiocy from a small group of activists. A new

[306] Yana Welinder, "[Wikimedia Announcements] [PRESS RELEASE] Airtel Offers Nigerians Free Access to Wikipedia," June 1, 2014, https://lists.wikimedia.org/pipermail/wikimedia-l/2014-June/072336.html.

[307] "Wikipedia Zero avanza en Chile", September 24, 2014, http://www.vpschile.cl/servidor-virtual/3821/1/internet/wikipedia-zero-avanza-en-chile.html

form of regulatory capture."[308] Another penned an opinion piece in the leading newspaper titled "positively discriminatory, but not arbitrary, in favor of the poor."[309]

However definitive proof to whether harm to consumers of competition could be determined by examining the traffic data. As AppAnnie analysis shows, WhatsApp has always been a popular service in Chile. Once zero rating began, WhatsApp actually lost a modest amount of traffic on Apple devices while on Android it stayed relatively constant. Meanwhile competing messaging applications such as Facebook Messenger, Twitter, Skype, Badoo, Google Hangouts, Emoji, LINE, Telegram, imo, Talking Tom and Viber remained popular and did not experience a change in traffic as a result of zero rating in 2012-2014. Each one of these apps has a different value proposition and appeals to a different market segment. Therefore the zero rating of one does not cause a decrease in another. The apps are not substitutable.

The Chilean Consumer Authority publishes an annual report of complaints related to telecommunications. The report[310] for 2012-2013 is telling in what consumers complain about; which companies; and how complaints are resolved. Complaints about mobile communications make up about half of all the complaints in the country for the period. About 2 of every 200 mobile subscribers complain. For mobile communications, the single largest set of complaints is about phones (13%) and problems with phones connecting with networks leading to slow speeds (11%). Thereafter the bulk of complaints (56%) have to do with the contracts

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[308] "Sobre Redes Sociales Gratis (with Image, Tweets) · ongCivico," Storify, accessed August 5, 2015, http://storify.com/ongCivico/sobre-redes-sociales-gratis.

[309] Pepe Huerta, "Redes Sociales Gratis Y La Circular de SUBTEL. ¿Donde Surgió El Problema?," Neutralidad Si, June 2, 2014, http://www.neutralidadsi.org/2014/06/02/redes-sociales-gratis-y-la-circular-de-subtel-donde-surgio-el-problema/.

[310] "Servicio Nacional Del Consumidor | SERNAC Y SUBTEL Dan a Conocer Ranking de Reclamos En El Mercado de Telecomunicaciones," Sernac, (January 24, 2014), http://www.sernac.cl/sernac-y-subtel-dan-a-conocer-ranking-de-reclamos-en-el-mercado-de-las-telecomunicaciones/.

themselves, issues of customer care information is faulty, wrong or inadequate; disputes on charges for additional services; charges made for services not used; contract termination; term of warranty for phone; lack of accurate and timely information; and billing cycle change. In fact the largest single complaint across all telecommunications networks is incorrect charges, 27%. The report notes that complaints were resolved at least two-thirds of the time for all but one mobile operator. The report notes that total complaints declined 3.6% from 2012 to 2013.

Importantly the report does not list specific net neutrality, zero rating, or free data complaints, and if they exist, they do not amount any more than 1.8% of complaints, the smallest category of any collected complaint. Moreover, if the zero rated version of WhatsApp was hurting competition, it would be expected that its competitors, Line, Telegraph, and so on would have complained. So such complaints could be found on either the regulator's or competitor authority's website.

It appears that speed and quality are the more important issues, not net neutrality and zero rating. Chilean consumers increasingly demand content that is not Chilean. It is housed in far locations and takes time to reach Chile. This can also be observed that when one is in Europe accessing a Chilean website, one may experience latency. Sandvine notes,

> In Latin American mobile networks, two companies, Facebook and Google, now control over 60% of total traffic in the region. This dominance is driven by the popularity of low cost Android smartphones in the region as well as
> Facebook's decision to embrace social networking and messaging through their acquisitions of Instagram and WhatsApp. With such concentration, corporate decisions by these major players, like Facebook's decision to auto-play videos

> uploaded to its site, can instantly and dramatically impact subscribers and network operators. [311]

The issue could be resolved with intermediaries such as content delivery services, video encoding, and content formatting. Generally content owners purchase these services to ensure the fidelity of their content, as well as to lower their operating costs (better formatting reduces storage cost and energy consumption). However it is not necessarily clear that all content owners will have a strategy for Chile, especially if they don't license their content for the country.

In a 2015 presentation[312] to the Body of European Regulators for Electronic Communications (BEREC), Subtel chair Huichalaf declared that zero rating is attractive from the point of view of users. However he believes that the regulator still has a role to decide whether such offers should be allowed. In October 2015 Huichalaf was removed by the Chilean President,[313] indicating dissatisfaction on his leadership to facilitate increased market share of entrants and MVNOs.[314]

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311 "Sandvine - Global Internet Phenomena - Latin American Report May 2015," Sandvine, (May 2015), https://www.sandvine.com/trends/global-internet-phenomena/.

312 Pedro Huichalaf, "Neutralidad de La Red: Explorando El Impacto En REGULATEL," Gobierno de Chile, July 2015, http://berec.europa.eu/files/doc/4.%20PPT-%20CHILE%20-%20REGULATEL%20-%20BCN.pdf.

313 Nicolas Larocca, "Chile: magro resultado electoral obligó a hacer cambios y Pedro Huichalaf fue desplazado de la Subtel", October 27, 2016 http://www.telesemana.com/blog/2016/10/27/chile-magro-resultado-electoral-obligo-a-hacer-cambios-y-pedro-huichalaf-fue-desplazado-de-la-subtel/

314 Nicolas Larocca, "La lucha tripartita, lejos de correr riesgo, se consolida en Chile", October 4, 2016, http://www.telesemana.com/blog/2016/10/04/la-lucha-tripartita-lejos-de-correr-riesgo-se-consolida-en-chile/

5.1.2 NETHERLANDS

The Netherlands could be considered the world's most competitive broadband market for the number of multiple broadband facilities available.[315] On account being the world's flattest and most densely populated country, there are nearly two wired infrastructures (copper and cable) to every residence, three mobile networks (and a fourth under construction), resellers on top of the copper infrastructure; and dozens of virtual mobile providers. Fiber is available in some cities as well. It is counterintuitive that net neutrality laws should be so strict, for if ever a market existed where consumers could switch if they didn't like their provider, it is the Netherlands.

Since adopting the net neutrality law, a number of financial indicators reveal a worsening situation for Dutch telecoms, though a number of trends were already in play well before the law, including declining voice revenue and service revenue growth. The Netherlands is a saturated market in both fixed and mobile. Growth of subscribers is flat in fixed. In mobile, it has been declining since 2011 when it had a high of 105% and has fallen below 100%. There are no new customers for operators; the only possibility is to poach each other's customers. Frequently this can mean a race to the bottom. The monthly churn rate for the industry is 2.5%, relatively high for a postpaid market. This indicates that customers can and do change providers.

Nevertheless financial results reveal that costs are managed prudently. To maintain profitability in a strict regulatory environment where new business models are not allowed, the only recourse is to lay off workers. In 2014, KPN laid off 2000 in the consumer branch and another 500 in the corporate.[316] This follows other cuts in recent years across the industry.

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[315] See section 3 on Coverage and Geography. "OECD Broadband Portal," July 23, 2015, http://www.oecd.org/sti/broadband/oecdbroadbandportal.htm.

[316] Janene Van Jaarsveldt, "KPN to Cut 580 Jobs," NL Times, December 10, 2014, http://www.nltimes.nl/2014/12/10/kpn-cut-580-jobs/.

Net neutrality advocacy organization Bits of Freedom has been instrumental to bring attention to net neutrality.[317] Though they had conducted campaigns for a number of years on the topic, they found little interest with the general public. However a statement from a KPN executive, suggesting that the company would charge users to access WhatsApp, catapulted Bits of Freedom (BoF)'s efforts to center stage. In addition to viral take-up of the issue in the media, the stakeholders BoF had cultivated, including key parliamentary sponsors, allowed the organization, in just two months, to push through the legislation it had created. There was no hearing of mobile operators or investigation of traffic management. The Law was promulgated in 2012 and came into force the following year.

The Dutch Parliament had been revising its Telecommunication Act during this period, and BoF found support among a number of Parliamentarians It also provided the lawmakers with a proposed text for the law[318] as well as position papers developed under the support of the Council of Europe (an agency empowered to protect human rights) to support the legislation.[319] Encouraging Dutch innovation in internet services and applications was a reason given to support net neutrality.

From the operators' side, the uptake of the free SMS applications in lieu of proprietary services materially affected revenue. KPN, for one,

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[317] Roslyn Layton, "Net Neutrality in the Netherlands: Dutch Solution or Dutch Disease?," 24th European Regional ITS Conference, Florence 2013 (International Telecommunications Society (ITS), 2013), http://econpapers.repec.org/paper/zbwitse13/88488.htm.

[318] Matthijs van Bergen, intern at Bits of Freedom "played a consulting role in the establishment of net neutrality legislation in the Netherlands." https://www.linkedin.com/in/matthijsvanbergen

[319] "Protecting Human Rights through Network Neutrality: Furthering Internet Users' Interest, Modernising Human Rights and Safeguarding the Open Internet" (Steering Committee on Media and Information Society (CDMSI), December 3, 2013), http://www.coe.int/t/dghl/standardsetting/media/CDMSI/CDMSI(2013)Misc19_en.pdf.

was not prepared for the shift. For the first time in many quarters, the company issued a profit warning.

In its quarterly announcement, it noted a large drop in SMS revenue in Q1 of 2011 and lowered EBITA projections by €200 million euros from the prior year. KPN also noted that to lower costs, it would lay off 25% of its Dutch workforce, about 4000-5000 employees.[320] Before making the suggestion of charging for WhatsApp, KPN obtained permission from the Dutch telecom regulator OPTA.[321] The regulator approved the offer and noted, "This means more choice for consumers, which allows subscriptions can take better suited to use. We therefore welcome such a development, on condition that the provider is transparent about the cost."[322]

What is frequently described as a predatory situation between operators and third party applications, might also be viewed as operators having the wrong business model in a time of change. Until 2010, data consumption on mobile devices was limited in the Netherlands, and the price reflected that users did not demand it very much. But with smartphones and emerging online services, consumers started to shift their consumption. This came at a time where the prevailing terminating regime in the caller pays, both increased the price of voice and SMS, but also created an incentive for off-net termination.[323]

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[320] "2011 EBITDA Outlook Adjusted Downwards, Free Cash Flow Confirmed," KPN, (April 21, 2011), http://corporate.kpn.com/press/2011-ebitda-outlook-adjusted-downwards-free-cash-flow-confirmed.htm. Hear KPN CEO Elco Blok http://nos.nl/audio/234661-ontwikkelingen-hebben-negatieve-invloed-op-omzet.html

[321] OPTA is the Dutch Post and Telecommunications Authority, the now closed Dutch telecom regulator. It was subsumed into ACM (Consumer and Market Authority) in early 2013

[322] Door Arnoud Wokke, "KPN: 'Chatheffing' Voor Mobiel Internet Komt Deze Zomer," Tweakers, (April 21, 2011), http://tweakers.net/nieuws/74017/kpn-chatheffing-voor-mobiel-internet-komt-deze-zomer.html.

[323] An important point to underscore for the US is that having a termination in which both sides paid reduced any incentive to block VOIP and SMS applications on smartphones.

It is important to note that WhatsApp has remained in the top position as the most popular messaging app in the Netherlands for years. No operator or competitor has succeeded to impact its position.

Once the law came into effect, there were no reports of net neutrality violations for some time.[324] One view is that the law was working to deter violations. On the other hand, it be embarrassing politically if no violations occur, for it may appear that the law was made too hastily. As such, there could be political pressure to find a problem to justify the law ex post.

In January 2013 the new telecom regulator, now rationalized in the Dutch Consumer and Market Authority (ACM) commissioned a study[325] of over-the-top (OTT) services. Rather than prohibiting the development of third party applications and services, operators facilitate OTT services through their provision of mobile broadband. Increasingly consumers use these services. It also noted the declining power of mobile operators, specifically, "On sales level we see a shift from KPN to cable and a parallel of shifting market shares. Mobile data market is the engine of growth, with WiFi as a substitute for

[324] There was on complaint about T-Mobile throttling wifi on trains. ACM ruled that it is acceptable for T-Mobile to manage its networks for congestion. Peer to peer and file sharing applications create a lot of traffic and this harms other applications, especially on a train where 2G/3G service is offered. The moving trains also makes the connection difficult. Managing the traffic is acceptable in this circumstance. "Correspondentie Afsluiten onderzoek 'T-Mobile HotSpot in de trein' | ACM.nl," Correspondentie, (December 30, 2013), https://www.acm.nl/nl/publicaties/publicatie/12508/Afsluiten-onderzoek-T-Mobile-HotSpot-in-de-trein/.

"Nieuwsbericht T-Mobile mag gratis internet in NS-treinen beperken," Nieuwsbericht, (December 30, 2013), https://www.acm.nl/nl/publicaties/publicatie/12507/T-Mobile-mag-gratis-internet-in-NS-treinen-beperken/.

[325] "Onderzoek Overzicht markt voor over-the-top diensten Nederland - januari 2013 (Telecompaper) | ACM.nl," Onderzoek, (July 23, 2013), https://www.acm.nl/nl/publicaties/publicatie/11717/Overzicht-markt-voor-over-the-top-diensten---Nederland---januari-2013-Telecompaper/.

mobile or mobile data. The mobile service revenue and ARPU show a slight downward trend."[326]

Meanwhile in Brussels, the European Parliament passed a net neutrality resolution on April 3, 2014. The Alliance for Liberal Democrats for Europe (ALDE) drove its passage with Dutch Member of Parliament Marietje Schaake.[327] She celebrated the passage on the website of D66, the Dutch Democratic Party, noting "Conversely, Europe must also ensure that Internet and communication technologies are regulated too. More and more countries and the UN are working on laws and regulations to enhance the control of governments."[328] Though the Parliament's resolution requires the agreement of the European Commission and the Council of Ministers (head of state of the EU member nations) to become law,[329] the resolution triggered the Dutch to strengthen the interpretation of their net neutrality law, specifically to eliminate exceptions for zero rating.

The Dutch Ministry of Economic Affairs started a process to discuss how the net neutrality law should be interpreted, how strict it should be, and what to do about the practice zero rating, called "loose" or stand-alone services. A consultation was held in May 2014.[330] Among the 30 respondents was Netflix,[331] which just a few months before,

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[326] Ibid

[327] Marietje Schaake, "Europees Parlement Steunt Voorstel Schaake Voor Netneutraliteit in Europese Wet," D66, April 3, 2014, https://d66.nl/europees-parlement-steunt-voorstel-schaake-voor-netneutraliteit-europese-wet/.

[328] "Digitale Vrijheid Prioriteit in EU-Buitenlandbeleid - Doe Mee, Word Lid!," D66, November 7, 2014, https://d66.nl/ep-commissie-steunt-d66-digitale-vrijheid-prioriteit-in-eu-buitenlandbeleid/.

[329] This was ultimately resolved on June 30, 2015 with rules coming into force on April 30, 2016. "Commission Welcomes Agreement to End Roaming Charges and to Guarantee an Open Internet," European Commission, June 30, 2015, http://europa.eu/rapid/press-release_IP-15-5265_en.htm.

[330] "Consultatie Beleidsregel netneutraliteit," consultatie, (May 2, 2014), http://www.internetconsultatie.nl/netneutraliteit.

[331] "Consultatie Beleidsregel netneutraliteit, reactie," webpagina, (May 28, 2014), http://www.internetconsultatie.nl/netneutraliteit/reactie/71331718-03d9-43be-9d87-43d2cdff1355.

signed on as the first customer in the New York office of the Amsterdam Internet Exchange[332] (The company has since moved its European headquarters to Amsterdam and plans to use the location to help grow its business in the Middle East and Africa.[333]) Netflix commended the Ministry's efforts, supported a strict policy against zero rating, noted that net neutrality stimulates innovation, and suggested a broad interpretation of net neutrality, effectively ensuring that consumers increasingly choose flat rate packages. The outcome of the consultation is strict version of net neutrality with a strict interpretation which the regulator must enforce.[334] Interestingly Netflix is zero rated in Australia as part of its partnership with fixed lined operator iiNet.[335] The company calls the introduction of Netflix to the Australian market a game changer.[336]

On June 5, 2014 in "Net neutrality the work in progress"[337] Bits of Freedom described the process conducted by the Ministry of Economic Affairs to clarify ambiguities in the Dutch net neutrality

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[332] "Netflix Signs On To New York Open Internet Exchange," Amsterdam Internet Exchange, December 2, 2013, https://ams-ix.net/newsitems/124.

[333] http://www.iamsterdam.com/en/business/invest/business-news/netflix-officially-opens-european-headquarters-in-amsterdam

[334] "Besluit van de Minister van Economische Zaken van 11 mei 2015, nr. WJZ/15062267, houdende beleidsregel inzake de toepassing door de Autoriteit Consument en Markt van artikel 7.4a van de Telecommunicatiewet (Beleidsregel netneutraliteit)," officiële publicatie, officielebekendmakingen, (May 15, 2015), https://zoek.officielebekendmakingen.nl/stcrt-2015-13478.html.

[335] Janko Roettgers, "Netflix won't count against iiNet broadband caps in Australia", March 2, 2015, https://gigaom.com/2015/03/02/netflix-wont-count-against-iinet-broadband-caps-in-australia/

[336] iiNet to flick on quota-free Netflix, March 3, 2015, http://www.iinet.net.au/about/mediacentre/releases/2015-03-03-quota-free-netflix.html

[337] Door Kreiken, "Netneutraliteit Blijft Work-in-Progress," Bits Og Freedom, June 5, 2014, https://www.bof.nl/2014/06/05/netneutraliteit-blijft-work-in-progress/.

law. It criticized Facebook, Vodafone, RTL, and Endless Spotify[338], a zero rated program offered by Hi, a virtual mobile provider (owned by KPN) offering discount services focused on the youth market. The blog refers to an article[339] mentioning the Vodafone's Sizz[340] and T-Mobile's Deezer. The article includes a quotation from the Dutch regulator, calling Endless Spotify a "stand alone service", meaning that purchase of the subscription is not tied to the purchase of a data package, therefore it does not violate net neutrality.[341]

It notes that such stand-alone services are by "allowed by the letter of the law, but runs counter to the intent of the law. Positive discrimination is discrimination. The ACM sees no problem." BoF continues, "We thought about whether other Internet areas must meet the same kind of neutrality values. Some claim that 'soft neutrality' is not enough and that efforts should be made for 'hard neutrality', including peering and transit. And what about search? Or application stores? Another response to the consultation argued that the rules should also apply to the provision of IPv4 and IPv6."

For the week of September 20, 2014 BoF notes on its blog,[342] "We were visiting the ACM to discuss net neutrality and its enforcement. We began our analysis of the law in the Netherlands; very interesting

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338 "Hi Introduceert Eindeloos Spotify: Onbeperkt Muziek Streamen Op Je Mobiel Zonder Dat Dit MB's Kost," KPN, (January 6, 2014), http://corporate.kpn.com/pers/persberichten/hi-introduceert-eindeloos-spotify-onbeperkt-muziek-streamen-op-je-mobiel-zonder-dat-dit-mbs-kost.htm.

339 Door Arnoud Wokke, "Hi Haalt Verbruik Spotify-App Niet Meer van Databundel Af," Tweakers, January 6, 2014, http://tweakers.net/nieuws/93502/hi-haalt-verbruik-spotify-app-niet-meer-van-databundel-af.html.

340 Andreas Udo de Haes, "Vodafone En T-Mobile Schenden Netneutraliteit," Webwereld, June 17, 2013, http://webwereld.nl/netwerken/78147-vodafone-en-t-mobile-schenden-netneutraliteit.

341 The price to the user is the same whether he buys the subscription from Spotify or Hi, but in the latter, the data use is not charged to the subscription.

342 Door Tim Toornvliet, "De Week in 417 Woorden," Bits of Freedom, September 20, 2014, https://www.bof.nl/2014/09/20/de-week-in-417-woorden/.

in light of the upcoming European law[343] and the current debate in the US."[344]

Some two years after the Dutch net neutrality law took effect, ACM fined two operators for violations. Vodafone had only 3200 customers on its HBO Go app, was fined €200,000, and was ordered to end the offer. It is likely that the fine is more than the company earned on the service.

KPN was fined €250,000 for what amounted to blocking on a free wifi network. The company admitted its mistake, a setting that had been on place its wifi networks, which it forgot to update once the net neutrality rules came into effect. About one third of the wifi traffic was at Schiphol Airport and the free service was designed as a convenience for travelers for a short and quick internet connection upon landing, for example to check messages and email. BitTorrent, FTP, SSHA, Telnet and VoIP were blocked to ensure the smooth functioning of the free service. The blocks are now removed but presumably the free basic internet service doesn't run as well. Interestingly a number of comments under the BoF blog mention that they have 4G services so wifi not important to them anyway.

In May 2015 KPN was ordered to end zero rated Spotify contracts, though the traffic generated by Spotify traffic is negligible on KPN networks. It is interesting to note that while zero rated offers of Spotify may be maligned by net neutrality advocates, for Spotify, one of only a handful of successful European startups, the partnership with telecom operators has proven important for its growth.[345] Not only can Spotify leverage an operator's billing system (avoid the cost of using its own system and give customers the benefit of not having to

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[343] Link in article points to https://www.bof.nl/2014/04/03/persbericht-netneutraliteit/

[344] Link in article points to "ISPs Mislead Public, FCC About Protecting the Open Internet," Electronic Frontier Foundation, September 15, 2014, https://www.eff.org/press/releases/isps-mislead-public-fcc-about-protecting-open-internet.

[345] "Adventures in the Netherlands:" (Spotify, July 17, 2013), https://press.spotify.com/dk/2013/07/17/adventures-in-netherlands/.

enter payment credentials into a new system), Spotify earns valuable paying customer. Most free users of Spotify never upgrade to the premium version, but in a telco partnership, subscribers who are already paying for a mobile subscription are more willing to take on an additional paid service because of the convenience of the bundle.

Not only is the sale of premium subscriptions essential for Spotify's survival, the revenue earned plays an important role to lessen music piracy and to help bring revenue to the music industry. Sweden's music industry was decimated by the rise of digital music on the Internet; revenues declined steadily from 2002 to 2009. With the introduction of Spotify, however, the industry has managed a 20% gain in the last three years.[346]

The Netherlands fared even worse with its traditional music industry than Sweden, but Spotify helped to reduce piracy in the country, with 29% of the 1.8 million Dutch BitTorrent pirates taking just 1 music file in 2012. The top 10% of the pirates account for half of the content obtained illegally, some 16 files each or more.[347] Passive pirates don't bother to pirate material when then can get a reliable, quality music experience for a good price.

In Sweden, digital music revenues account for almost 60% of all music industry revenue. In Netherlands the amount is just 27%, but if it could increase to the level of Sweden, ideally with more uptake of services such as Spotify, there would be an additional $124 million for the music industry and musicians. In any case, digital music sales grew by increased by 66% in the country in 2012, the highest of any country in Western Europe.[348]

While music piracy may be on the wane as a number of viable music streaming alternatives have emerged, piracy of film is going strong. Having more Spotify-like solutions for film is preferable to

[346] Ibid p. 9

[347] Ibid p. 1

[348] Ibid p. 24

criminalizing pirates. And yet HBO Go, one such solution, is maligned by net neutrality advocates.

In a statement on June 1, 2015, the ACM praised the state of Dutch 4G networks and increased mobile data consumption. They note,[349]

> After Mobile operators' investment to roll out 4G is almost complete. After a peak of investment in 2013 of €2 billion, the investment in 2014 fell back to more than € 800 million. Henk Don, board ACM: "With the introduction of 4G has paved the way for fast internet on your smartphone. And there are many uses. The consumption of mobile data is doubled. "This is attributable to approximately 4 million consumers who are relatively common and many Internet via their phone. For example, to stream movies or music. The number of customers using 4G also doubled in a year to about 40 percent. What is evident from the Telecom Monitor is that the rapid growth of data consumption is leveling off.

Vodafone Netherlands, forced to end its 3 month zero rated offer of HBO Go and to pay a fine of €200,000, challenged the Dutch telecom authority's ruling as unlawful and the fine as excessive, but was turned down in court. The decision notes that the Dutch law was initially concerned about users paying more for certain services,[350] and that the idea that users paying less could be problematic was a new concept. However the court recognized that the EU law does not provide a categorical ban on zero rating.

The net neutrality law that was supposed to be a "silver bullet" has created new problems.[351] Instead of a flowering of local content and

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[349] "Investeringen uitrol 4G bijna voltooid, apps besparen op dataverbruik," Nieuwsbericht, ACM, (June 1, 2015), https://www.acm.nl/nl/publicaties/publicatie/14305/Investeringen-uitrol-4G-bijna-voltooid-apps-besparen-op-dataverbruik/.

[350] Rechtbank Rotterdam, Accessed November 16, 2016, http://uitspraken.rechtspraak.nl/inziendocument?id=ECLI:NL:RBROT:2016:810

[351] Ibid

services, the Netherlands experiences the "Netflix effect"[352] in which a single American company consumes twenty percent of the country's bandwidth with a small subset of users. Netflix is one of the most downloaded apps in the Dutch Google Play store.

Even with the new EU law, the Ministry and the Dutch Parliament have updated their net neutrality law regarding zero rating.[353] While the language restricts "loose" or "stand alone services and specifically states "tariffs for Internet services do not depend on the services,"[354] this is how many interpret bans on zero rating and price discrimination.

However it appears that the Dutch regulator would prefer an approach harmonized with BEREC. ACM's Henk Don was quite involved with the BEREC process to develop implementation guidelines. The Dutch regulator observes[355] that its net neutrality rules are more strict than the EU and the associated BEREC guidelines: "The joint European telecoms regulators have guidelines in a less strict interpretation given to the Regulation than the Dutch legislature. According to the collaborating European regulators, certain services under strict conditions may be provided free or cheaply." The Dutch discrepancy

[352] Van Eijk and Nico, "The Proof of the Pudding Is in the Eating: Net Neutrality in Practice, the Dutch Example," SSRN Scholarly Paper (Rochester, NY: Social Science Research Network, August 2, 2014), http://papers.ssrn.com/abstract=2417933.

[353] Beleidsregel netneutraliteit, May 11, 2015, http://wetten.overheid.nl/BWBR0036617/2015-05-16

[354] See 4.7a provision 3 Wijziging van de Telecommunicatiewet ter uitvoering van de netneutraliteitsverordening,, May 17, 2016, https://www.eerstekamer.nl/behandeling/20160517/gewijzigd_voorstel_van_wet_2/document3/f=/vk48kqq22cxq.pdf

[355] ACM gaat nieuwe dienst T-Mobile onderzoeken, October 11, 2016, https://www.acm.nl/nl/publicaties/publicatie/16438/ACM-gaat-nieuwe-dienst-T-Mobile-onderzoeken/

could be challenged under EU competition rules and the free movement of services across member states. [356]

5.1.3 SLOVENIA

Zero rating, called free data transfer in Slovenia, was a common practice among operators and existed in country since 2007. Consumers could choose from a number of zero rating programs, including free access to music, online storage, and customer service applications to manage their mobile subscriptions. The net neutrality law in Slovenia was created primarily about concerns of theoretical harms and was the culmination of more than a year of public proceedings[357], but did not include an official investigation of traffic management practices.[358] A line about price differentiation was removed in the final version of the law which was promulgated on December 31, 2012.[359] This omission appears to be a linchpin for the legal battle on zero rating going forward.

To understand the sequence of events, a personal interview[360] was conducted with Dr. Dusan Caf, a leading net neutrality advocate who has been instrumental to effecting a ban on zero rating in Slovenia.[361]

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[356] European Parliament (2016) Freedom of establishment and freedom to provide services. Available at: http://www.europarl.europa.eu/atyourservice/en/displayFtu.html?ftuId=FTU_3.1.4.html

[357] "Posvet v Zvezi Z Osnutkom Predloga Novega Zakona O Elektronskih Komunikacijah," Ministrstvo Za Visoko Šolstvo, Znanost in Tehnologijo, November 10, 2011, http://www.arhiv.mvzt.gov.si/si/delovna_podrocja/informacijska_druzba/elektronske_komunikacije_in_posta/javne_obravnave_predlogi/arhiv/.

[358] "I am afraid that there wasn't any comprehensive analysis carried out (related to net neutrality) prior to the adoption of the current electronic communications law and net neutrality provisions - neither by the NRA nor the ministry," notes Dusan Caf in an email August 9, 2015.

[359] Article 203 of the Electronic Communications Act (Official Gazette of the Republic of Slovenia, Nr. 109/12, 110/13, 40/14 – ZIN-B and 54/14 – CC dec.)

[360] Telephone Interview August 7, 2015

Caf holds two key positions[362] in telecommunications, one as Chair of the Electronic Communications Council (a body appointed by the National Assembly) and another as Chair of the Council of the Agency for Communications Networks and services of the Republic of Slovenia (AKOS, the telecom regulator).[363] An engineer by training, Caf has been a consultant to a number of telecom and IT companies in Slovenia, though he assures that his honorary positions

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[361] "Pripombe Na Osnutek Predlog Zakona O Elektronskih Komunikacij," Svet ZA Elektronske Kommunikacije, July 5, 2012, http://www.sek-rs.si/1/Aktualno/tabid/107/ID/3/Pripombe-na-osnutek-predlog-Zakona-o-elektronskih-komunikacij-ZEKom-1.aspx#.Vc4MNa1J24B.

"Pripombe Na Predlog Zakona O Elektronskih Komunikacijah (ZEKom-1) - EPA: 667 - VI > SEK," Svet ZA Elektronske Kommunikacije, November 18, 2012, http://www.sek-rs.si/1/Aktualno/tabid/107/ID/275/Pripombe-na-predlog-Zakona-o-elektronskih-komunikacijah-ZEKom-1--EPA-667--VI.aspx#.Vc4MnK1J24B.

"Predlog Amandmajev K Predlogu Zakona O Elektronskih Komunikacijah (ZEKom-1, Druga Obravnava, EPA 667 - VI) > SEK," Svet ZA Elektronske Kommunikacije, December 20, 2012, http://www.sek-rs.si/1/Aktualno/tabid/107/ID/274/Predlog-amandmajev-k-predlogu-Zakona-o-elektronskih-komunikacijah-ZEKom-1-druga-obravnava-EPA-667--VI.aspx#.Vc4M8a1J24B.

[362] "Dusan Caf to Head Slovenian Regulator - Report," Telecompaper, January 14, 2014, http://www.telecompaper.com/news/dusan-caf-to-head-slovenian-regulator-report--993155.

[363] The Agency Council is authorised to give opinions to the programme of work, the financial plan and the annual report of AKOS; approve the statute adopted by the Agency Director; propose the appointment or dismissal of the Agency Director; propose a temporary prohibition on the performance of functions by the Director; propose the early dismissal of members of the Agency Council. The Members of the Agency Council or persons authorised by the Agency Council may inspect the business accounts as defined in the Slovenian Accounting Standards and the AKOS' accounting documents. Upon every such request by the Agency, the Agency director must submit to the Council a report on the operations of the Agency and any other information that the Agency Council requires in order to carry out its functions. The Agency Council may suggest improvements in the operation of the Agency to the Agency director, as well as point out to him any irregularities in the AKOS operations and notify the competent bodies of these irregularities. "Profile of AKOS," February 6, 2014, http://epra3-production.s3.amazonaws.com/organisations/documents/30/original/Profile_AKOS_SI_02_2014_final.pdf?1391706889.

are not a conflict of interest, and if they were, he would exclude himself from voting.[364]

In a blog[365] on December 9, 2013 Caf decried the state of the Slovenian telecom market 15 years after liberalization. The media is a poor observer, and the debate as lacking depth, he wrote. "Professional analysis" is needed to explain the gap, and "Captured regulators" are the root of the problem, he declared. To address these problems, he proposed increasing the transparency of the regulatory process, strengthening the efficiency and effectiveness of regulation, strengthening the development of electronic communications, and improving the wellbeing of citizens.

Caf called Slovenia's net neutrality law strict, but not being implemented prior to 2015. The problem with zero rating emerged with mobile broadband prices being too low. He cited the offer of €25 for 1 GB of data and €30 for 100 GB. Caf called these offers "good for consumers in the short run, but not sustainable in the long run" and believed that they needed to be stopped. "This is not a two-sided market," he said.

Caf does not know whether consumers complained about the offers to the regulator. His organization is not privy to such complaints. They only learn what is published by the telecom regulator or the competition authority. However one person did complain to the SEK, that he wanted to use his account balance to choose which sites should be zero rated.

[364] Ales Percic, "Neuradno: Na Čelo Sveta Akosa Dušan Caf," Finance.si, January 29, 2014, http://www.finance.si/8355990/Neuradno-Na-%C4%8Delo-sveta-Akosa-Du%C5%A1an-Caf.

[365] "Competitive Analysis & Foresight: Ugrabljeni Regulatorji," CAF, December 9, 2013, http://blog.caf.si/2013/12/ugrabljeni-regulatorji.html.

On June 22, 2014 Caf published a blog[366] titled "Free download mobile content jeopardizes the neutrality of the Internet" critiquing the zero rating offers of Telekom Slovenia and Si.mobil which "unduly encourage (users) to procure their services or applications and their partners, because of the high price of data transfer but they complicate the selection and use of competing products." Caf also notes, "Mere legal protection of net neutrality is not enough. It is important that AKOS enforce the regulatory principles" and that the SEK discusses the situation at its June meeting, he notes. Caf said that he made a point to write in English to bring international attention to the issue in Slovenia

On behalf of SEK on July 17, 2014, Caf made a formal complaint about zero rating to the telecom regulator, but did not receive a response. He believed that the regulator was reluctant to make a ruling on zero rating.

Caf said he made a point to mention only Telekom Slovenia and Si.Mobil in his complaint. He did not want to implicate the smaller providers Tusmobil and Amis because they need zero rating offers to differentiate themselves in the marketplace. The complaint describes that Telecom Slovenia's unlimited data transfer offers the ability to view the matches of the UEFA Champions League, watch films HBO GO, and access proprietary online storage. Telecom's own service" discriminates against end users using competing products", notes the complaint.

The complaint is critical of Si.Mobil's unrestricted offer to view the World Cup and unlimited access to the VOYO content over a two year period. It claims that free video data is problematic because it is a fastest growing category of service and makes up the bulk of internet traffic, and that offers with unmetered traffic exceed the amount of data used on basic packages. Moreover operators are offering unmetered service to the exclusive content they have licensed but not

[366] "Competitive Analysis & Foresight: Brezplačen Prenos Vsebine Ogroža Nevtralnost Mobilnega Interneta," Competitive Analysis & Foresight, (June 22, 2014), http://blog.caf.si/2014/06/brezplacen-prenos-vsebine-ogroza-nevtralnost-mobilnega-interneta.html.

giving the same conditions to competing content. It is described as discriminatory to users because they have to use metered access to enjoy competing services on the same platform. The letter states that operators are violating Slovenia's net neutrality rules and that Telecom Slovenia is abusing its dominant position in the marketplace.

Caf regrets that, in the end, the regulator punished the smaller providers by ordering them to stop all their zero rated practices, while the incumbent received a lighter reprimand. Telekom Slovenia was required only to end the zero rated music service for Deezer, but was allowed to keep zero rating its proprietary video application. That the smaller operators received a tougher punishment supports Caf's assertion that the telecom regulator favors the state-owned Telecom Slovenia.

Concurrently Caf sent the complaint to the Slovenia Competition Protection Agency, which did reply on September 4, 2014.[367] They recognized the concerns about discriminatory traffic management, but note that the risk is significantly lower in a transparent and competitive environment. Net neutrality puts emphasis on the requirement that operators transparently disclose their practices regarding managing internet traffic. In a transparent environment, consumers, if unhappy with traffic management practices, can switch providers. They observe that differentiated offerings are important because they are

> . . . the fruit of competitive advantages and therefore increase efficiency and bring consumers the benefits (i.e. cheaper cinema tickets for students). Thus price discrimination increases the availability of the product to more cost-sensitive consumers and ensures an overall increase in sales volume, thereby lowering average the overall costs and increasing

[367] A copy of the reply is not available on the authority's website, however it is referenced in the EU Scoreboard document on the link for Slovenia. "Scoreboard 2015 - Report on the Implementation of the Telecommunications Regulatory Package (per Country)," Digital Agenda for Europe, June 19, 2015, http:///digital-agenda/en/news/scoreboard-2015-report-implementation-telecommunications-regulatory-package-country.

> efficiency. The boundary between pro-competitive and anti-competitive conduct can be thin, so borderline cases should be assessed. But intervention is necessary only in cases where economic analysis shows that the injury to the consumers outweigh the benefits to consumers.

The competition authority notes that Telecom Slovenia has not abused its market power. It could be tested with an in-depth investigation that would begin with defining the relevant market, in this case the market for data transfer. It notes that Slovenia is a market with at least three mobile providers which will evolve significantly in the coming years. It notes that the market for mobile services is primarily characterized by call services, and with the different prices for calls on and off net, the effect of data transfer services is negligible. Moreover, even though Telecom Slovenia has a 50 percent market share and falling, it does not have the power to control the market for Internet applications, even with its zero rated offer. It notes,

> Vertical relationships can be bring benefits to consumers. For example, by offering free Internet encourages Telecom Slovenia to invest in expensive exclusive content such as UEFA Champions League. Si.Mobil might not have invested EUR 60 million in the acquisition of spectrum if it expected that it would be not be able to grow the market for newly built broadband 'highways' through various campaigns for free use of data transmission.

It notes further that sports rights and copyrighted content when licensed to a buyer (e.g. Telecom Slovenia) and offered in a zero rated program do not constitute a violation of competition. Moreover the operator's offer of Deezer and a proprietary cloud service does not harm the market for such services, as there are many choices worldwide from which users can access.

As for the price of the offer, the competition authority notes that the operator does not engage in either improving the quality of the zero rated products or degrading other applications, but rather in a form of discount or positive discrimination. To assess this, it is necessary to examine the price and costs of the offer and the services contained

within. It observes that the voice is the largest cost driver and that the use of Deezer is negligible, amounting to a few cents out of an offer of €26 per month.

> The competition authority notes that the emergence of zero rating reflects fierce competition in the mobile marketplace and even with current limits, consumers still have the freedom to decide what kind of content they want.

It notes further that the net neutrality rules are designed to protect competition for the purpose of the benefit of consumers. It is therefore necessary to determine the effect of zero rating on consumers. No intervention should be made if there is no evidence of consumer harm. The competition authority describes situations in which it considers extreme and necessary for intervention, for example the Microsoft browser case, but the zero rating issue in Slovenia is not one. The authority made a point as well that critics consider the Dutch net neutrality too extreme because operators are restricted from making offers.

Caf rejected the competition authority's conclusion, in particular because it made an analysis based on mobile prices from 2012. However if 2014 prices were used, the impact of zero rating would likely be even smaller because prices have fallen in the period.

Caf worked with the country's leading newspaper to bring attention to the issue. On November 12 an article[368] appeared in the newspaper *Delo* (English: Labour) by Matjaž Ropret[369] introducing the topic of zero rating as problematic and reporting on developments in the USA. The article concludes with a screen shot of Frank Underwood of Netflix's "House of Cards" with the caption "You need the gatekeeper." Underneath the photo is the caption "Providers such as Netflix in the US have paid operators for smooth transfer of content to subscribers."

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[368] Matjaz Ropret, "Izmuzljiva Internetna Nevtralnost," Infoteh, November 12, 2014, http://www.delo.si/mnenja/blogi/izmuzljiva-internetna-nevtralnost.html.

[369] Matjaz Ropret, "Tehnokamra − Internetna Nevtralnost," Delo, November 14, 2014, http://www.delo.si/multimedija/video/tehnokamra-internetna-nevtralnost.html.

The article links to another article that appeared in *Delo* from Slovenian correspondents in the US titled "Political cuisine on the future of the Internet: White House asks independent telecom commission for the Internet be declared a public service, which is controlled by the state." [370] The article describes President Obama's net neutrality announcement and some political background in the US. In a sidebar it notes that after ratifying its own net neutrality law two years earlier, Slovenia experienced its first complaint under the concept of zero rating.

On November 14, *Delo* published a short article[371] embedded with a video[372] highlighting Barack Obama's previous net neutrality announcement[373] followed by a presentation by Dusan Caf and *Delo* tech journalists Matjaž Ropret and Lenart J. Kučić[374] discussing the situation of net neutrality in Slovenia. During the discussion Caf produces a tablet where he points to a copy of the Slovenia net neutrality law and how the section on zero rating was removed as part of the final rulemaking.

[370] Sebastijan Kopusar, "Politične Kuhinje O Prihodnosti Interneta," Delo, November 12, 2014, http://www.delo.si/znanje/infoteh/politicne-kuhinje-o-prihodnosti-interneta.html.

[371] Matjaz Ropret, "Tehnokamra − Internetna Nevtralnost," Delo, (November 14, 2014), http://www.delo.si/multimedija/video/tehnokamra-internetna-nevtralnost.html.

[372] Tehnokamra - Internetna Nevtralnost, 2014, https://www.youtube.com/watch?t=186&v=_PBaeuvDC_w.

[373] Ezra Mechaber, "President Obama Urges FCC to Implement Stronger Net Neutrality Rules," The White House, November 10, 2014, http://www.whitehouse.gov/blog/2014/11/10/president-obama-urges-fcc-implement-stronger-net-neutrality-rules.

[374] Lenart Kucic, "Lenart J. Kučić Blog," accessed July 27, 2015, http://www.lenartkucic.net/about/. The journalist also writes books critiquing the media. Lenart Kucic, "Lenart J. Kučić's Bibliography," accessed July 27, 2015, http://www.lenartkucic.net/bibliography/.

A blog[375] by Caf on December 5 characterizes Slovenia as a country that has net neutrality rules but does not enforce them. It describes a country where "Net neutrality (is) weakened by industry lobbying and inactive regulator" and recounts how zero rating, originally included in the Slovenia rules was removed by "lobbying from the industry". Caf also warns about the "spreading of discriminatory practices" and refers to a study of zero rated offers in the EU.[376] He notes that SEK sent a letter to AKOS describing the discriminatory practices of Telekom Slovenije but "based on the regulator's strong pro-industry stance the outcome is uncertain."

It is not clear whether from media pressure or international influence, but AKOS relented and commenced a review on zero rating on December 18. Soon after Caf appeared in an interview[377] in *Europolitics* in which the journalist questioned whether undue pressure has been put on the Slovenian telecom regulator. Caf notes that even though authorities pronounce zero rating beneficial to consumers, the practice is still problematic. "An efficient regulator is required in order that legislation adopted should really be implemented. However, I think it is important to resolve the matter of zero rating, and not to tie competition law on neutrality, since procedures and market analyses take too long," he notes.

On January 10, 2015 *Delo* published an article[378] of some 2500 words explaining net neutrality by comparing the internet to the road network where all drivers have the same rights. Telecom operators are

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375 "Competitive Analysis & Foresight: Zero-Rating Violates Slovenian Net Neutrality Law," Competitive Analysis & Foresight, December 5, 2014, http://blog.caf.si/2014/12/zero-rating-violates-slovenian-net-neutrality-law.html.

376 "List of 75 Zero-Rated, Potentially Anti-Competitive Mobile Applications/services, Violating Net Neutrality, in EU28," DF Monitor, October 2014, http://dfmonitor.eu/insights/2014_oct_zerorate/.

377 Nathalie Steiwer, "Zero Rating: Slovenian Regulator Exposed to Excessive Pressure," Europolitics, January 5, 2015, http://europolitics.info/tech/zero-rating-slovenian-regulator-exposed-excessive-pressure.

378 Lenart Kucic, "Internet Nevtralen Kot Javno Cestno Omrežje?," Delo, January 10, 2015, http://www.delo.si/sobotna/internet-nevtralen-kot-javno-cestno-omrezje.html. See appendix for Google translated article

characterized as deploying sneaky business models such as zero rating. Dusan Caf's efforts to end the practice are described.

A blog[379] from Caf appeared two days later in an attempt to increase the pressure on the telecom regulator to ban zero rating. He refers to the complaint SEK made to the regulator in July 2014 followed by "nearly three months of analysis, in which we analyzed the controversial business practice of mobile operators." He notes that at the end of 2014 Telekom Slovenia had 50% market share and Si.Mobile 36%.

On January 23, 2015 AKOS announced its decision,[380] finding Telecom Slovenia's zero rating of Deezer and Si.Mobil's zero rated offering of the cloud platform Hangar Mapa to be net neutrality violations. An announcement in English followed on January 26, the only news story on the English language section of its website.[381] Telekom Slovenia's zero rating of UEFA Champions League, HBO GO, and the online storage TviN continues. In neither case did the regulator mention any evidence for harm to consumers or competition because of the offers.

On February 20, 2015 AKOS similarly found Amis Mobile with its proprietary TV service and Tusmobil with its customer service platform in violation of net neutrality. [382] The operators were required to end the banned practices in 60 days.

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379 "Competitive Analysis & Foresight: Nevtralnost Interneta vse Bolj Vroča," CAF, January 12, 2015, http://blog.caf.si/2015/01/nevtralnost-interneta-vse-bolj-vroca.html.

380 "Akos Ugotovil Kršitve Načela Nevtralnosti Interneta," Akos, January 23, 2015, http://www.akos-rs.si/akos-ugotovil-krsitve-nacela-nevtralnosti-interneta.

381 "AKOS Finds Violations of the Principle of Net Neutrality," Akos, January 26, 2015, http://www.akos-rs.si/akos-finds-violations-of-the-principle-of-net-neutrality.

382 "Akos Ugotovil Kršitve Načela Nevtralnosti Interneta Tudi Pri Storitvah Amisa in Tušmobila," Akos, February 20, 2015, http://www.akos-rs.si/akos-ugotovil-krsitve-nacela-nevtralnosti-interneta-tudi-pri-storitvah-amisa-in-tusmobila.

In response Caf posted a blog[383] celebrating the regulator's decision banning offers from Telekom Slovenia and Si.Mobil. He notes that SEK conducted an examination of the practices and that telecom regulators attended its meetings. He notes that the competition authority "issued the opinion after a consultation with AKOS in which regulators exchanged and shared views and information on net neutrality issues." He describes the competition authority opinion as "based on dubious facts and presumptions." He faults the competition protection authority for declining to begin an investigation.

Caf recounts his efforts to speed the regulatory process and enlighten senior officials whose views were "generalized and lacked thorough analysis". He recounts the steps that made the ban possible: his blogs and articles, his analysis indicating a potential breach of competition law, and the support of leading technology journalists. He reiterates his earlier blog of December 5 of why zero rating is a violation of the Slovenian net neutrality law. He notes that while the decisions only apply to music and cloud services, that they should also apply to video streaming. He notes that, "Consumers may shortly expect new data plans and enjoy open and non-discriminatory access to the internet."

Following the announcement of the banning of the zero rated services of Tusmobil and Amis, Caf penned another blog.[384] While he was pleased with the action against the other operators, he called the allowance of zero rating by Telekom Slovenia "unacceptable and AKOS shall intervene as soon as possible. There is no legal ground in communications or media law for any exemption of internet streaming of sporting events or cloud storage traffic."

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383 "Competitive Analysis & Foresight: Telekom Slovenije and Si.mobil Found in Breach of Net Neutrality," Competitive Analysis & Foresight, January 25, 2015, http://blog.caf.si/2015/01/telekom-slovenije-and-simobil-found-in-breach-of-net-neutrality.html.

384 "Competitive Analysis & Foresight: Another Win for Net Neutrality Advocates in Slovenia: AKOS Issues New Decisions Limiting Zero-Rating," Competitive Analysis & Foresight, February 22, 2015, http://blog.caf.si/2015/02/another-win-for-net-neutrality-advocates-in-slovenia-akos-issues-new-decisions-limiting-zero-rating.html.

He notes that these "the decisions have already had a positive impact and, as we correctly predicted, consumers benefited from the regulator's net neutrality decisions. Telecom Slovenia and Si.Mobile have both come up with special offers and packages with larger data caps or inexpensive data cap options. Consumers may shortly expect even more plans with larger data caps."

Caf describes the mobile market today as competitive, particularly because of price competition driven by American owned cable provider Telemach in their cross-selling of service from Tusmobil.

On June 27, 2015 an article[385] explores Caf's evolution from professor and consultant to the telecom industry and Chamber of Commerce to his most recognizable position as the leader of the Council for Electronic Communications. The same day two additional articles[386] [387] appear on Caf and his accomplishments.

On July 1, 2015, the day after the EU's concluded agreement on net neutrality, Caf is interviewed[388] by Slovenian Radio and TV saying that Slovenia users are less protected, as the new EU rules "override" Slovenia's. The article notes a tweet from a Ministry of Education official who sees it differently, Slovenia "is (was) alone in demonstrating the principle is the wrong approach," he notes.

The European Union is the midst of an effort to create a Digital Single Market. One of goals of which is to strengthen European based small

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385 Ales Lednik, "Večer: Kršijo Zakon, Nihče Ne Trzne," Vecer, June 27, 2015, http://www.vecer.com/clanek/201506276125307.

386 "Dušan Caf : V Državni Lasti Bo Telekom Težko Konkurenčen," Finance.si, June 27, 2015, http://www.finance.si/8824292/Du%C5%A1an-Caf-V-dr%C5%BEavni-lasti-bo-Telekom-te%C5%BEko-konkuren%C4%8Den.

387 "STA: Caf Za Večer: V Državni Lasti Bo Telekom Težko Konkurenčen," Sta, June 27, 2015, https://www.sta.si/2150491/caf-za-vecer-v-drzavni-lasti-bo-telekom-tezko-konkurencen.

388 "Zvodeneli Kompromis Medmrežne Nevtralnosti Pustil Nezadovoljstvo," Prvi Interaktivni Multimedijski Portal, MMC RTV Slovenija, July 1, 2015, http://www.rtvslo.si/znanost-in-tehnologija/zvodeneli-kompromis-medmrezne-nevtralnosti-pustil-nezadovoljstvo/368779.

and medium enterprises (SME) on the Internet.[389] Once it took effect, AKOS's ban on zero rating caused traffic to certain Slovenian content and applications to fall by half. Operators' customer support centers saw a five-fold increase in telephone calls because subscribers could no longer top up their account balance online for free.[390] A Slovenian cloud provider experienced a marked, but not devastating, decline in traffic as a result of the ban.[391] To be sure, no content provider's marketing strategy relies entirely on zero rating.

The Slovenian operators appealed the regulator's and won.[392] In July 2016 the court ruled that a ban against price discrimination is not implicit in the law[393] and cited the non-binding judgement from the Slovenia Competition Authority explaining how an economic analysis of zero rating could be performed and the positive value of price discrimination.

That two different countries' courts rule differently on the issue suggests that outright bans will likely be difficult to support. Moreover bans on zero rating may violate an EU tenet for the freedom of movement for services as well as general EU competition law. If parties can demonstrate that they are materially harmed by bans, they may have a case to push against the new EU law. In the meantime, zero rated offers continue in the EU.

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[389] EU Digital Market, Accessed November 16, 2016, http://ec.europa.eu/priorities/digital-single-market/

[390] Confidential interview

[391] Confidential interview

[392] Matjaž Ropret, "Operaterji bi lahko spet uvedli ničelno tarifo", July 25, 2016, http://www.delo.si/znanje/infoteh/operaterji-bi-lahko-spet-uvedli-nicelno-tarifo.html

[393] Layton, Roslyn (2016) Slovenia strikes down ban on zero rating, upholds rule of law. Technopolicydaily.com blog: http://www.techpolicydaily.com/communications/slovenia-zero-rating-rule-law/

5.1.4 DENMARK

Denmark has been recognized by net neutrality advocates for its broadband competition, speed, and price.[394] The country has been rated as one of the world's top digital nations by the International Telecommunication Union's *Measuring the Information Society Report*[395] which has measured countries' access, use, and skills of information communications technologies (ICT) since 2007. Denmark took first place in the ranking in 2014, unseating South Korea. Following Senator Bernie Sanders's presidential campaign suggestion that that US should be like Denmark in its public provision of health and education,[396] some may infer that Denmark's broadband infrastructure is government subsidized and heavily regulated. But while the Danish government has a significant level of involvement in the health and education sectors, it has a relatively *laissez faire* approach to most other markets, including telecommunications, which culminated in the Center Left government dismantling the telecom regulator in 2011[397] and accepting the telecom industry's proposal for

[394] Danielle Kehl, Robert Morgus, and Sarah Morris, "The Cost of Connectivity 2014 - Data and Analysis on Broadband Offerings in 24 Cities across the World," *New America*, October 30, 2014, http://www.newamerica.org/oti/the-cost-of-connectivity-2014/. Note that most broadband price comparisons don't not include the cost of compulsory media license fees. The 2017 fee is about $177 and is assessed on every internet access subscription. It covers the cost of content from the public broadcaster Danish Radio. The. http://www.dr.dk/om-dr/licens/licens-english For further discussion see p. 10 of Layton and Horney's "Innovation, Investment and Competition in Broadband and the Impact of America's Digital Economy" August 2014, Mercatus Center. https://www.mercatus.org/system/files/Layton-Competitionin-Broadband.pdf

[395] Measuring the Information Society Report , 2015, http://www.itu.int/en/ITU-D/Statistics/Pages/publications/mis2015.aspx

[396] ABC News, *Sen. Bernie Sanders Says U.S. Should Look More Like Scandinavia*, 2015, https://www.youtube.com/watch?v=cz0u2FH5Bnk.

[397] Morten Falch and Anders Henten, "The future of telecom regulation: The case of Denmark." Paper presented at ITS, Bruxelles, Belgium (2014). http://econstor.eu/bitstream/10419/101404/1/795227221.pdf

self-regulation on net neutrality in lieu of heavy regulation.[398] These measures are unthinkable to regulatory advocates in the U.S. who assert that a strong and punitive telecom authority needs to regulate the market in order to deliver good policy outcomes.[399] The success of the Danish model for telecom policy suggests otherwise.

Danish telecom policy has been encoded in in the 1999 "Teleforlig" (Telecommunications Agreement), a standing agreement across all political parties to pursue a no-subsidy, market-led, technologically neutral approach to telecommunications. The goal is to transition telecommunications away from sector-specific regulation to full competition under a general ex post competition regime. So far, Denmark has surpassed the U.S. in achieving this vision.

This is not to say that Danish government has no involvement in the market. Rather than regulate communications prices and

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[398] As of April 2016, EU law on net neutrality now supersedes the Danish model for self-regulation.

[399] "The FCC should use the legal authority it possesses to relabel [Internet] services as regulated ones. Our future depends on it." Susan Crawford http://www.newsday.com/opinion/oped/why-net-neutrality-matters-to-you-susan-crawford-1.6807160

"The development of the Internet and the explosion of broadband innovation was a direct result of strong regulation against discrimination. The Internet we know today exists because broadband networks have been regulated since their inception, and continued regulation will protect everyone's ability to innovate and communicate online...Only regulation can prevent [the development of slow and fast lanes] from happening. " Michael Weinberg http://www.usnews.com/opinion/articles/2014/06/23/the-fcc-should-regulate-broadband-providers-to-protect-the-open-internet

"Now, as Chairman of the FCC, I do not intend to allow innovation to be strangled by the manipulation of the most important network of our time, the Internet." Remarks of Tom Wheeler, Chairman, Federal Communications Commission. National Cable & Telecommunications Association April 30, 2014. He states further, "I am proposing that the FCC use its Title II authority to implement and enforce open internet protections. Using this authority, I am submitting to my colleagues the strongest open internet protections ever proposed by the FCC." https://apps.fcc.gov/edocs_public/attachmatch/DOC-326852A1.pdf April 30, 2014

technologies, the Danish government has had an important role by being a key buyer of information and communications technologies, digitizing government services, and providing a set of digital assets which individuals and enterprises can use to lower transaction costs. Other lessons such as the the self-regulatory regime for net neutrality, the framework to fast-track mobile infrastructure, the dismantling of the telecom regulator, and the continued efforts to removed outdated and obsolete regulation demonstrate the Danish approach.

The so-called "Nordic Model"[400] of free market capitalism with a social safety net is a helpful reference, but it does not fully explain Danish telecom policy. Indeed, Denmark's telecom policy differs significantly from its Scandinavian neighbors. For example Sweden has been known for its government-funded fiber projects and partially state-owned incumbent, while privatization and prohibitions against subsidies have been the rule for Denmark. Henten and Falch suggest it is the interplay of regulatory and developmental approaches that explain the Danish approach to telecom policy.[401] and Layton and Kane suggest that it is Denmark's preference for multi-party cooperation and facilitation that supports its success.[402]

This approach has been further vindicated by the Danish Productivity Commission in 2014.[403] The group of the nation's top economists and industrial experts surveyed the country's various infrastructures and concluded that the market-led, technology neutral approach, left no need for government targets for telecommunications.

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[400] Gøsta Esping-Anderson, "The Three Worlds of Welfare Capitalism," *Princeton University Press*, 1990.

Kristoffer Granov, "Velfærdsstaten," *Faktalink,* November 2013, http://www.faktalink.dk/titelliste/velfaerdsstaten/hele-faktalinket-om-velfaerdsstaten.

[401] Morten Falch and Anders Henten, "European broadband policy - regulation vs. facilitation," Paper presented at ITS, El Ecorial, Spain. (2015). DOI: 10.13140/RG.2.1.4728.0484

[402] Layton, Roslyn and Joseph Kane. Mercatus. Forthcoming 2017.

[403] Infrastructure Analysis Report 5, Danish Productivity Commission, (January 2014).

Digitization as a national strategy beginning in 1994

The World Economic Forum[404] has observed that when it comes to ICT competitiveness, broadband infrastructure is but one factor. Competition is generated by government, businesses, and individuals utilizing the ICT infrastructure utilizing advanced infrastructure, not is not by the infrastructure itself. This partially explains that while Denmark and Japan may each have widespread broadband deployment, Japan falls short on competitiveness because many Japanese do not use broadband networks and technologies.[405] Similarly, South Korea experiences "jobless growth" as overinvestment in high speed broadband networks does not materialize into increased productivity.[406] Moreover, some Koreans may overconsume broadband services (e.g. non-stop video games and Internet addiction) such that they do not function in productive roles in society.

It may be the case that Denmark was less concerned about regulating telecommunications because it had a larger vision for a national ICT strategy already in 1994.[407] Unlike the US which had a number of large companies and enterprises that drove the adoption of ICT, Denmark's single largest buyer for ICT services was the Danish government. Danish political leaders concluded that by defining a national digital strategy and some common digital assets, the government could kick start ICT adoption by individuals and

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[404] "Networked Readiness Index," *World Economic Forum, The Global Information Technology Reports 2006–2012* (2007).

[405] Igari, Noriko. "How to successfully promote ICT usage: A comparative analysis of Denmark and Japan. *Telematics and Informatics.* Volume 31, Issue 1, February 2014, Pages 115–125.

[406] Ju Jaeuk, and Jung Hyun-Joon, A Study on the impact of new ICT service and technology on employment," *KISDI Research Report* (2012). https://www.kisdi.re.kr/kisdi/fp/kr/publication/selectResearch.do?cmd=fpSelectResearch&sMenuType=5&controlNo=13006&langdiv=2

[407] Christian S. Friis, "A Critical Evaluation of the Danish National ICT Strategy," *Economic & Social Review* (1997). http://www.tara.tcd.ie/handle/2262/64736.

enterprises.[408] Henten and Falch describe this as Denmark being on the forefront of the shift from the regulatory to the developmental approach.

> ICT policies increasingly are part of a larger 'package' of policy initiatives for the development of e-health, smart cities, e-learning etc… The revival of the developmental mode of governance within the ICT area is related to ICT convergence and the growing importance of access to ICT services… The revival does not imply a return to Keynesian inspired policies practiced in the post-war period. Developmental initiatives must conform to a liberal market environment, and private enterprises are involved whenever it is possible.

Denmark established a national digital strategy with a set of goals and objectives: to reduce the resources consumed by the public sector, simplify the process in which the citizens interact with the public sector, improve citizens' experience with public services, and help companies save on regulatory compliance costs so that they can devote more resources to their core activities.[409] The expected benefits included effective communication with citizens, an easier path to growth for companies (using fewer resources), efficient collaboration with patients (as health care professionals have the right ICT tools to access data necessary for treatment), and enabling the use of technology for social services, particularly for the care of the elderly, children, the disabled, and disadvantaged youth.[410]

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[408] "Digitaliseringsstrategien 2011-2015," *Digitaliseringsstyrelsen*, accessed May 10, 2016, http://www.digst.dk/Digitaliseringsstrategi/Digitaliseringsstrategi-2011-15. In English http://www.digst.dk/~/media/Files/Digitaliseringsstrategi/Engelsk_strategi_tilgaenge lig.pdf

[409] "Baggrundsnotat: Digitalisering I Den Offentlige Sektor," *Statsministeriet*, accessed May 9, 2016, http://www.stm.dk/multimedia/baggrundsnotat_om_digitalisering_i_den_offentlige_ sektor.pdf.

[410] Ibid

The strategy included creating a set of digital assets for all persons and enterprises in the country, including

1. Personal ID number: given at birth at hospital (CPR, Det Centrale Personregister) 1968[411]
2. Unique number for each business (CVR, Det Central Virksomhedregister)
    a. First implementation (SE-nummeret)1985[412]
    b. Current implementation 1999[413]
3. Digital signature: single login for all government and financial services, as well as any business (NemID) 2003[414]
4. Easy account: one account for personal payments to and from government (Nemkonto)2007[415]
5. Mailbox: Digital inbox for all government and financial communications (Eboks) 2012[416]

Taken in this perspective, Danes already recognize the value of the digitization and how it can make the government more efficient. That

[411] "Www.cpr.dk," accessed January 8, 2017, https://www.cpr.dk/cpr-systemet/historie/.

[412] Uffe Rasmussen, "SE-nummer," *Gyldendal Den Store Danske* (2014). http://denstoredanske.dk/Samfund%2c_jura_og_politik/Samfund/Samfund_og_statistik/SE-nummer

[413] "LBK nr 653 af 15/06/2006 Gældende" (2016). https://www.retsinformation.dk/forms/r0710.aspx?id=27293

"CVR-Nummer | Gyldendal - Den Store Danske," accessed January 8, 2017, http://denstoredanske.dk/Samfund,_jura_og_politik/Økonomi/Driftsøkonomi/CVR-nummer.

[414] "Historien Om NemID - NemID," accessed January 8, 2017, https://www.nemid.nu/dk-da/om-nemid/historien_om_nemid/.

[415] " LBK nr 798 af 28/06/2007 Gældende" (2007). https://www.retsinformation.dk/Forms/R0710.aspx?id=6037

[416] "LOV nr 528 af 11/06/2012 Historisk" (2016). https://www.retsinformation.dk/Forms/R0710.aspx?id=142234

the telecom regulator would be dismantled is not necessarily radical to Danes because they accept that the government must continually improve the way it delivers processes and services.

At the same time, government employees are respected and well-compensated, but this comes with the understanding that they may be shifted to different roles over time, even being asked to move to new locations, as is the current government's move to decentralize offices from Copenhagen to locations across Denmark.

While the government was not interested in regulating telecom operators, it did see a role for itself in "facilitating" the digital society.

1999 Multi-Party Agreement on Telecommunications

"Cooperation across the middle" ("Samarbejde over midten") is the hallmark of Danish politics. This is an important distinction about Danish politics which differs from U.S. bi-partisanship and even the Swedish "consensus."[417] In practice, Danish political leadership is held by 2-3 major parties with 4-5 smaller parties. No party has won a majority in the Parliament for more than a century, so politicians are accustomed to crafting solutions that cut across party lines and perspectives. The work of getting so many parties on board for decision making tends to drive a desire for long-term planning and stability. Danish society is also characterized by trust, transparency,[418] and accountability,[419] and this includes a set of political safeguards for citizens to check the activities of government. These safeguard mean that citizens have high trust in government,

[417] John Alexander, *Consensus: The Hidden Codes of Swedish Leadership* (Inter Media Publications, 2008). http://johnalexandersweden.com/pdf/CONSENSUS.pdf

[418] Denmark ranks #1 bu Transparency International in being the world's least corrupt country. It has consistently scored at the top of this list. "Corruption Perceptions Index" *Transparency International.* http://www.transparency.org/country/DNK

[419] Paul Hegedahl and Gunnar Svendsen, "Tillid - Samfundets Fundament," *Syddansk Universitetsforlag* (2011). http://syd.ungetalenter.dk/sites/default/files/aktiviteter/tillid_-_samfundets_fundament_bog.pdf.

and, therefore, are willing to pay the high rate of tax in exchange for a range of government services. Given the high cost of labor, there is also an openness to digital and self-regulatory solutions.[420]

In 1999, a group of political parties made the Teleforlig[421] (Telecom Agreement), the mission and vision for the national telecom policy in a mere 10 pages. In practice all political parties have upheld the Telecom Settlement, even those parties which did not agree to it, and it remains in force even when some political parties later disband. Such a forlig, underpinned by cooperation, make it possible for the country to make long-term, stable policy which incidentally supports long-term investment, which is important for telecom operators.

The teleforlig emphasizes the need for a market-based, technology neutral telecommunications policy. Though the government wants to ensure that consumers can access low cost, high quality telecommunications, it is not for the government to decide which technologies should be used nor the price points. The agreement accepts that convergence will create competition and new market realities. When markets become competitive, the regulation should be removed.

2011 Net Neutrality Forum

There is a tradition for self-regulation in Denmark and the recent history of the roll-out of premium SMS with an effective self-regulatory regime such that the service is widely adopted with little to no consumer complaints. The Danish telecom operators believe that they can deliver a net neutrality regime better than the regulators and offer it in such a way that it improves the brand and quality of their services.[422] Therefore the Danish operators took the initiative to

[420] Martin Vith Ankerstjerne, "Nej til lobbyregister – ja til selvregulering," *Debat*, January 11, 2014. http://www.b.dk/kronikker/nej-til-lobbyregister-ja-til-selvregulering

[421] "Teleforlig fra september 1999," *Erhvervsstyrelsen,* (1999). https://erhvervsstyrelsen.dk/file/teleforliget-fra-september-1999pdf

[422] Interview with Jakob Willer, Teleindustrien. November 26, 2015.

create the Net Neutrality Forum[423], a set of net neutrality principles and a multistakeholder process, to which the telecom regulator attends.

Denmark eschewed hard net neutrality rules, opting for self-regulation. Adding new rules which require administration is not necessarily welcome in this country where there is high labor cost. There is a national digital plan with the expectation that the government bureaucracy should not grow in head count or budget, but must rather be more efficient through digitization. As such, digital and self-service solutions are preferred. This means there is a notion that products and services should be well-designed from the beginning so that society need not bear the cost of regulation. Moreover, there is a tradition for self-regulation and the recent history of the roll-out of premium SMS with an effective self-regulatory regime such that the service is widely adopted with little to no consumer complaints.[424] The Danish telecom operators believe that they can deliver a net neutrality regime better than the regulators and offer it in such a way that it improves the brand and quality of their services. Therefore the Danish operators took the initiative to create the Net Neutrality Forum, a set of net neutrality principles and a multistakeholder process, to which the telecom regulator attends.

Though participation is open to anyone, the forum generally includes the internet service providers, head of consumer organization, Google, and the telecom regulator.[425] In the Danish regime, internet service providers agree to uphold a set of consumer-centric principles similar to the Four Freedoms with an additional commitment to the quality of the connection. Should problems arise, the forum provides a means for quick and flexible resolutions. According to the industry association, there has only been one issue.[426] At one point, one

[423] Tele Industrien, "Netneutralitet," http://www.teleindu.dk/branchesamarbejde/netneutralitet/ (accessed April 8, 2016).

[424] Rammeaftalen, accessed January 8, 2017, http://www.rammeaftalen.dk/om/

[425] Multistakeholder models can be direct and representative. In our study we find that while the processes are deemed open, in general, a set of self-selected experts tend to participate..

[426] Supra Jacob Willer

operators wanted to make a surcharge for WhatsApp. The Forum advised against it.

The Net Neutrality Forum describes its principles for a best-efforts, open internet as the following

1. Users have the right to an internet connection with a declared quality and capacity.
2. User have the right to access the legal content, applications, and services of their choice that don't harm the network
3. Users should have access to transparency, and the ability to inspect the relevant traffic management and operator practices
4. Operators should not discriminate in relation to specific service providers, content or applications

The key contrast between countries with soft rules such as Denmark and countries with hard rules is that the former emphasize user rights while the latter emphasize industry requirements. The Danish rules are similar to the 2005 *Internet Policy Statement*[427] adopted by the FCC, consisting of four consumer-centric guiding principles, also referred to as the "Four Freedoms"[428] "to ensure that broadband networks are widely deployed, open, affordable, and accessible to all consumers":

- Consumers are entitled to access the lawful Internet content of their choice.
- Consumers are entitled to run applications and use services of their choice, subject to the needs of law enforcement.

[427] 20 FCC Rcd 14986.

[428] "Remarks of Michael K. Powell Chairman, Federal Communications Commission At the Silicon Flatirons Symposium on 'The Digital Broadband Migration: Toward a Regulatory Regime for the Internet Age,'" Preserving Internet Freedom: Guiding Principles for the Industry, February 8, 2004, https://apps.fcc.gov/edocs_public/attachmatch/DOC-243556A1.pdf. In these remarks, Chairman Powell referred to four freedoms: (1) Freedom to Access Content; (2) Freedom to Use Applications; (3) Freedom to Attach Personal Devices; and (4) Freedom to Obtain Service Plan Information. These are nearly identical to the four principles adopted by the commission.

- Consumers are entitled to connect their choice of legal devices that do not harm the network.
- Consumers are entitled to competition among network providers, application and service providers, and content providers.

It may be observed that the Danish model goes a step further in that the operators commit to delivering the stated speed and quality of the promised connection.

2015 Updating telecom policy for the Internet

Also update competition rules so that OTT are considered competitors to traditional telecom. This is obvious to users, but bears mention that FCC would not deign to update its policies accordingly. Unwittingly the FCC response to growing technological diversity is to add more regulation.

In response to the European Commission's Digital Single Market initiative, the telecom authorities of the Nordic countries conducted a dialogue about further improvements for telecom policy.[429] Katrine Winding Deputy Director General of the telecom section within the Danish Business Authority wrote the position paper for the group. It notes that telecom regulation needs to be updated to reflect the competition from over the top technologies, the substitutability of OTT for traditional telecom services, the need to level the playing field, and the need to roll back sector specific regulation. The submission to the European Commission explains.[430]

[429] See the position papers of the Nordic telecom regulators. "Nordisk samarbejde. De nordiske telemyndigheders positionspapir til Kommissionens meddelelse om Det digitale Indre Marked (DSM)." Erhvervsstyrelsen.dk Accessed November 16, 2016. https://erhvervsstyrelsen.dk/nordisk-samarbejde-0

430 "The Digital Single Market Strategy The Nordic NRAs' viewpoints." Erhvervsstyrelsen.dk 25 August 2015 https://erhvervsstyrelsen.dk/sites/default/files/media/nordisk_positionspapir_august_2015.pdf

The Nordic regulators agree that there is a general need to evaluate and maybe revise the sector-specific competition regulation in the light of technological developments and development of telecommunications markets both in Europe and globally. It is crucial that the future regulation creates stable and favourable conditions for the development of new and innovative solutions and business models in the digital economy and that any changes of the regulation are based on thorough analyses.

Any changes to the telecommunications regulation should take into account the new competitive environment in the digital economy due to CAPS (content and applications provision services)/OTT (Over-The-Top) players delivering content services like Netflix, Skype and YouTube or other type of services using existing broadband connections in the digital value chain. Some of these players act as service providers in direct competition with the traditional telecom operators either on the telecom market or within the audio-visual media service area.

The European Commission, BEREC and several NRAs are in the process of analysing CAPS/OTT services and their impact on the telecommunication sector. The analyses should be focused on the OTT media services and OTT communication services as they increasingly act as substitutes to media and communication services that have generated revenues for traditional telecommunications companies through the usage of e.g. telephone calls, SMS or TV subscriptions packed with broadband subscription. Moreover, OTT media services require great stability and capacity in the network. Therefore, these services also demand special requirements of the infrastructure.

With the purpose of assessing the impact on the telecommunication sectors, the analyses should describe developments and changes in the value chain and business models, including how and why some companies spread across the value chain, the strategy behind this and revenue source of

> the business models for both OTT players and traditional telecommunications companies.
>
> The playing field for all actors in the digital economy needs to be levelled out. To promote innovation and new solutions in the European digital economy, the Nordic regulators agree that the starting point should be reducing the regulatory burden where possible, rather than extending the present sector-specific regulation.
>
> It is important that any possible roll back of the current sector specific regulation also takes into account whether certain common requirements related to information security, data protection and privacy are still needed or if general consumer protection law and competition law should be applied.

The position was further updated in 2016 to recognize that telecom operators are not "bottlenecks" to OTT, or edge providers in American parlance.[431]

> The OTT development has been intensive over the last couple of years. When the open Internet is used as distribution platform, the delivery of telecommunication and media services becomes global and consumers are no longer forced to buy these services together with the network service. This leads to a more competitive market situation at local level.
>
> Previously, the aggregator or distributor role was linked to the network ownership, giving these companies a unique position as owners of a bottleneck resource. Today, we see a development, where the link between the aggregator and network ownership is disintegrating. This development removes the high entry barriers on delivery of content services as aggregator and it opens up for many companies to position

431 "The EU telecommunications legislation for the Digital Single Market The Nordic NRAs' viewpoints." Erhvervsstyrelsen.dk. 4 July 2016. https://erhvervsstyrelsen.dk/sites/default/files/media/nordisk_positionspapir_juli_2016.pdf

themselves in the role as aggregator/content service provider. So far, it is the experience in the Nordic countries that the reduced vertical integration has a positive effect on market dynamics, innovation and investment.

This view sharply contrasts with the view that ISPs have the ability and incentive to harm openness.

5.2 CRITIQUE OF NET NEUTRALITY

This section attempts to account for why the preliminary results run contrary to policymakers' and supporters stated expectations. This section critiques some of the assumptions and assertions of net neutrality. It reviews the various interpretations of the end to end principle; the notion of a neutrality platform; and the idea that there is an essential architecture in the original internet which is responsible for innovations. Some derivate assumptions related to these points are also discussed.

5.2.1 END TO END PRINCIPLE

The "End-to-End Argument" is an engineering statement often mentioned by network neutrality advocates as a founding design principle of the Internet. Many think that the papers proposing the principle are unquestionable founding documents. They believe that the opinions within these documents justify rulemaking. While regulation should be informed by science and research, creating laws from papers written on general design theories seems extreme.

The network neutrality legalists misunderstand the end to end argument, transport it from the field of engineering to a concept of social justice, and ignore the authors' commentary and delimitation. Even more confusing, the principle has been stated differently at different times. To address this foundation of network neutrality thinking, the discussion must start at the beginning.

The original end-to-end argument is undoubtedly an important contribution to network engineering. The authors of the original paper (1984), in their wisdom, properly use careful language to allow for

other possibilities. They also state the requirement for a cost/benefit analysis. One needs only to look at the choice of words contained within the summary at the beginning of the paper to understand (bold emphasis added below):

> This paper presents a **design principle** that helps **guide** placement of functions among the modules of a distributed computer system. The principle, called the end-to-end-argument, **suggests** that functions placed at low levels of a system **may** be redundant or of little value **when compared to the cost of providing them** at that low level.

While the summary is a good overall guide to the paper, it is not the actual End-To-End argument. Further in, the complete argument reads:

> The function in question can completely and correctly be implemented with the knowledge and help of the application standing at the endpoints of the communications system. Therefore, providing that the questioned function as a feature of the communications system itself is not possible. Sometimes an incomplete version of the function provided by the communication system may be useful as a performance enhancement.

As can be seen, it is a suggested exception for performance enhancement. The paper also explains that *application requirements* provide the basis of the argument. The basis is important because application requirements are also the basis for offering separate categories of service.

In the later paper, 1998,[432], the same original End-to-End Argument authors assess a particular technology in relation to the End-to-End Argument. However, it has been noted that within this paper the

[432] Reed, Saltzer, Clark. "Active Networking and End-to-End Arguments" (May/June 1998) IEEE Network 12, 3: pgs. 69-71. http://web.mit.edu/Saltzer/www/publications/endtoend/ANe2ecomment.html

authors state the Argument with different wording, thus changing its meaning.[433] It is a detail worthy of mention, as some commentary on End-to-End design differs based on which version of the Argument a person chooses to consider.

Much like the original paper the authors' choice of words form careful language to summarize the principle and discuss trade-offs (Bold emphasis added):

> Some twenty years have elapsed since we identified and named end-to-end-arguments, a class of system design principles that organize and **guide** the placement of a function within a system. These arguments and the underlying principles have now been invoked in many contexts, becoming part of the vocabulary of network protocol and operating system designers. Like other **general** design principles, end-to-end arguments impose a structure on the design space, rather than solving the design problem. This structure **provides a basis for discussion and analysis of trade-offs**, and **suggests** a strong **rationale** to justify design choices."

Then in the third paragraph, they restate the principle in a new way:

> …the end-to-end principle that a function or service should be carried out within a network layer only if it is needed by all clients of that layer, and it can be completely implemented by that layer.

The restatement is also annotated, further recognizing that the principle is not perfect:

> There are some situations where applying an end-to-end-argument is counter-productive.

The paper also provides additional context:

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[433] van Schewick, Barbara "Internet Architecture and Innovation" (2010): pg. 58.

> Part of the context of an end-to-end argument is the idea that a lower layer of a system should support the widest possible variety of services and functions, so as to permit applications that cannot be anticipated. That is, minimize the lower-layer function, get out of the way, and let the higher layer do its thing.

The paper further reads on the various risks of adding complexity to a system. Quite notably however, it specifically states that "the complexity added by priority mechanisms used in limiting congestion is modest."

The paper concludes that analysis of the particular technology should be on a case-by-case basis.

Clearly, as shown, the authors have been careful to include the support for different types of applications and the possibility of exceptions to their design principle. Unfortunately, such details are often ignored by network neutrality advocates who insist on a rigid application of the End-to-End Principle, which is in fact an interpretation of an earlier argument.

Lemley and Lessig, two lawyers, have developed a legal principle based upon an engineering concept, but their assertions demonstrate that they misunderstand what Saltzer, Reed and Clark and might not understand network engineering either. The assert that vertical integration of services by a network operator constitutes placing functionality *within* the Internet. One can suspect they are confused about the physical placement. In reality, while competing Internet services may be introduced by network operators, and be housed within the same buildings as network infrastructure, the actual equipment would have to be at addressable endpoints of the network, and not acting as a function in the middle. Such competitive services would be, in fact, completely in line with the End-to-End argument. Even a content-delivery network integrated within a network operator still must connect to the Internet at an addressable network endpoint, and does not add any network functionality within the Internet itself.

Lemley and Lessig suggest that the End-to-End Argument implies resources should not be "particular to or optimized for any single application". However, the grouping of Internet applications into distinct *categories* is not addressed. What they do not understand is that the Internet, if it remains an un-categorized best-effort service only, *is optimized* for bursts of traffic that are not time-sensitive. Lemley and Lessig, to provide support for their rationale, quote the paper containing the alternate form of the End-to-End argument. However, they ignore the additional context and footnotes within the source paper and largely misinterpret the meaning of the quoted information.

One statement of note from within the passage they quote:

> Lower-level layers, which support many independent applications, should provide only resources of broad utility across applications, while providing to applications useable means for effective sharing of resources and resolution of resource conflicts (network transparency).

Expressed in this quotation, the original End-to-End authors have offered another good piece of network design guidance. It is the interpretation of Lemley and Lessig however, which warped the meaning. For allowing different categories of applications *is* providing broad resources. Otherwise, a singular best-effort Internet traffic handling rule provides only narrow utility.

From this, one could imagine a worst-case scenario of government "End-to-End" compliance inspection and certification programs being a requirement of all Internet network design changes and builds. However, there is a major flaw when network neutrality advocates repeat Lemley and Lessig's excitement over the "default design" of the Internet. For the networking protocol of the Internet (IP) has *always* had support for declaring alternate service categories.

5.2.2 DAVID CLARK ON THE END TO END PRINCIPLE

The political acceptance of the end-to-end principle as a proof of the Internet's "original" architecture seems a fait accompli in net neutrality policymaking, even though the end to end engineering paper was not published until 18 years after internet protocol had been designed. David Clark, one of author of original end-to-end papers has devoted decades to promote network innovation and disagrees with "religious" interpretations and prescriptions.[434] He cautioned interpreting the principle for policy ends and suggested reasons why the internet should depart from end to end arguments namely because of an untrustworthy world, more demanding applications, ISP service differentiation, rise of third party involvement, and fewer sophisticated users.[435]

Clark also served as the Vice Chair to the FCC's Open Internet Advisory Committee. At the introductory meeting of the group he had the following comments.[436]

> Back then we didn't use the word 'open'. It's not really part of our language. We understood generality…if you go back to the end to end paper I wrote with Jerry Saltzer and David Reed—which has been used as a religious tract far beyond what it will sustain if you are a strict constructionist (A person who construes a legal text or document in a specified way)—I believe I verified that the paper does not contain word 'open'. That paper was about correctness, which is a narrow objective. It's not even about performance.

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[434] See separate discussion of David Clark in this paper.

[435] Clark, David and Marjory Blumenthal. "Rethinking the design of the Internet: The end to end arguments vs. the brave new world" 2000. http://dspace.mit.edu/bitstream/handle/1721.1/1519/TPRC_Clark_Blumenthal.pdf

[436] Open Internet Advisory Committee Meeting. July 20, 2012. Video http://www.fcc.gov/events/open-internet-advisory-committee-meeting, scroll to 65 min

Clearly "open" is in play by 1994. We had a study which we described Open Data Network (ODN) and the hourglass figure. 'Internet' was the word that was contested at that time, not open.

Now openness has taken on a sort of religious tone. Openness is a slippery word. It doesn't mean much. I have cynically observed that it's a word you put in front of another to create a positive value (open borders, open conversation, open continents, open relationship). It's obvious that it's opposite of closed, which is a bad word. Openness is not a goal, nor is network neutrality a goal.

Envision not an hourglass, but a bow-tie with the word open in the middle. One the one side you have a sense of requirements: innovation, economic investment in the network and applications, freedom of discourse, civil society etc. On the other side you have specifics, rules and technological decisions. Open is the word that we use to tie them together.

Sometimes "open" is a convenient shorthand, but sometimes it obscures the linkage between the decisions you're making on the one hand and the requirements you're trying to meet on the other.

We will continue to use the word "open" in this conversation, just as we use the word internet, but it important that we go back from time to time and tag up, what the deeper problems that we are actually addressing, are we being sensitive to needs of various stakeholders, for example do we have the right economic incentives to innovate, invest and improve? Are we being sensitive to the larger social construct, the civil society, the discourse? There are also profound international issues.

> The historical message is that we've been using open since 1994 as a code word for a basket of requirements on the one hand and technical decisions and rulemaking on the other. We should not focus on open as the objective but with the relationship between these two sides. We should use 'open' as a code word but carefully.

Clark references Steve Deering's *Watching the Waist of the Protocol Hourglass*[437], which offered another handy image in which to envision the internet. The hourglass has a wide variety of host-based protocols at the top and the variety of networking and transmissions technologies at the bottom. Internet Protocol is the "hourglass's narrow waist" allowing anything at the top to communicate with anything at the bottom. The beauty of the waist of the hourglass is internet protocol (IP) which maximizes interoperability, that is anything that uses IP can communicate with anything else on the internet that uses IP.

However Deering expresses his concern in a phrase he calls "putting on weight at the waist", meaning that as the load of content and applications from the top of the hourglass increases, it makes greater demands of the underlying networks below. Hence the networks needs to evolve to keep pace with new demands.[438]

Clark also mentions his work with the National Research Council. Consider that groups book *The Internet's Coming of Age*[439] published in 2001by the Committee on the Internet in the Evolving Information Infrastructure, Computer Science and Telecommunications Board, Commission on Physical Sciences, Mathematics, and Applications. The book reveals that it is not openness, but rather robustness which is

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[437] Deering, Steve. "Watching the Waist of the Protocol Hourglass." IETF 51. August 2001. http://www.iab.org/wp-content/IAB-uploads/2011/03/hourglass-london-ietf.pdf

[438] Ibid slide 5.

[439] Committee on the Internet and the Evolving Information Infrastructure. Internet's Coming of Age. National Academy Press, 2001. http://www.nap.edu/catalog.php?record_id=9823

most important. Calling it "the single most enabling characteristic of the internet", the robustness principle is loosely about TCP implementations "being conservative in their sending behavior and liberal in its receiving behavior" or "be conservative in what you do, be liberal in what you accept from others".

The ARPANET had its origins in a defense environment, with the key goal being survivability. If the network was attacked, it could reconnect with a new and diverse set of networks. This underlies the internet's ability to evolve over time with new applications and innovations. Beside the idea of the sender/receiver relationship, there is also the definition of conservative, careful design at the transport level to deal with packet loss and delay. Robustness also has to do with the configuration of the switches and routers in the network and the ability for the network to constantly reconfigure the routing of data, for example if a package is dropped.

The main difference is that the Saltzer, Reed and Clark had in mind much flexibility and "generality" whereas net neutrality supporters demand "hardline" rules that are at odds with the spirit of a robust network. If there was a rule, it was probably "always find a workaround". The ARPANET engineers never intended their guidelines to become religious dogma. Indeed Bob Kahn who develop TCP/IP calls net neutrality is a "slogan"[440] and the networks need the ability to innovate and experiment. He indicates that engineers did not have politics, let alone net neutrality, in mind when they developed the architecture.

5.2.3 OTHER CRITIQUES OF THE END TO END PRINCIPLE

One challenge in proving the end-to-end arguments is that every network is in fact an end-to-end system. The argumentation is tautological in a sense. While we all may agree that the Internet has a set of beneficial features, this does not necessarily mean that this is a justification to enshrine a particular set of technologies and practice and ban the emergence of others. Van Schewick seems to suggest that

[440] "Computer Pioneer Robert Kahn with Ed Feigenbaum" Interview at Computer Museum. November 15, 2007. http://www.youtube.com/watch?v=t3uTKs9XZyk

the end-to-end design was a single, deliberate, and inviolable decision. More likely what we attribute the "openness" and flexibility of the Internet, that anyone can write a program and it can be distributed to through network, is its "datagram."

As network engineer and co-inventor of wifi Richard Bennet explains in "Designed for Change: End-to-End Arguments, Internet Innovation, and the Net Neutrality Debate"[441], the value of the datagram, instead of the traditional telecom control system, is that network logic can be exported to the end-user systems where it is easier to experiment with policies and protocols by writing new software. We might consider it the ability to conduct an A-B split test on a set of points before incorporating a change in the network overall.

Bennett addresses the legal side of end to end argumentation as well. As network neutrality lawyers attempt to reach back to the End-to-End Argument as a source for justification, much like a U.S. constitutional lawyer would reach back to the Federalist Papers. Bennett however reaches further back, bypassing the TCP/IP Internet, to the original birth of end-to-end as a networking concept - The CYCLADES network designed by Louis Pouzin in France. The ARPANET engineers studied this and adapted this method to their own experimentation.[442] Bennett found that Pouzin had expressed *efficiency* as a valid reason for placing functionality within the network. One could liken Bennett's depth to that of a more rigorous U.S. constitutional lawyer, looking back beyond the Federalist papers, to the works of another Frenchman of great importance - Montesquieu. This edge experimentation is not mutually exclusive to experimentation at the core of the network.

Bennett suggests that misinterpretation of the End-to-End Arguments is a persistent problem in the network neutrality discussion, along with the refusal to include current network architectural discussions in the

[441] Bennett, Richard. "Designed for Change: End-to-End Arguments, Internet Innovation, and the Net Neutrality Debate". September 2009. ITIF. http://www.itif.org/files/2009-designed-for-change.pdf?_ga=1.159879231.325869708.1469543774

[442] Ibid.

debate. In extensive technical content, the paper exposes the unavoidable issues created by the functionality in higher architectural layers being isolated from the network layers, causing the end applications to be unable to properly respond to particular problems. As an example, Bennett presents the TCP "congestion collapse", in which the situation required the reengineering of the TCP protocol. The issue ultimately was inadequately addressed. The modified TCP (which implemented the "Jacobson Algorithm") was consistent with the End-to-End Arguments, as the adjusted functionality was only at the endpoints.

Bennett argues in favor of an alternate resolution which would have placed some functionality within the network, and adds "It's widely acknowledged that Jacobson's Algorithm is no longer appropriate for the Internet." Evidently, coordination between endpoints and the network appears to be the key to ultimately fixing the TCP traffic control issues. Although one could also even argue that adding such functionality to solve the TCP design flaw may actually comply with the End-to-End Arguments' "performance enhancement" exception, the point still stands: Outright banning of functionality within the Internet is foolish to enact.

Bennett plainly sees the problems with Lemley and Lessig's analysis of the End-to-End Arguments. They insist that these network engineering documents carry the full weight of law. Furthermore, they greatly misinterpret the concepts put forth within the original works, ignore the true needs of varied applications, and appear to have no knowledge of IP network structure in general. Also, somewhat strange for lawyers, they do not acknowledge the clearly cautious language by the End-to-End Argument's authors. Moreover there are countless other engineering guidelines to consider.[443]

[443] James P. G. Sterbenz and Joseph D Touch "High Speed Networking" (2001) Appendix A "Axioms and Principles": pgs. 555-573.

Yoo describes van Schewick's approach to the End to End Argument as "modularity,"[444] referring to the degree to which a system's components can be separated and recombined. While there may be benefits related to the independence of applications (that the applications need not take into account the underlying network in order to function), modularity imposes costs of its own including a constraint for engineers to present solutions for network security, mobility, mass media distribution (multicasting), and support for multiple connections to the same location (multihoming).[445] As such, it may be helpful to define when modularity is optimal and allow innovation to continue with more informed policies.

For example Wu notes that broadband providers exaggerate security risk, but that observation might not hold in 2016 when security is a critical issue for the Internet.

5.2.5 NEUTRAL PLATFORM

Wu suggested that if the network is a "neutral platform", then there can be "meritocratic" and "Darwinian" competition among applications. Wu does not state his assumptions, but they can be deduced. He declares that "private interests of broadband providers and the public's interest in a competitive innovation environment centered on the Internet" are inherently in conflict. This itself is worthy of empirical investigation. If anything, the near universal uptake of mobile telephony in many countries suggests that public and private interests are aligned in many respects.

This dichotomy of application versus network impugns a zero sum game, as if the amount of innovation were finite. This contradicts the notion of an ecosystem in which the actors engage in symbiotic relationships. In such an ecosystem, innovation can be a positive sum game. The parts of the system flourish together.

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[444] Christopher S. Yoo "Modularity Theory and Internet Regulation" University of Illinois Law Review, Vol. 2016, P. 1 (2016) http://papers.ssrn.com/sol3/papers.cfm?abstract_id=2032221

[445] Ibid

Barely a decade after Wu's article, Internet connectivity is available through a variety of networks, increasingly at speeds of 100 Mbps or more. As the Organization for Economic Cooperation and Development reports for the member countries,[446] mobile broadband penetration was 85.4% in June 2015, up from 76% in June 2014. In fixed-line broadband subscriptions reached 365 million in June 2015, up from 351 million in June 2014. Smartphones are nearly ubiquitous in highly developed countries. Internet adoption is near saturation in many developed countries; more than two-thirds of the population is online,[447] and 3.2 billion people are online.

As Cisco reports, mobile networks carried fewer than 10 gigabytes per month in 2000 and less than 1 petabyte per month in 2005, [448] but the amount of data consumed globally per capita has increased in real terms from 2.1 exabytes per month in 2014 to 3.7 exabytes per month in 2015. In the history of technological innovation, only the mobile phone has grown faster than the Internet,[449] which is the foundation for nearly every person on the face of the earth to be connected to the internet. It would seem that the growth of Internet connectivity is a success.

Noted atheist Christopher Hitchens remarked, "That what can be asserted without evidence can also be dismissed without evidence."[450] As such, polemic pronouncements such as "the internet is too important to be left to the market" are proffered when the justification for the regulation is otherwise not supported by the facts. It could be that broadband providers and the public interest are not aligned, but it

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[446] OECD Broadband Portal, OECD, August 2016, http://www.oecd.org/sti/broadband/oecdbroadbandportal.htm

[447] ICT Facts and figures, OECD, 2016, http://www.itu.int/en/ITU-D/Statistics/Pages/stat/default.aspx

[448] Cisco Visual Networking Index: Global Mobile Data Traffic Forecast Update, 2015–2020 White Paperhttp://www.cisco.com/c/en/us/solutions/collateral/service-provider/visual-networking-index-vni/mobile-white-paper-c11-520862.html

[449] Felton, Nicholas. "Consumption Spreads Faster Today." February 10. 2008. New York Times http://www.nytimes.com/imagepages/2008/02/10/opinion/10op.graphic.ready.html

[450] Hitchens, Christopher "Mommie Dearest". Slate. 20 October 2003.

would be helpful to qualify the statement with some evidence. In any case, while Wu's assumption is that the two interests are in conflict, the opposite is an equally acceptable premise, that the interests are in cooperation.

It bears mention that Creative Commons is a stand-alone entity which Lessig founded to give creators a choice of how to distribute their content. It is Lessig's vision of neutral platform for content which anyone can use. His hope is that Creative Commons would grow to be a counterbalance to traditional copyright.

However to create Wu's neutral platform of a broadband network requires a regulatory taking of a private network in the form of government-mandated restrictions. That is to say that the network owners have no choice in the matter. It begs the question of why not just build the so-called neutral network from scratch. Indeed if it is so vital and can deliver the promised innovation, it's a wonder that there are not more entrepreneurs, investors, and even application providers investing in such a network.

Some suggest that government-owned networks could be conceived, built and run as "neutral, open" networks. [451] This thesis focuses on privately owned mobile networks, so a discussion of the pros and cons of government-owned networks is out of scope. Government network proponents note that success requires a number of factors and that the record to date is mixed.[452] Suffice it to say that the premise of the superiority of government broadband rests upon the assumption that government providers are better stewards that private ones. However decades of deregulation of state-owned telephone monopolies

[451] Brett M. Frischmann, Infrastructure: The Social Value of Shared Resources, 1 edition (New York: Oxford University Press, 2012).

[452] Susan P. Crawford et al., "Community Fiber in Washington, D.C., Seattle, WA, and San Francisco, CA: Developments and Lessons Learned," SSRN Scholarly Paper (Rochester, NY: Social Science Research Network, May 27, 2014), https://papers.ssrn.com/abstract=2439429.

suggests that market competition has advantages.[453] In addition governments can impose significant restrictions on the content and management of networks, compromising their "neutrality."[454] The celebrated Stokab network in Stockholm is bolstered by a set of laws forbidding investment by private actors in surrounding areas, so it is not clear that the network is neutral if other actors cannot participate.

Even if we accept the idea of the neutral platform, the net neutrality assertion that zero is right access price for content providers[455] is not supportable. Indeed if an innovator values a platform and enjoys benefits, it follows that innovator should pay a usage fee or some kind of fee to maintain the network. It is understandable that a larger user would pay more. Even if we consider the Internet a commons, there are still access and usage fees.

Wu gives the example of the retail store as a neutral platform, but in reality even a retail store is not neutral. However retail stores, even being non-neutral, can support innovation. Retail stores have a symbiotic relationship with the companies that supply their products. In addition, many retail stores have a house brand in addition to the third party brands they offer. A supermarket earns a fee for selling the products to customers, but may also charge a fee to the brand to be put on the shelf. Some of those brands may participate in activities to help the overall attractiveness of the store, special promotions, marketing etc. The relationships are all determined by the store strategy and the various elasticities of demand for the product.

There is no doubt that some products will be present in all stores (Coca-Cola, Kellogg's cereal, Snickers candy bar etc), just like

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453 "10th Anniversary Telecommunications Regulation Handbook | infoDev," Infodev, accessed November 4, 2016, http://www.infodev.org/articles/10th-anniversary-telecommunications-regulation-handbook.

454 Enrique Armijo, "Government-Provided Internet Access: Terms of Service as Speech Rules," SSRN Scholarly Paper (Rochester, NY: Social Science Research Network, June 20, 2014), https://papers.ssrn.com/abstract=2457231.

455 Lee, Robin S. and Tim Wu. 2009. "Subsidizing Creativity through Network Design: Zero-Pricing and Net Neutrality." Journal of Economic Perspectives, 23(3): 61-76.

favorite apps will be found on all networks. But some stores will likely differentiate. For example, some stores may engage in "blocking" by not stocking certain products or even classes of products. Consider Whole Foods[456] which won't stock foie gras or products that contain bleached flour, high fructose corn syrup, Aspartame, or any artificial colors or flavors. However people love Whole Foods for the upscale experience. Indeed Whole Foods' "discrimination" has opened and expanded the market to a more aesthetic approach to shopping. One observer calls Whole Foods the "luxury brand of millennials."[457] Overall American supermarkets have improved significantly and now offer organic foods, natural foods as well as to make the shopping experience more substantive[458] with aesthetic displays, coffee bars, cafes etc. Not allow the store to differentiate, the neutral platform as it were, would actually limit the kinds of products in the marketplace.

Communication networks are no different. Their diversification can benefit users and applications providers. The same regulation which is purported to protect user choice and innovation may in fact do the opposite. Open Internet regulation could in fact retard valuable network innovation and innovation by third parties.

The standard justification for why communication networks must be regulated is conventional wisdom that they are natural monopolies. Thus notion has been turned on its head by the facilities based competition afforded by new technologies for communications networks.[459] The same argument appears again in justification for net

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[456] "Foods You'll Never Find at Whole Foods." FoxNews.com November 6, 2014. http://www.foxnews.com/leisure/2014/11/06/foods-youll-never-find-at-whole-foods

[457] Pavone, Michael. "How Whole Foods Became the Luxury Brand of Millennials". February 23, 2012. https://www.fastcoexist.com/1679351/how-whole-foods-became-the-luxury-brand-of-millennials

[458] Postrel, Virginia. The Substance of Style: How the Rise of Aesthetic Culture Is Remaking Commerce, Culture, and Consciousness. HarperCollins, 2003.

[459] Parker, Edwin B. "The Toppling of the Natural Monopoly Doctrine." http://lirne.net/resources/netknowledge/parker.pdf

neutrality regulation in "internet exceptionalism,"[460] the view that the Internet is so special and different that it must be regulated to retain its "original" character that was "open" and "free". In a subsequent article Wu extolls the value of the Internet in that anyone can be a publisher, that it was founded not by "private firms" but as a non-profit research project (but ignoring the trillions of dollars of private investment to make it possible), its ideology of practical libertarianism, and decentralization by design. He then concludes that the Internet is passing from its "utopian" phase to its "open" phase, and then will become another communications network, which, he implies will need to be regulated to retain the Internet's "original" goal, as if to say there was a set of defined founders and defined goals and can never deviate. This further assumes that the regulators can be entrusted to achieve such a preservation and that such rules will actually work to return to this Paradise Lost.

5.2.6 DISCRIMINATION

Wu makes another assumption that managing a network for profit is harmful and "discriminatory." As such, the word "discrimination" is a word frequently used by advocates for net neutrality and critics of zero rating. This word appears to be misunderstood both in the economic and technical context.[461] The primary definition of "discrimination" is to recognize a distinction, to differentiate, or to perceive differences, as in "babies can discriminate between different facial expressions."[462] The economic concept of "price discrimination" is predicated upon this primary meaning. When a vendor can perceive differences between two or more customers, then it may be possible to charge them different prices for the same product (price discrimination) or to customize the product offered to each in a

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[460] Wu, Tim. "Is Internet Exceptionalism Dead?" December 28, 2010. Social Science Research Network
http://papers.ssrn.com/sol3/papers.cfm?abstract_id=1752415

[461] Howell, Bronwyn and Roslyn Layton. "An Economic History of Net Neutrality." Forthcoming 2017.

[462] "Discriminate - Definition of Discriminate in English from the Oxford Dictionary," accessed June 27, 2016,
http://www.oxforddictionaries.com/definition/english/discriminate.

manner that reflects the difference (product differentiation). If the customized products impose different expended or expected costs on the vendor, then charging different prices does not constitute price discrimination.[463] Similarly technical discrimination as is traffic management would imply a similar ability to differentiate.

Tim Wu's non-discrimination principle is predicated on the legal meaning of the word, the secondary definition of discrimination, which has to do with prejudice, for example "an employment policy that discriminates against women." In fact, the flat and unlimited plans that users enjoy are forms of price discrimination, just as zero rating is.[464] From an economist's perspective, these offers are not different. Price discrimination, of which zero rating is one variant, is a fundamental tenet of economics, and its value to promote social welfare has been recognized for at least a century. Google's Hal Varian described the social welfare effects of price discrimination in 1985,[465] Schmalensee in 1981,[466] Robinson in 1933,[467] and so on.

In addition to economics, there is acknowledgement in engineering that some discrimination is required in the transference of data to preserve the working and security of the network; such rules are

[463] Dennis W. Carlton and Jeffrey M. Perloff, Modern Industrial Organization, 4 edition (Boston: Pearson, 2004).

[464] Howell, Bronwyn. "The Danger of Using History to Guide Modern Internet Policy." TechPolicyDaily.com, 2015. http://www.techpolicydaily.com/internet/history-guide-internet-policy/

[465] Varian, Hal R. (1985) Price Discrimination and Social Welfare. The American Economic Review. Vol 75. No 4 (Sept 1985), pp 870-875. At: http://www.jstor.org/stable/1821366?seq=1#page_scan_tab_contents

[466] Schmalensee, Richard. "Output and Welfare Implications of Monopolistic Third-Degree Price Discrimination," American Economic Review, 1981, vol. 71, issue 1, pages 242-47 http://econpapers.repec.org/article/aeaaecrev/v_3a71_3ay_3a1981_3ai_3a1_3ap_3a242-47.htm

[467] Robinson, Joan. The Economics of Imperfect Competition, London, 1933

defined as "Internet traffic management."[468] Traffic management techniques imply at a certain level discrimination of content that might be independent of the protocol employed for the sending of data and can be applied to a specific protocol or application. These techniques put the operators or ISPs as the control points[469] and affect the ability of users to send and receive information, hence traffic management is allowed based on the principles of a real and legitimate purpose or goal.

Zero rating programs are mainly services allowing certain types of Internet traffic not to be counted as part of the total data plan to which the consumer subscribes. It is then a *discrimination based on specific contents and their relation to payment*, but it is *not discrimination based on access*. In other words, it is a commercial but not technical discrimination. Yoo (2016) refers to the discrepancies on the understanding of what zero rating is by saying "differential pricing is something of a misnomer, since that term suggests that different end users are being charged different prices for the same service. A similar critique applies to the tendency in European debates to refer to service differentiation as positive or negative price discrimination. A more appropriate term would be service differentiation, since ISPs vary the services being offered and charge the same price to every end user purchasing that service plan."[470].

Some criticize usage-based pricing for artificially introducing scarcity that forces users to curtail Internet use. These criticisms are not grounded in reality, as there is nothing artificial about the scarcity of mobile capacity—data caps simply give operators an additional tool

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[468] ITU (2005) Essential Report on IP Telephony. https://www.itu.int/ITU-D/cyb/publications/2003/IP-tel_report-es.pdf (original text in English). Geneva, Switzerland.

[469] Predictable Network Solutions Ltd. (2015) A Study of Traffic Management Detection Methods & Tools. Available from: http://stakeholders.ofcom.org.uk/binaries/research/technology-research/2015/traffic-management-detection.pdf

[470] Yoo, Christopher. (2016) Letter sent to TRAI (Indian Telecom Regulator). "India Consultation on Differential Pricing for Data Services." Sent to TRAI, 2016. http://trai.gov.in/Comments_Data/Others/Yoo.pdf.

for planning and pricing around this scarcity. Such tools are especially important when operators are competing on their networks' performance.

Other stakeholders criticize specific forms of usage-based pricing, preferring some models to known others. When it comes to zero rating, critics have been particularly vocal about exclusive dealing, where carriers only offer to zero rate particular content, and exclusive deals with affiliated content above all[471].

The "harmful discrimination" critique of zero rating claims that ISPs are allowed to discriminate against content that users want to see.[472] Critics suggest that established providers could use zero rating to make it more expensive for consumers to access nonproprietary content or new content where its providers could not pay to subsidize users' transport costs. In order for this argument to hold one must assume that there is perfect competition in content, that any piece of content can be substituted for any other, that users have perfect information, and there are no transaction costs. In such a market consumers are indifferent to content, and would only chose one over the other because of price.

While this perfect competition model is interesting for academic purposes, it doesn't exist in the real world. The better economic model is imperfect competition, which takes into account product variation that assumes that both users and content providers know the relative strength of users' preferences for the different variations, and they each know where the best matches will be made. As a result, they will match up in a manner that maximizes total welfare. As new variations

[471] Brake, Doug. "Zero Rating: The Economics and Innovation Behind Free Data." Washington D.C, USA: ITIF - The Information Technology & Innovation Foundation, 2016. http://www2.itif.org/2016-zero-rating.pdf?mc_cid=fbe8957fb0&mc_eid=db21bcda2d.

[472] Van Schewick (2016) Personal blog: https://medium.com/@schewick/europe-is-about-to-adopt-bad-net-neutrality-rules-here-s-how-to-fix-them-bbfa4d5df0c8#.fb4r1h2ik

are developed, customers migrate freely to their new preferred variant. Howell explains, [473]

> The welfare effects of zero rating are highly contingent on the circumstances in which it is applied. Zero rating is likely to more beneficial the more heterogeneous the options are (or the greater the real difference consumers perceive between them) and the less informed consumers are about the value the differences offer them. This suggests that zero rating is more likely to be an issue for concern in the provision of a handful of homogeneous and easily described and defined services (cloud storage, for example) than in the provision of highly differentiated individual and content-based applications that make up the majority of the Internet's content. Until more information is available about consumer preferences, case-based competition law provides more flexibility to take account of different contexts than imposing potentially costly prohibitions that favor homogeneity over differentiation.474

The debates about free and subsidized content are not new. Licensed television providers who decried lobbed a similar criticism that free or advertising-supported TV would put them out of the business. Rather the opposite has happened. There is a market for both because the two kinds of TV programming are not perfect substitutes; they produce different content. While users avail themselves to both, the advantage of the two models is that advertisers are allowed to participate, and hence more content is created overall. If only licensed TV were

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[473] Howell, Bronwyn. "Ice Cream Illustrates They You Don't Have to Fear Zero Rating." TechPolicyDaily.com. February 3, 2016. http://www.techpolicydaily.com/internet/ice-cream-illustrates-why-you-dont-need-to-fear-zero-rating/

[474] For a detailed explanation of the model see Howell and Layton, Evaluating the Consequences of Zero Rating: Guidance for Regulators and Adjudicators. 2016 https://tprc442016.sched.org/event/7jzE/evaluating-the-consequences-of-zero-rating-guidance-for-regulators-and-adjudicators

allowed, there would be less content,[475] as consumers have only a limited amount they can spend. However by adding a second option, consumers get more content without the need for addition TV expenditure.

The same analysis applies to free and subscription newspapers. There would be no room for subscription newspapers if they offered the same information as free newspapers. It is frequently the case that volunteers and local advertisers subsidize local newspapers. Making it free may increase the likelihood that community members will read it in that town, but that does not mean they will give up their subscription to a national newspaper. Moreover just because the local newspaper is free does not mean the people in the next town will want to read it. The content in that local newspaper has a particular interest to the people in that community.

Internet traffic patterns show that some content is highly valuable, but most content is not. In fact, much of the content on the Internet has no value to most users. This is particularly the case for much of the worlds unconnected, as they speak a language for which there is no content on the Internet, and they don't write, so they have a challenge to navigate on the Internet with a basic feature phone. Transliteration, speaking the information into the phone, can help, but this assumes that such a feature is enabled on the phone and that the message can deliver a relevant result. Free Basics may be similar to a local newspaper for each of the countries where it is deployed, as it has a set of unique content for that location in a particular format optimized for first time Internet users, but it is probably not a set of content that is interesting for most experienced Internet users.

[475] This was the case in many European countries which only allowed licensed television, which people paid the government for access to the national TV station. Viewers could see only 2-3 channels. Opening up the airwaves to community and advertising supported television, expanded the number of channels. The television market is a diverse mix today.

As such, banning "free" or zero rated content can both reduce distribution and incentives for content creation. Additionally Zero rating programs represent effective ways to bring poor people from the developing world into the digital era and promote innovation and competition in the Internet sector. These programs enable people who lack the financial resources for expensive data plans to use certain applications without having that usage charged towards the individual's data cap. Around 45 percent of mobile operators around the world offer some type of zero rating services. If countries can make progress in bringing unconnected people to the Internet, it would encourage greater economic development, improve education and health care, and strengthen civil society around the world.[476]

BEREC's recent report[477] shows that consumers, those who have even heard of net neutrality, value its attributes differently. Some would value prioritized access but doubt that their provider could be able to deliver it. Others believed that if bad behavior occurred, they would switch. Not surprising young males desired it the most. This is the group of users who most frequently use high bandwidth for video games and p2p application, and the ability to amortize the cost of the network across all users most benefits them. Those who desired net neutrality the least were older, low volume users who prefer just to pay for their own usage. Across the board, users noted that if broadband providers blocked websites, they value their connection less. At least among this survey, it disproves the notion that broadband providers have an incentive to block content and services. They certainly did not adopt the tone of net neutrality advocates against

[476] West, Darrell. "Digital Divide: Improving Internet Access in the Developing World through Affordable Services and Diverse Content." Brookings, 2015. http://www.brookings.edu/research/papers/2015/02/13-digital-divide-developing-world-west.

[477] The Value of Network Neutrality to European Consumers. BEREC Report. April 2015. http://www.wik.org/fileadmin/Studien/2015/2015_BEREC_Summary_Report.pdf

zero rating, as they value offers that to reduce the price of broadband subscriptions.

5.3 CRITIQUE OF *ARCHITECTURE AND INNOVATION*

5.3.1 END TO END PRINCIPLE

Over 500 pages, van Schewick explains the so-called end-to-end architecture and its role in innovation. However there is one wrinkle in the story; the end-to-end arguments were made *after* the Internet Protocol (IP) suite was developed.

The first document to officially define the Internet Protocol was dated in January 1980[478], and was later tweaked in a document dated September 1981[479] to establish the Internet Protocol we know and use today. Meanwhile, the original end-to-end arguments[480] were presented in 1981 and published in 1984. The "broad" version[481] of the arguments, which van Schewick deems most influential to the Internet's design, was published in May 1998, 18 years after the original definition of the Internet Protocol.

Following is a summary of the timeline of the development of the Internet Protocol as it relates to this point.

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[478] "DOD Standard Internet Protocol" RFC 760, Information Sciences Institute, University of Southern California (January 1980) https://tools.ietf.org/html/rfc760

[479] "Internet Protocol DARPA Internet Protocol Specification" RFC 791, Information Sciences Institute, University of Southern California (September 1981) https://tools.ietf.org/html/rfc791

[480] Saltzer, Reed, Clark "End-To-End Arguments in System Design" ACM Transactions on Computer Systems, Vol. 2, No. 4, (November 1984) Pages 277-288 http://groups.csail.mit.edu/ana/Publications/PubPDFs/End-to-End%20Arguments%20in%20System%20Design.pdf

[481] Reed, Saltzer, Clark "Active Networking and End-To-End Arguments" IEEE Network 12, 3 (May/June 1998) Pages 69-71 http://web.mit.edu/Saltzer/www/publications/endtoend/ANe2ecomment.pdf

1980 January - RFC7601 - Original Department of Defense (DOD) standard Internet protocol design specification (spec) with ToS (Type of Service) field.[482]

1981 April - Original end to end (E2E) arguments are presented at conference and subsequently published in conference proceedings[483]

1981 September – RFC 7912 - Original (Non-DoD) IP Internet protocol design spec. Derived from DoD spec. Also includes ToS field.[484]

1984 - Original E2E paper is published, [485] a modification of original presentation.

1998 – Updated E2E paper published[486]

While van Schewick does acknowledge that the end-to-end arguments were presented and published after the development of the Internet, she asserts that such design practices were in informal practice prior to the paper's codification of them (pgs. 111-112). Unfortunately, her direct reference to make this point is actually a reference to the *first*

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[482] "DoD Standard Internet Protocol," Defense Advanced Research Projects Agency, January 1980, https://tools.ietf.org/html/rfc760.

[483] Saltzer, J. H., D. P. Reed, and D. D. Clark (1981) "End-to-End Arguments in System Design". In: Proceedings of the Second International Conference on Distributed Computing Systems. Paris, France. April 8–10, 1981. IEEE Computer Society, pp. 509-512.

[484] "Internet Protocol," Defense Advanced Research Projects Agency, September 1981, https://tools.ietf.org/html/rfc791.

[485] J. H. Saltzer, D. P. Reed, and D. D. Clark, "End-to-End Arguments in System Design," ACM Transactions on Computer Systems 2, no. 4 (November 1, 1984): 277–88, doi:10.1145/357401.357402.

[486] David P Reed, Jerome Saltzer, and David Clark, "Active Networking and End-To-End Arguments," accessed November 13, 2016, http://web.mit.edu/Saltzer/www/publications/endtoend/ANe2ecomment.pdf.

published version of the end-to-end arguments from 1984,[487] and not the "broad" version in which the evidence of direct influence is weak. However, her other defense points to commentary within the "broad" version paper which illustrate that the end-to-end arguments arose out of work on various systems from 1976-1978. While quite promising to van Schewick's point of view, hard evidence that the distinct "broad" version of the end-to-end arguments was *explicitly* defined prior to 1998 is lacking. Critical readers are ultimately left to judge the "broad" version's specific influence on the design of the Internet for themselves.

In her analysis of the "broad" version of the end-to-end arguments, Van Schewick discusses "evolvability" and argues that there may be problems with networks that support application-specific functionality. She states that "functionality that lets some applications work better may hurt other applications whose needs differ." However, while the basis for the contrast with the statement is not explicitly clear, she later conversely explains that network Quality-of-service (QoS) functionality offering differentiated traffic characteristics (and even ventures that differential pricing) actually would comply with the end-to-end arguments when it is requested by the application or the user.

Unfortunately, she doesn't appear to explicitly define "application-specific functionality". Based on inference from her given context on TCP/IP architecture, it appears that her definition of "application-specific functionality" means "application specific functionality which takes place at the application-layer". However, the critical eye could view such a definition as not analogous with the simple statement. Further confusing the absence of an "application-specific functionality" definition, van Schewick offers an example of telephone line load coils and DSL. However, those issues are physical-layer issues, affecting a physical cable, and are not related to the application-layer or nor applications in general when deploying TCP/IP architecture.

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[487] Van Schewick, Chapter 3 ref #92, referring to the first version of E2E presented 1981, published 1984

Van Schewick offers an example of peer-to-peer applications as support for the particular claim "Today, asymmetric bandwidth creates problems for applications that send and receive an equal amount of data; these applications are called peer-to-peer applications." However, in point of fact, peer-to-peer has nothing to do with equal amounts of traffic flow. It is only a broad term for decentralized alternatives to the typical client-server network computing model[488] Peer-to-peer is a generalizable term meaning communication between endpoints which is not being managed or served from a third centralized endpoint device. For example, there is no centralized file server in a decentralized file-sharing app.

Van Schewick provides examples of peer-to-peer application but these do not prove the point. There is not equal flow in Internet Telephony (Vonage, Skype). Moreover, depending on implementation, packets utilizing technology such as Voice Activity Detection (VAD) may transmit much less from an internet telephony endpoint when input is quiet/silent.[489] Nor is flow equal for video conferencing. Many video compression schemes represent visual information in ways that vary with input and its alteration.[490] Nor does file sharing (Napster, Gnutella, BitTorrent) require equal flows. Flows are based on supply and demand, which is almost never completely equal between all peer-to-peer file network participants. Just because one user is downloading a file doesn't mean someone else is downloading or uploading a file of equal size.

Van Schewick asserts that "application blindness" prevents discrimination and "an end-to-end network is neutral among applications". The conflation of the word *discrimination* which

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[488] Harry Newton, Steve Schoen "Newtons Telecom Dictionary" entry for "P2P", 28th edition, Harry Newton (2014)

[489] "Voice Over IP - Per Call Bandwidth Consumption" Cisco Systems, Document ID 7934, last updated April 13 2016 http://www.cisco.com/c/en/us/support/docs/voice/voice-quality/7934-bwidth-consume.html

[490] "H.264 The Advanced Video Coding Standard" International Telecommunications Union, Last accessed September 10, 2016 http://www.itu.int/itudoc/gs/promo/tsb/87066.pdf

appears to be just another word for rendering, which may simply be the network discharging the required treatment of the application. While van Schewick asserts that the end-to-end arguments are essentially a commandment, it is not inherent that application-specific network behavior automatically results with detriment to other applications.

Van Schewick's assertion seem to discount that every network has abilities and constraints. If a future network could allocate resources within a precise constraint profile to each instance of an application, as requested by the application itself, we would have a precision network which could serve all apps *exactly* as they want or need to be served. A variable allocation of network resources within specific constraints based on the applications' actual wants and needs is bright potential future for network design. Quite simply, applications are individuals. To remain a stickler to van Schewick's interpretation of the end-to-end arguments, to the point that it dis-incentivizes or flatly prohibits development of future precision networks which may be based on other architectures/models, is itself a "discriminatory" way to encourage innovation. Even the authors of the "broad" version paper (to which van Schewick ascribes) are careful to express in a footnote that "There are some situations where applying an end-to-end argument is counter–productive."[491]

Van Schewick also claims that the original version of the end-to-end arguments asks for a case-by-case evaluation, whereas the "broad" version is more prescriptive and "has resolved the trade-off between evolvability and performance on a general basis". However, the is no conclusive evidence that such a trade-off between evolvability and performance inherently exists in the set of *all possible* technological developments – it is not natural law. Further, if one reads the full "broad" version paper to the end, there is a section in the paper *specifically titled* "Take it Case-by-Case" (page 3), which states, "It is important to keep in mind that end-to-end arguments are one of several important organizing principles for systems design. While there will be situations where other principles or goals have greater weight, an end-to-end argument can facilitate the design conversation

[491] Supra Saltzer 1984, footnote 2, p. 1

that leads to a more flexible and scalable architecture." This does not appear to be justification for a sweeping regulatory regime but rather guidance about strengths and weaknesses of different arguments.

It is important to remember that the end-to-end arguments are "arguments", that is they are interpretations. They are not inviolable principles or physical laws. While it may be useful to discuss them and identify the pros and cons, it is not necessarily appropriate to build a regulatory regime on the interpretation of an argument and then deem it as fact.

Some engineers appreciate that van Schewick's work has been helpful to underscore the importance of Quality of Service to push back on the non-technical view of net neutrality that all data must be treated equally.[492] It is interesting to note that the end-to-end arguments have much greater valence with legal scholars than with network engineers themselves, the latter who recognize its novelty, but do not see it as the end-all, be-all principle.[493] Van Schewick appears to have an implicit presumption that the "broad" version of the end-to-end arguments is the "correct" way to engineer a network. One network mathematician called this rigid approach "lawgeneering."[494]

Strict adherence to the end-to-end arguments, if enacted in regulation, could be a declaration of any other nonconforming network design principle as de-facto *illegal.* The U.S. Open Internet NPRM actually came close, including comments from select third parties within the

[492] Richard Bennett "Van Schewick's View of Net Neutrality and Quality of Service" High Tech Forum, June 14, 2012, http://hightechforum.org/van-schewicks-view-of-net-neutrality-and-quality-of-service/

[493] Ibid

[494] Martin Geddes "Why telecoms regulators must ignore 'lawgeneers'" Blog Post, October 23, 2015, http://www.martingeddes.com/why-telecoms-regulators-must-ignore-lawgeneers/

footnotes of the rules[495] which use the end-to-end arguments as rationalization for the Open Internet order.

Worthy of inspection is van Schewick's support of enacting regulations which bans flexible, commercial QoS (in the U.S.[496] and the EU[497]) which contradicts the QoS capabilities she views as conforming to the end-to-end arguments. Her focus is user-control. She explicitly notes:

> Some researchers assume that the broad version of the end-to-end arguments rules out the provision of Quality of Service in the network. This interpretation of the end-to-end arguments is too strong.

She then elaborates:

> The principle of application autonomy described above suggests that applications (or ultimately the users) should determine which type of service they need; this does not imply that they should get this service for free.

Further, she offers:

> Imagine that the Internet layer offered different services with different bandwidth and delay characteristics to higher layers at the end hosts. The higher layers would choose the type of service they desired and would communicate that choice to the

[495] "Protecting and Promoting the Open Internet" Federal Communications Commission, GN Docket No. 14-28, March 24, 2015, https://apps.fcc.gov/edocs_public/attachmatch/FCC-15-24A1.pdf

[496] Barbara van Schewick "Historic FCC Vote will Protect the Future of America's Economy and Democracy" Stanford Law School Center for Internet and Society, Blog Post, February 26, 2015, https://cyberlaw.stanford.edu/blog/2015/02/historic-fcc-vote-will-protect-future-americas-economy-and-democracy

[497] Barbara van Schewick "126 Leading Academics to Europe's Telecom Regulators: Protect the Open Internet in Europe" Stanford Law School Center for Internet and Society, Blog Post, July 21, 2016,https://cyberlaw.stanford.edu/blog/2016/07/126-leading-academics-europe%E2%80%99s-telecom-regulators-protect-open-internet-europe

> Internet layer through the Internet layer's service interface (e.g., by setting a type-of-service field). Such an architecture would not require application-specific functionality to be implemented in the network's core beyond what is necessary to implement functions that cannot be implemented by the end hosts alone. Thus, it would not violate the broad version of the end-to-end arguments.

However, the reasonable scenarios described above are explicitly banned in the network neutrality regulations enacted in both the U.S. and the EU – yet both rulemakings were largely applauded by van Schewick. The blanket bans on differential treatment and paid prioritization enacted by the U.S. and EU go beyond the approach van Schewick advocated in her book.[498]

Van Schewick states that "the Internet Protocol provides a technology independent interface to the services provided by the network" (p. 383). While the Internet Protocol, yes, acts as an interface, the claim of its technological independence is, quite flatly, incorrect. Interfaces may act as enablers, but they may also create bottlenecks. If someone creates a new functionality within the link layer, which resides below the Internet Protocol, the Internet Protocol does not automatically provide a compatible interface to the new underlying network functionality. Thus, the Internet Protocol interface naturally constrains the range of functionality, based on its individual design. Form can both support and limit function.

Additionally, van Schewick's seems to confuse the true architecture, by assuming it automatically includes the Internet Protocol. The Internet Protocol is simply a specific module inserted into the Internetwork layer of the overall architectural model. To assume that no other Internetwork layer protocol could, or should, appear is rather presumptuous. For example IPv4 and IPv6 are fundamentally different within internet protocol.

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[498] Barbara van Schewick "Network Neutrality and Quality of Service" Stanford Law School Center for Internet and Society, June 11, 2012, http://cyberlaw.stanford.edu/files/publication/files/20120611-NetworkNeutrality_0.pdf

Further, to suggest that the Internetwork Layer should never act as an application-specific interface to the network is to favor the comfortability of past designs at the expense of dynamism. A truly flexible and customizable network that can morph to serve the exact properties of individual applications is an admirable goal, and is one which would serve applications in a more precise manner.

It begs the question of the value of Internet Protocol if there is no network across which the protocol can run. While some want to suggest that innovation starts with the IP suite, the truth is that innovation in computing, communications, and content have been going on for centuries, without which there would be no Internet today. Simply put, the Internet itself is a complementary asset to computers and communications networks. They each add value to the other.

5.3.2 INNOVATION

For van Schewick the large American Internet companies surrounding her at Stanford is proof of her claims. She describes a large group of diverse innovators. But a cursory review of some of the key innovators show that they are not so diverse; they tend to be white, middle to upper class, and have backgrounds in computering. *Wired* calls Silicon Valley the "myth of meritocracy" that "denies the role of personal connections, wealth, background, gender, race, or education in an individual's success."[499]

Jessica Livingston documents that the leading Silicon Valley entrepreneurs even have the same characteristics and ways of working. In *Founders at Work: Stories of Startups' Early Days*[500], in which she interviews the founders of more than two dozen leading Silicon Valley companies about their beginnings. The founders

[499] Alice Marwick, "Silicon Valley Isn't a Meritocracy. And It's Dangerous to Hero-Worship Entrepreneurs," WIRED, November 25, 2013, https://www.wired.com/2013/11/silicon-valley-isnt-a-meritocracy-and-the-cult-of-the-entrepreneur-holds-people-back/.

[500] Jessica Livingston, Founders at Work: Stories of Startups' Early Days, 1st Corrected ed., Corr. 2nd printing edition (Berkeley, CA : New York: Apress, 2007).

typically highlight the accidental nature of the starting of their company. Then, once started with their idea, they were determined to make a great application that solved a real problem. Livingston also describes that the founders exhibited tremendous perseverance to sustain in the midst of uncertainty, isolation, and lack of progress. They also faced consistent rejection before their idea became a success.

Interestingly these entrepreneurs never mentioned the end-to-end principle or network neutrality as being essential for their success. Moreover it would seem that the environment in which the application is deployed might have something to do with innovation, for example market need, proliferation of personal computers, proliferation of internet subscriptions, and so on.

Van Schewick prefers archetypal iconic examples of a handful of firms to justify the regulation, but paying little regard for the thousands of firms which don't succeed, as if they were just not the user's choice. Van Schewick likes to illustrate her point with Skype. She makes a narrative about two entrepreneurs who took on the telecoms, and, had it not been for net neutrality, Skype would not exist, because telecom operators would have blocked this application which created competition for its own long distance service.

But the truth is that Skype founders Nicklaus Zennstrom and Janus Friis met while working for Swedish telecom operator Tele2 in Copenhagen. Fondly describing Tele2 as "the best entrepreneurial school I could get",[501] Zennstrom worked as an executive assistant in product development. He had worked at Tele2 for 3 years during which time he hired Friis, then only 21, to lead the new ISP's customer service support team. Their project at Tele2 was to launch a discount ISP brand (get2net) and a web portal (everyday.com). Indeed this ISP actually envisioned making an "edge" application.

[501] Henrik Huldschiner, "Zennström: 'Jag Behöver Ingen Lön,'" Dagens Industri, March 18, 2008, http://www.di.se/artiklar/2008/3/18/zennstrom-jag-behover-ingen-lon/.

Zennstrom and Friis left Tele2 to focus on the file sharing music application KaZaa. Skype came later on and could be summarized as invention following necessity. It was because Zennstrom in Amsterdam needed to call Friis in Estonia (who was heading development for Joltid) and wanted to save on phone bills and that they used IP telephony, which did not work so well, that they created Skype.[502] He describes that "success begets success", and that the reason that his subsequent startups (Joltid, Altid, Joost) have worked out so well is because he has become smarter, can hire better people, can raise more money, etc.[503]

While Zennstrom and Friis did invent Skype, they did not invent internet telephony; they only improved it. Much of the Internet applications we enjoy today are not fundamental innovations, but incremental innovations (innovations over 1 to 3 years). They represent the unique implementation and commercialization of underlying technologies, for example the internet protocol itself. Fundamental innovations can take 15 years or more to develop and are frequently the outcome of large budgets and extensive collaborations across universities, corporations, and government labs. There is no rigorous theory of how net neutrality leads to fundamental innovations. Indeed, it may lessen the revenue for investment for fundamental innovation. If networks cannot earn a return on their networks, not only will they not invest in infrastructure, they will not invest in research and development.

Eugene A. Fitzgerald, the Merton C. Flemings-SMA Professor of Materials Science and Engineering at MIT, author of *Inside Real Innovation – How the Right Approach Can Move Ideas from R&D to Market – And Get the Economy Moving* (2011, World Scientific) explains,[504]

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[502] Ibid

[503] Ibid

[504] Eric Brown, "Rediscovering Fundamental Innovation," MIT News, December 3, 2015, http://news.mit.edu/2015/rediscovering-fundamental-innovation-eugene-fitzgerald-1203.

> We were fortunate in the U.S. to have a fundamental innovation paradigm that gave us incredible economic growth for decades throughout all our institutions. Now, with Moore's Law coming to an end, we're seeing slower growth… With the fading away of corporate labs like Bell Labs, the innovation ecosystem in the U.S. has changed. The lack of forward corporate investments has hurt innovation productivity… The lack of investment has cut off the more fundamental innovations that are required for very high economic growth.

The danger in prioritizing application innovation over network innovation is that we lose investment and determination for innovation in fundamental computing and communications. Such shortsightedness may limit such technologies which can power the next wave of economic growth, along with constraining the range of future applications which may not otherwise be supported.

What van Schewick describes as end-to-end internet innovation, essentially, that there is a diverse group of innovators and there is user choice are characteristics that would describe multiple networks. Indeed the ability for any user to create and implement an internet application where end users can choice it amongst others is present in multiple networks including mobile and radio and is not unique to the Internet.

This ability to post information and find it has existed in other networks for more than a century. Consider mobile networks in which one can access premium SMS and value-added services. One need not be a subscriber of the network as the phone numbering system is interoperable. These solutions have been deployed distributed to billions of users for more than two decades. But long before mobile, users accessed via their landline telephones. In fact, shortly after the telephone was invented in the 19th century, the "telephone newspaper" allowed users and innovators to share news, music, and other

information.[505] The telephone newspaper was used for a few decades until it was supplanted by the radio and subsequently television.[506]

While advances in delivering information across the telephone network continued, it wasn't until the 1990s, a century later, that digital subscriber line (DSL)[507] became available, offering a viable means to deliver news, entertainment, and host of other services over telephone wires. With continued innovations in vectoring, copper networks in conjunction with fiber optics, deliver increasing speeds, topping 100 Mbps, and given current buildout, is the prevailing broadband technology in a number of countries.

While not comprehensive, the following chart based upon information[508] from Silicon Valley Computer Museum shows three columns representing the key innovations in computing, communications, and content. These three categories are what comprise convergence, what we consider today as our experienced of the connected world. Considering the grading of Internet innovation, one can see that much of early Internet history was dependent on the development of binary information representation, electronics, computer languages to input data, machines to process the languages, materials to store the data, and processors to computer the data. In communications we have observed techniques in which to send messages across distances, requiring experimentation in materials and transmission methods. We also see the incorporation of the manipulation of electricity to create signals, sounds, and image. These innovations all came about without the TCP/IP protocol stack, and

[505] Roslyn Layton, "What the 'Telephone Newspaper' Tells Us about Today's Internet," Tech Policy Daily, August 13, 2015, http://www.techpolicydaily.com/internet/telephone-newspaper-todays-internet/.

[506] Ibid

[507] Richard Bennett, "John Cioffi, the Father of DSL," High Tech Forum, July 15, 2015, http://hightechforum.org/john-cioffi-the-father-of-dsl/.

[508] Kim Ann Zimmermann, Live Science Contributor | September 8, and 2015 04:10pm ET, "History of Computers: A Brief Timeline," Live Science, September 8, 2015, http://www.livescience.com/20718-computer-history.html.

moreover, enabled it, along with many other innovations. Television and radio immediately come to mind.

For the purposes of the illustration, the first internet content is considered email in 1971, though we could trace the history of content through the millennia. But even the first email precedes the IP suite, as do bulletin boards, online shopping and usenets. There is no doubt that internet content and applications are in their relative infancy, but there is no reason to believe that the innovation in computing and communications is done. Indeed if we freeze the architecture of the internet today and not allow it to take advantage of new advances in computing and communications, it will certainly stunt the growth of edge applications.

Figure 52: Key advances in computing, communications and content

Computing[509]	Communications	Content
1679: Modern Binary Number System	Smoke signals	1971: ARPANET email
1822: Steam-driven calculating machine (Babbage)	550- BC: Mail (Persia)	1973: Bulletin Board System (BBS)
1890: Punch cards (Hollerith	1775: Signal by lanterns in the old North Church (Paul Revere)	1979: Online shopping
1936: Turing machine (Turing)	1790: Semaphore lines (optical telegraphs)	1980: Usenet (Newsgroups)
1937: Computer (Atanasoff)	1838: Electrical telegraph	1982: Whois user information search
1943: Colossus	1867: Signal lamps	1982: SMTP email
1944: ENIAC (Mauchly, Eckert)	1876: Telephone	1983: AOL
1945: John V. Neumann writes draft of stored-program computer	1877: Acoustic phonograph	1988: Internet Relay Chat (IRC)
1947: Transistor (Shockley et al)	1896: First practical wireless telegraphy systems based on Radio	1990: Archie, First content search
1945: First program run on a computer	1914: First North American transcontinental telephone calling	1990: Browser (Tim Berners-Lee)
1953: Grimsdale and Webb build early transistor computer	1915: Western Electric “Coordinate Selector” (used in crossbar switching systems)	1991: First voice over IP telephony application (Speak Freely)
1953: COBOL (Hopper)	1927: Television	1993: Music Performance (video) broadcast over the Internet
1956: Direct keyboard computer	1930s: Teletype	1994: Web-based Internet forums
1958: Integrated circuit (Kilby, Noyce)	1956: Transatlantic telephone cable	1995: IPTV
1962: MIT link, early example of a personal computer	1960: Founding of digital signal processing	1996: Google Founded
1964:Computer-mouse-GUI (Engelbart)	1962: ARPA	1999: Napster
1965: 3C DDP-116, the world’s first 16-bit commercial computer	1962:Commercial telecommunications satellite	1999: News aggregators
1969: UNIX (Bell Labs)	1964: Multics; a time sharing, multi-user system.	1990s: blogging
1969-73: C Programming Language	1964: Intergalactic Computer Network	1990s: instant messaging
1970: DRAM Chip (Intel)	1964: Fiber optical telecommunications	2004: Facebook founded
1971: Arcade Games (By the predecessor to Atari)	1965: Electronic Switching System (ESS) put in service	2005: YouTube
1971: Floppy disk (Shugart)	1965: GE/BELL/MIT Network	2005: Android
1971: Intel launches the first microprocessor	1972: ARPANET	(uncertain year): peer-to-peer networks
1980: Commodore launches VIC-20, the first to sell 20 million	1972: TCP/IP	(uncertain year, depending on definition) social networking
1981: IBM Computer with MS-DOS	1972-1973: CYCLADES Network	(uncertain year, depending on definition): file sharing
1982: Commodore launces the Commodore 64	1973: Metcalfe (Ethernet)	
1983: Apple Lisa (first computer with GUI	1973: First modern-era mobile (cellular) phone	
1983: Gavilan SC (first laptop)	1979: Patent for the use of existing telephone wires for both telephones and data terminals	
1983: GNU OS project announced (Free Unix-Clone) (Richard Stallman)	1981: First mobile (cellular) phone network (NMT)	
1984: Apple launches the Macintosh	1984: ISDN	
1985: Microsoft Windows	1985: First .com registered	
1991: First Linux Released	1988: ADSL	
1993: Pentium microprocessor	1989: HTTP (Berners-Lee)	
2001: Mac OSX, Windows XP	1991: The first Wireless internet was available	
2003: AMD 64-bit processor	1991: Home Broadband	
2010: Apple introduces the iPad	1996: 56K Modem (Townsend)	
	1997: DOCSIS	
	1997: First version of the 802.11 protocol was released	

[509] Ibid.

The idea that the internet is the first and only electronic network for data is wrong. Indeed, the telephone itself was used as both a newspaper and stereo. News, music, and other data were transmitted across telephone wires more than 100 years ago. A key innovation came from Hungarian Tivadar Puskás with his invention of the telephone exchange, enabling switching capacity to increase from 50 to half half a million users. Puskas also developed a "Telephone News Service", launched as Telefon Hírmondó (Telephone Herald) in 1893 and operated for 49 years in Budapest. Using telephone technology, the company built a dedicated network across the city, some 1100 miles of copper, to deliver a daily schedule of spoken news, stock quotations, weather, and entertainment. There was a was no license or regulator as such, so the service operated under a gentleman's agreement with the government and police receiving a written copy of the day's news before it aired.

By 1907 Telefon Hírmondó had some 200 employees and served 15,000 households in Budapest (population 800,000 at the time)[510] as well as a number of establishments (cafes, doctors' offices etc) with coin operated stand-alone phones. Subscriptions cost the equivalent of $16/month in today's dollars.

Naturally to reduce the cost of the network to end users, Telefon Hírmondó had advertising. In conversation with the *Scientific American* in 1907, the managing editor of Telefon Hírmondó remarked that ads were "sandwiched between two particularly interesting items of news, and so (they) commands special attention. Our advertising charges as a general rule are fifty cents for twelve seconds of the stentor's voice… "I have often marveled why a country like America with its amazing enterprise and development has not produced a 'Telefon-Hirmondo' of its own on a far vaster scale than Budapest could possibly manage. You Americans like novelty; your advertisers are enterprising above all others. Possibly before long New York and Chicago, Philadelphia, Boston, and San Francisco will each have a 'Telefon-Hirmondo' of its own, bringing enormous profits to their owners. For all kinds of expenses are eliminated from the cost of

[510] W. G. FITZ-GERALD, "A Telephone Newspaper," Scientific American, Page 507, June 22, 1907, http://earlyradiohistory.us/telenew5.htm.

production, such as paper, ink, typesetting, and a great and expensive staff."

The concept was later licensed as the Telephone Herald[511] in Newark, NJ by M. M. Gillam, former advertising manager of the New York Herald, but it failed a year after launch. A discussion of the American concept and its challenges, including a six month delay from the Public Utilities Commission, appeared in *Telephony* on March 30, 1912. Over 1000 subscribers took advantage of the service for the price of $18 a year, or five cents a day, with a second line for $7 a year, or two cents a day. Without a dedicated line for the service, it was not possible to consume news and make a phone call at the same time.

A similar concept was tried in France, called the Théâtrophone[512] (1890-1932). Transmitters were installed on the stage at the Paris Opera connected by wire to a dispatch center and then to hotels, clubs, cafes, and subscribers' homes. News supplemented the daily transmission of performances. Price discrimination was employed to sell subscriptions and tickets at various rates to different levels of content.

In Britain the Electrophone[513] (1895-1925) service was offered over the existing telephone network in cooperation with the National Telephone Company and British Post Office. Content included live theatre, music, and on Sunday, religious services. One could request a particular program a la carte or by subscription. There was no advertising and subscriptions were high, $50/year in 1900, equivalent to monthly fee of $1428 in today's dollars. At its height, it had only 2000 subscribers. The service was supplanted by the British Broadcasting Corporation, funded through a mandatory licensing fee

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511 Arthur F. Colton, "The Telephone Newspaper--New Experiment in America," Telephony. Page 391-392, March 30, 1912, http://earlyradiohistory.us/telenew3.htm.

512 "The Theatrophone," The Electrical Engineer, Page 161, August 30, 1889, http://earlyradiohistory.us/1889thea.htm.

513 "News and Entertainment by Telephone," United States Early Radio History, accessed August 12, 2015, http://earlyradiohistory.us/sec003.htm.

AT&T made a number of attempts to deliver a news and entertainment service over the telephone in the 1880s-1890s, but it wasn't a success. This shows that just because a network provider offers a service does not mean that it will succeed, even if it owns the network facilities. Ultimately radio broadcasting supplanted news over the telephone, having more favorable economic and physical properties to deliver information farther more cost effectively.

Lee De Forest was a key innovator in this regard, having developed the audion (three electrode vacuum tube) and phonofilm (sound-on-film recording). He also coined the name "radio". He founded the De Forest Radio Company to deliver a WWW of its own: "world wide wireless." Though opera had long been broadcast by telephone in Europe, the company's radio transmission of Tosca from the Metropolitan on January 12, 1910,[514] considered a revolution in communications in America.

DeForest continued experimenting in radio broadcasts in cooperation with the Columbia Graphophone Co., the record company getting a mention on the radio each time a new song was played. There were neither spectrum licenses to deliver radio broadcasts nor consumer subscriptions to receive them. Essentially all transmission were "zero rated" by the network and content providers. By setting up a tower set up at the Woolworth Building in New York city, transmissions could be received by ships at sea. "Dr. De Forest declares that by means of his newly-developed receiving apparatus more perfect music can be heard by wireless transmission than can be conveyed by telephone wires,"[515] noted an article from the Music Trade Review in 1916. Such experiments ended with America's entry into World War I.

Clearly, the mere existence of the telephone network created innovative new services, as did the existence of internet. The internet architecture was quite different from the telephone model, however whether the direct influence of the architecture as the cause of

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514 "The Decades That Invented the Future, Part 1: 1900-1910," Wired, October 18, 2012, http://www.wired.com/2012/10/12-decades-of-geek-part-1/.

515 "Columbia Used to Demonstrate Wireless Telephone," The Music Trade Review, Page 52, November 4, 1916, http://earlyradiohistory.us/1916col.htm.

innovation is questionable, perhaps, PC ownership and network access were strong influencers in such success. However, reading van Schewick, one infers an attitude of forbidding any future competitive technology, as if development in network architecture has finished.

As leader of the Initiatives Group and the Chief Scientist of the International Computer Science Institute in Berkeley, California, Scott Shenker concluded, 20 years ago, "No matter what the eventual long-term developments are, we must modify the architecture to enable the Internet to provide adequate support for multimedia applications in the near term." [516]

We still have not completed this task, but network neutrality advocates want to declare the Internet as a finished product and preserve it in its current form. Such a network can barely stands the test of the application needs of today. Sicker and Lehr observe the "CDN overhang" that characterizes the Internet today to allow it to deliver the most desired application, video. This was not the application for the IP was expressly designed. A lot of patchwork is done to make it possible. This suggests that the functionality of the internet, especially for video, could be improved with a better architecture.

5.3.3 PRIORITIZATION AND DIFFERENTIAL TREATMENT OF TRAFFIC

Van Schewick defines differential treatment as "discrimination" and takes issue with "categorization" of traffic. However, simply categorizing traffic does not mean actually treating it unfairly. Not considered by network neutrality advocates, is that the process of traffic categorization can be configured in a way in which packets are categorized, but are scheduled in an equal manner.[517]

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[516] Shenker, Scott. "Fundamental Design Issues for the Future Internet" (September 1995) IEEE Journal on Selected Areas in Communications, Vol. 13, No. 7: Pg. 1186.

[517] For example, if two categories of traffic are each given 50% of time, the traffic would thus be treated equally. Further, this could also be done with a four category configuration of [25%, 25%, 25%, 25%], or a five category configuration of [20%, 20%, 20%, 20%, 20%], and so on.

The Internet Protocol suite included a number of specifications for to allow priority for certain packets. This can be found by researching the protocol packet design, from the original Priority Bit, to the Type of Service field, and to the present-day Differentiated Services Field. The need for such a service option, particularly for time-sensitive traffic, had been foreseen by the original architects. As such, claims that prioritization of traffic violates the original design intentions of the Internet is are false.

Some of the those protocols include

- The original “type of service” ToS field was proposed and accepted in the IP header. See RFC 791
- The “differentiated service” or DSCP (or just DS) field was proposed and accepted in the IP header. See RFCs “3260, 3168, 2474 and " others."
- The "urgent" bit was proposed and accepted in TCP RFC 793.
- The “class of service” CoS field was proposed and accepted in the Ethernet frame. See IEEE 802.1q extension from year 1987

One may ask why a network operator would set up traffic categories if they are treated equally, thinking that this would eliminate the benefits of prioritization. But such a configuration[518] would separate the traffic into distinct *congestion domains*. What this means is that traffic within one category cannot congest traffic within another category[519]. This could be thought of as setting up individual virtual networks each with its own slice of capacity. For example, a category for streaming video-on-demand traffic could be separate from an alternate category reserved for the bursty data patterns of instant messaging applications. The messaging bursts would not congest the video streams.

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[518] When combined with the appropriate queueing algorithms which have rate guarantees.

[519] Some may think this practice would be inefficient use of capacity, but there are queueing algorithm possibilities that eliminate this worry. Consult with your equipment vendor for their particular solutions.

Furthermore, once the categories have been created, they could also be split and sent across separate physical cables sized proportionately to the needs of each category. Such a practice does not prioritize one category over another, but still allows for different amounts of capacity for each category.[520] Categorizing traffic, therefore, does not always mean that any categories are prioritized or treated in a hierarchical manner.

Van Schewick also takes issue with prioritization, [521] what she calls "fast lanes," [522] a choice of words which seems to have a political end game. Prioritization is a general term, which includes many different practices and network configurations. When network neutrality advocates protest against the evils of enabling prioritization within the Internet, such claims are not technical, as they don't identifying the specific processes, options, measurements, or configurations of particular solutions, which by and large are legitimate activities in the network.

Prioritization in networks refers to queueing and scheduling. While queues are virtual lanes that can be serviced differently, they are not always in use. In typical IP network equipment, queues only form when there is congestion.[523] Without congestion, there are no lanes, and packets are immediately scheduled for output on the device.

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[520] Some critics may assume that splitting traffic categories onto separate links of different speed will "speed up" one category of traffic, however such an analysis is in error. Traffic cannot be re-transmitted any faster than it is received. Further, some may be fooled into "seeing" bursts of speedier packet flow transmission rates. They simply have not considered that for such behavior to be observed, the traffic must have been queued prior to transmission on the physical link, which would cause a delay equal or greater than the link transmission rate burst.

[521] Chris Riley and Robb Topolski "A Free Press/New America Foundation Policy Brief: The Hidden Harms of Application Bias", November 2009, http://www.freepress.net/sites/default/files/fp-legacy/The_Hidden_Harms_of_Application_Bias.pdf

[522] Levy, Josh. "Life in the Fast Lane", November 15, 2011, Free Press blog post. http://www.freepress.net/blog/11/11/15/life-fast-lane

[523] Szigeti, Barton, Hattingh, and Briley. "End-to-End QoS Network Design" (2014) Chapter 5: Pg. 84.

Furthermore, a queue cannot make any traffic go any faster. All that the queueing and scheduler combination can do is to protect traffic during congestion or reduce some delay introduced by the congestion. The claim that network operators can "speed up" traffic is nonsensical, yet even the United States White House webpage on network neutrality includes such a statement.[524] Packets cannot be retransmitted by a network device any faster than it receives them.

Others claim that prioritized packets go "to the front of the line" [525] or "to the front of the queue."[526][527].The problem with such explanations is that they only assume a particular type of algorithm to prioritize traffic, with a particular network configuration. The reality is quite different.

The type of process that net neutrality advocates seem to refer to is called *strict priority-queuing*. Such algorithms are frequently presented in popular computer science texts[528][529] particularly in the study of using basic data structures. One could reasonably suspect that such texts are the sources being consulted by these network neutrality prioritization "experts", especially by those who have studied general topics in computer science. Should such books be the source of the network neutrality advocates knowledge, then they would be failing to realize that the algorithms offered in such books are only simplified

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[524] The White House., November 10, 2014, Open letter, "No throttling" section. https://www.whitehouse.gov/net-neutrality

[525] Lennett, Benjamin "Dis-empowering users vs. Maintaining Internet Freedom: Network Management and Quality of Service (QoS)", 2009, Commlaw Conspectus Vol. 18: Pgs. 97-147. http://commlaw.cua.edu/articles/v18/18.1/06.Lennett.Final.pdf

[526] De Luca, Gennaro. "Net Neutrality for All", April 28, 2015, Leadership Society of Arizona blog post. http://ksmleadership.com/net-neutrality-for-all/

[527] Rajadhyaksha, Niranjan. "The Ambiguous Economics of Net Neutrality", April 18, 2015, Live Mint Article. http://www.livemint.com/Industry/hz8BtbDLFnLkV69HU2EWUP/The-ambiguous-economics-of-Net-neutrality.html

[528] Cormen, Leiserson, Rivest, and Stein "Introduction to Algorithms" (2009) Third Edition.

[529] Sedgewick, Robert. "Algorithms in C" (1998) Third Edition.

examples for the purpose of teaching basic concepts and programming code. It would be extremely difficult to find any modern carrier-network solution provider that actually recommends use of strict-priority-queueing as an algorithm for the scheduling of any IP traffic[530] other than for network control[531] [532].

The origin of study on strict-priority-queueing systems dates back as far as 1954.[533] Net neutrality advocates seem to imply that no further achievements have been made in the area of multi-service resource scheduling since the development of strict-priority-queueing. Fortunately, that is not where the state of technology stands.

Most current network switching and routing equipment would offer a type of traffic queueing algorithm based on a process known as *fair-queueing*[534] and particularly an evolved type known as *weighted-fair-queueing*[535]. Weighted-fair-queuing algorithms will differ by name and vendor implementation,[536] but many generally *guarantee* different

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[530] Particular solutions for supporting time-sensitive traffic (such as Cisco's interim PQ-WFQ and recent LLQ) may be accused of being a strict-priority-queue type, but they differ from classic models. In actuality, they are hybrids and the priority rates are policed. See: Szigeti, Barton, Hattingh, Briley "End-to-End QoS Network Design" (2014) Chapter 4: Pgs. 73 & 89.

[531] Rich Seifert and Jim Edwards "The All-New Switch Book" (2008) Chapter 13, part 13.5.6.1.2: Pg. 544.

[532] However, technology is trending towards moving management/control traffic completely out of data streams.

[533] Cobham, Alan "Priority Assignment in Waiting Line Problems." (1954) Journal of Operations Research.

[534] Demers, Keshav, and Shenker "Analysis and Simulation of a Fair Queueing Algorithm" (1989) Proc. SIGCOMM '89 Symposium on Communications Architectures and Protocols, New York, NY, ACM Press 1989: Pgs. 1-12.

[535] Rich Seifert and Jim Edwards. "The All-New Switch Book" (2008) Chapter 13, part 13.5.6.1.2: Pgs. 542-543.

[536] For example, Cisco has offered: CQ, WFQ, PQ-WFQ, CBWFQ, and LLQ. All are different implementations which use the concepts of weighted-fair-queueing. See: Szigeti, Barton, Hattingh, and Briley "End-to-End QoS Network Design" 2014, Chapter 5: Pgs. 86-87

amounts of time (or packets, or bits) to different categories of traffic. It seems that network neutrality advocates have no knowledge of these algorithms, options, and variants. However, it is also possible that they may be somewhat aware of weighted-fair-queueing algorithms, but simply misunderstand them. Or, perhaps they consider one particular implementation or option as a model strictly used by all other configurations.

In other words, in most modern network operator-grade network devices supporting multiple categories of service using modern queueing algorithms, "priority" packets would not simply "get to the front of line" or "get to the front of the queue", nor would they degrade traffic in other categories as is commonly claimed. Different categories of traffic are simply serviced at different rates, which once established do not degrade each other.[537]

For example, imagine that you are walking a path where there are two lanes. One lane is for walkers such as you, while the other is reserved for bicycle riders. While the bicycle riders may pass by you, your walk is not affected. You are not forced to stop, walk slower, nor move out of the way. There is no degradation of your walking rate caused by the bicycle riders. That is an example of a multi-service

[537] There would actually be a degradation of service if particular queueing algorithms are simply enabled on an existing link interface, as it would re-allocate capacity. Some algorithms may minimize this effect. To completely eliminate this capacity re-allocation degradation, network operators could simply enable the algorithms while adding capacity at the same time. Such action would compensate for the re-allocation. Once set up, there is generally no cross-degradation caused by traffic in separate categories (depending on choice of implementation).

network configuration that network neutrality advocates cannot seem to think of, which clearly refutes claims of degradation[538].

Beyond traffic categorization and prioritization lays an even more beneficial network practice known as resource reservation.[539] In resource reservation, a network endpoint is able to reserve an end-to-end connection with another endpoint on the network. The practice of resource reservation, by reserving data capacity on the network as an example, could make each connection impervious to congestion. Currently, additional traffic creates a dilution in network capacity, and all user data flows suffer. The "neutral" Internet technology, as it stands, cannot guarantee a user end-to-end anything. Speed, latency, jitter, and capacity subscription are all subject to change. Right now, they are variables.

Booking a hotel room is a real-life example of resource reservation. One pays for a chunk of capacity (the room) for a specified duration of time. Others staying at the hotel, and the public at large, have no rightful claim to access the space provided in your room or its contents. And you pay for this, as you are using the hotel's resources for your wants and needs.

Resource reservation also creates accountability on the part of network operators. For implementing resource reservation could bring back a concept from the telephone network – the busy signal. When a connection is requested of the network, if the resources aren't

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[538] Network neutrality advocates would say that there currently exists only one path, and that the bicycle lanes will be created by painting a line down the middle, making the walker's path narrower. They would reason that the walkers to have to slow down, briefly stop, or exit the lane when encountering the increased congestion of other walkers on the newly narrowed path. However, to provide an analogy of the previous footnote: If the owners of the single path widened the path when painting the division line, while keeping the walking path the same width (or expanding it), the walkers would not experience any degradation from the addition of a bicycle lane.

[539] This document uses the term "Resource Reservation" in a generic manner, only meaning the ability to reserve any network resource. It is not referring to any particular protocol or practice, such as "RSVP" (commonly known as "resource reservation protocol" or "resource reservation setup protocol").

available, the network does not accept the reservation,[540] thus preventing dilution of capacity to irritable or unusable levels. Such refusals would flow from provider to provider, ultimately identifying the network that refused the request for resources and could even include the reason why. This also creates a critical log of data which can be utilized by carriers in deciding network upgrades, troubleshooting customer complaints, or resolving multi-provider disputes.

Resource reservation sounds great, however the FCC's definition of "prioritization" somehow includes resource reservation.[541] So any solution of this type, regardless how beneficial, is banned under US Open Internet rules.

The farmers market is all about user-control. You may desire fresher produce, items that have had more vine-ripening time, or special varieties. Contrast this to commoditized produce which is from further away, picked early and ripens in a truck, with only a few varieties available. You frequently pay more for the attributes offered at the farmer's market which are important to you.

5.3.4 NETWORK ACCOMMODATION

Network accommodation is, ideally, user-directed choice. It allows the user to decide how their traffic should be handled in a variety of situations. Before we can continue however, it is an imperative that we dispel an enormously popular myth about network traffic: The assumption that deep-packet-inspection (DPI) is required to perform network accommodation. For this claim is the foundation of an edifice of argument that declares network service providers as the judge and assigner of packets into categories.

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[540] This is known as admission control.

[541] United States Federal Communications Commission (March 12, 2015) FCC 15-24, In the Matter of Protecting and Promoting the Open Internet, GN Docket No. 14-28, Part 125: Pg. 53.
http://transition.fcc.gov/Daily_Releases/Daily_Business/2015/db0312/FCC-15-24A1.pdf

DPI is when a network looks within a data packet to determine its contents. Some network neutrality advocates claim that the way accommodation works is by a service provider enabling DPI, peering into a packet, assessing the packet's content, and assigning said packet to a category based on what it finds within. Such vocalists sing songs of network service providers being the sole deciders of how content is interpreted, and call such practices gross privacy violations. The problem with the argument is its base assumption of accommodation-requires-DPI. But DPI is absolutely not a necessary part of network accommodation. In fact, it is an inefficient and inaccurate way to implement network accommodation. Its use is simply not needed. But this myth perpetuates, and taints the network neutrality conversation.

Currently, most highly-used programming languages contain the ability to set the field within IP packets which would indicate a category of service. It is not impossible, nor even just theoretical. This can be done right now. Programmers already have the resources available to make the most of this opportunity. Applications could easily have settings, configurable by the user. Such settings would dictate the categories for the constructions of packets *before they are placed on the network.* No DPI is needed, whatsoever. Further, both fixed and mobile operating system developers have this same capability, and should allow the user to create policies which cannot be violated or overridden by the applications.

But the FCC, in their Open Internet order, flatly banned the practice of network accommodation (referred to as prioritization). Such an act clearly ruins the ability of service providers to enable users to enjoy the benefits of user-controlled configuration-of-service. However, part 139 in the Open Internet Order contrarily expresses support for user control.

In the proper practice of configuration-of-service, implementing network accommodation, the user would control the assignment of their data to categories. Exposing the imagined foundation of accommodation-requires-DPI (and thus also the claim of carriers "picking winners and losers" as the result of no flat bans) as invalid, we can finally move on to explaining how accommodation actually

works. The user, within an application's settings, configures how their data should be handled.

For example, assume a multiservice communication app that offers VoIP calling, text messaging, picture sharing, document sharing, a live video feed, and multiuser turn-based gaming. Such requires disparate use of the network, optimized for different types of handling. The app may be loaded with defaults, but the user could customize the assignment of each offering into categories, perhaps further divided into input and output, to provide maximum desired benefit. The data from the app is then placed into packets tagged with the appropriate categories, and is handed off from the device to the network. The network receives the packets, handles them as directed by the user, and charges proportionately to the network resource demands of each particular category of service. This is simply pay-for-what-you-use, and offers no preference to one user or another in any given category. In addition to metered billing, assumedly, service providers may also offer pre-determined bundles of bulk usage to a customer, or custom plans as well. It's all up to the customer.

There is a conceptual misunderstanding of network accommodation. The policy hype consistently communicates that in practice, service categories are always deployed according to a model of preferential treatment over one another. That is but one possible implementation, but it is not required. Another possible configuration is one of utilizing categorization, but with equal treatment of categories by network devices. Without getting too technical, let it suffice to say that this would be providing a choice of separate virtual networks, over a single converged physical infrastructure. Such a practice would keep the ability to route traffic down separate optimized paths, but without the ability for one set of traffic to degrade another.

This misunderstanding of different ways to employ network accommodation brings fears of performance degradation. We have all heard that network accommodation "degrades" the performance of standard traffic classified as "best effort". That can be true, but only when service categories are deployed according to a model of preferential treatment. It is certainly *not* true when employing a virtual network configuration, in the ways discussed in the previous

paragraph. Another problem with this degradation claim is that "best effort" service is non-guaranteed to begin with, and is subject to dilution and degradation anyway. That's not to say that maybe mass-market customers aren't aware of this. If a service provider does not state clearly that service is not guaranteed or buries a disclaimer somewhere in a multi-page user agreement, they do so at their own peril.

In his June 26, 2015 appearance at the Brookings Institution, FCC Chairman Tom Wheeler states, "The telegraph was the original open network. There was no prioritization in it." While such a claim may be true, it doesn't recognize the larger context. The telegraph networks were absolutely a prioritization over the postal network for sending telegrams, and prices reflected this. This is important, for perhaps we need to stop looking at the Internet as a single network. With network accommodation, it could actually be a collection of separate virtual networks for differentiated services, over a converged physical architecture, as previously described.

Priority mail is a frequently-used real life example of network accommodation. It offers varied times of delivery for additional charge. It also offers other service enhancements that may be of interest such as signature options, delivery-tracking, return receipts, etc. – And it charges for those too. And lastly, for certain informational contents there is a more-affordable option: media mail.

If one uses priority mail, makes a hotel booking, or buys produce at a farmers' market, then one engages in user-controlled, paid, configuration-of-service. Given that these services are commonplace, it's strange that they should be outlawed by net neutrality rules.

The FCC's Open Internet Order only bans *paid* accommodation (referred to as prioritization). So any reasonable person would then ask: Why, if all this user control is possible, can a service provider not implement it free of charge?

The simplest answer is that assigning traffic from best-effort transmission to network segments featuring optimization of various network parameters costs money. Be it speed, shorter paths, more or

less shared capacity, guaranteed capacity, stable queueing rate, more security, or anything else, these special configuration-of-service options for the customer costs the service provider more money to design, build, and operate.

Secondly, paying for accommodation decreases the incentive for application developers, content providers, and customers to improperly set configuration-of-service options. With the financial motivation to only take what they really need and pay for it, the application developers, content providers, and customers actually maximize the benefit of the network for all other network participants. This is efficiency, and would thus keep costs down for all users.

Lastly, payment for accommodation and resource reservation also promotes quality technological solutions, namely, in upper-layer protocol and data design. If there is no realizable reward for efficient protocol and data design, they may bloat up into a single protocol or data format for all, and be stuffed with fields for every possible function possible. Such a situation is in stark contrast against slender, nuanced, purpose-fit protocols based on individual needs.

Payment for accommodation and resource reservation are not unreasonable requests. In fact, they are required for the network to operate in a way which spreads benefit to all participants. Paying for what you want and need is far from being a foreign concept. One could assert that it is common sense, practiced daily in many other aspects of life.

Who should pay? A simple solution would dictate that sender pays. The sender is placing the data on the network and taking up the resources. Such an arrangement would cover asymmetric usage such as content delivery, as well as peer-to-peer flows. Interconnection agreements can easily follow this. It also prevents parties from incurring fees upon others by sending them traffic. Consumers are also increasingly becoming content creators, particularly with live-video-feed apps such as Periscope, and will require quality upstream real-time service options. This diverges from typical categorization of mass-market users as being a content-consumption based population. Behavioral expectations of network services need to change, along

with pricing to reflect the new reality: Network operators need to offer options to optimize a variety of types of traffic, to and from any endpoint.

5.3.5 SOME LINGUISTIC ERROR CORRECTION ON DIFFERENTIAL TREATMENT

The net neutrality literature is full of doom-filled prophecies of "discrimination" and "fast lanes" threatening to "end the Internet as we know it" [542] and makes a call to arms against "specialised services" and zero rating, the "global threat to the Open Internet."[543] However regulation, not to mention a correct and meaningful discussion, requires more nuance.

The collected set of language in all its forms may be the greatest protocol set ever. It can transfer ideas. It allows expression, explanation, and a form of artistry. It can enable education and facilitate detailed understanding. But its users can become prisoners of a limited subset of language – the words themselves. Context therefore is extremely important, as shifting the streams of our imperfect words from one context to another can have dire consequences for one of our most important natural apps: The communication of our thoughts to others.

In debates, words can be used to invoke fear and misunderstanding as a means to promote a particular policy. In the net neutrality debate, terms such as "discrimination" and "fast lane" are deployed in inflammatory means to scare people into support particular regulation. "Fast lane" as deployed by van Schewick is not technically correct. Moreover, without prioritization or "fast lanes" the Internet as we

[542] Barbara Schewick, "Europe Is About to Adopt Bad Net Neutrality Rules. Here's How to Fix The," Cyberlaw, October 22, 2015, /publications/europe-about-adopt-bad-net-neutrality-rules-here%E2%80%99s-how-fix.

[543] Masse, Estelle. "Zero Rating: The Global Threat to the Open Internet." AccessNow, accessed 7 November 2016 https://www.accessnow.org/zero-rating-global-threat-open-internet/

know it will not work. Consider that content delivery networks (CDNs) already enable more than a majority of video traffic.[544]

Take the concept of network prioritization. What is unfortunate is the shift of the stream of words describing Internet prioritization used in a technical sense, into an unfitting context of social justice. Terms such as "priority", "class", "quality-of-service", "discrimination", when kidnapped from the discrete practice of network engineering and forced to perform within the arena of public policy.

What is really envisioned in the realm of differential treatment of Internet traffic is more appropriately conveyed with another term, *accommodation*. Accommodation is a recognizance of different entities with different wants or needs, and adjusting services to meet those most beneficial to the individual. It is a just vision, allowing for the network to exhibit elasticity and provide services for as many varied uses as possible. Also, our new term encompasses the very real practice in which differing traffic, while being treated separately, is not given any "priority" treatment resulting in detrimental effects to other traffic.

Another network term which in misappropriated social justice context is *class*. Class is a word which (in one particular context) hints of a status within a hierarchy, and is not accurately reflective of the technology. A more precisely mapped term would be *category*. For each category is not necessarily better than any other category, as the participants may be accommodated by the network in differing ways which deliver disparate desired outcomes. Also appropriate, is the older IP term *type-of-service*. Type-of-service reserves a tolerance of differences, without inadvertently indicating any forms of superiority or inferiority.

One may think that the above reasoning should therefore also require the removal of the term *tier*. Tier, however, tier argue has usefulness, as differing services may have alternate levels based on offering. For

[544] "White Paper: Cisco VNI Forecast and Methodology, 2015-2020," Cisco, June 6, 2016, http://www.cisco.com/c/en/us/solutions/collateral/service-provider/visual-networking-index-vni/complete-white-paper-c11-481360.html.

example, under a service offering titled “voice” one could have the following categories: “Tier 1: Classic Voice”, “Tier 2: Enhanced Voice”, and “Tier 3: High-Definition Voice”, where all still achieve “quality”. This term still indicates a level of service, but without the snooty connotations of class.

The next correction addresses another off-color and oft-repeated term, *quality-of-service*. The folly lies in the first segment of the term, *quality*. The word indicates that under such a phrase, all which follows is but a selection of variables and processes whose values either enhance or detract from quality. As with the prior terms, once again the supposed meaning lands off-the-mark. In a nod to accuracy, the term should be righted to describing its true definition, which is *configuration-of-service*. For individual applications absolutely have distinct uses, requirements, and tolerances of network variables, which while different, can all deliver quality.

Finally, the last stop on the road to recovery is removing the dirtiest network word of all, *discrimination*. The term comes stock with negative connotation, often a misapplied and inaccurate approximation of functional reality and purpose. Luckily, another more correct term is also already present in our network vocabulary, *differentiated service.* Differentiated service a recognizance of varied wants and needs, and that a network can serve the application in a multitude of ways.

Now, with corrected terminology, it is time to put it all together and state the true goals of this hotly-debated network technology:

To provide differentiated service to meet the wants and needs of various applications and their users, broadband providers wish to implement configuration-of-service options. Participants’ traffic is thus accommodated by the network to deliver the desired results to the participants.

Updating the vocabulary of the debate with proper and neutral language could improve the understanding of technology and the correctness of policymaking.

5.3.6 RESPONSE TO CALLS TO BAN ZERO RATING

Van Schewick was invited by BEREC to provide her input to the guidelines for implementation of net neutrality by national regulatory authorities.[545] She makes a number of assertions[546] for zero rating which should be addressed for their assumptions and lack of evidence.

Zero rating hurts competition

BVS: In the European Union, many ISPs zero-rate their own video applications. Users on these plans can watch unlimited zero-rated videos, but their bandwidth caps prevent them from watching more than 2–5 hours of video content unaffiliated with the ISPs. Similarly, many ISPs in Europe zero-rate their own cloud-storage applications. Their users can upload 10 gigabytes of traffic to the ISP's cloud storage for free. But it costs between $50 and $70 to upload the same amount of data to other cloud storage sites like Dropbox or Google Drive. These plans make it effectively impossible for unaffiliated providers to compete with the ISP's zero-rated application.

There are a number of reasons why an ISP would zero rate its own content, but it is not necessarily problematic. Indeed it is frequently pro-competitive. One concern of zero rating opponents is that if users perceive two applications as close substitutes, then they will chose the zero rated one over the non-zero rated one. This presumes the content market conforms to perfect competition (no market power of any actor, homogeneous products, no transaction costs, no barriers to entry, perfect information). This reality of the content market is different, so the model of imperfect competition is preferable for

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[545] "Update on BEREC Work to Produce Guidelines for the Implementation of Net Neutrality Provisions of the TSM Regulation," Berec, February 2, 2016, http://berec.europa.eu/eng/document_register/subject_matter/berec/press_releases/5740-update-on-berec-work-to-produce-guidelines-for-the-implementation-of-net-neutrality-provisions-of-the-tsm-regulation.

[546] Barbara van Schewick, "Europe Is About to Adopt Bad Net Neutrality Rules. Here's How to Fix Them," Medium, October 22, 2015, https://medium.com/@schewick/europe-is-about-to-adopt-bad-net-neutrality-rules-here-s-how-to-fix-them-bbfa4d5df0c8#.egr9aq45y.

analyzing the situation. The market for content is highly imperfect, and as has frequently been observed, that an ISP zero rates its own content has little to no impact on the market. Indeed the traffic and price impact is frequently so small that it cannot be measured.[547]

A common situation in which an ISP would zero rate its own content would be in the case of sports, and increasingly ISP purchase sports rights. The ISP already owns the content, and the subscribers indirectly pay for the content through their subscriptions. It may also be the case that a subscriber has a pay TV subscription for content for which they pay for the content and being able to access the content on a mobile device is a convenience. Many regulators may welcome new buyers to the sports market because it breaks the deadlock of established oligopolies of television broadcasters. To be sure, sports franchises are pleased about having ISPs as new buyers.[548]

But such investments also benefit content creators. Consider the purchase of AOL and Yahoo by Verizon. A key problem with classic internet business models is that advertising platforms only monetize content with ads; they don't necessarily pay for the underlying content. That mobile providers find means to pay for content and deliver it to their customers without data charges is a necessary and valuable development to create incentives for content creation. A number of providers purchase popular content with the hope of winning new customers and thereby justifying greater investment over a larger subscriber base. It may well be that that some customers select the ISP because they love football, but on the other hand, non-sports fans are not worse off by free football. Both enjoy the greater investment in network that can result with a larger subscriber base.

To be sure, Netflix would likely make the same argument, that provisioning the network serves all customers. However if all network operators have deliver Netflix in the same way, there is a no ability for the operator to differentiate and win customers as a result. It is

[547] Supra Layton, Calderwood 2015.

[548] Claire Atkinson, "NFL Looking to up Verizon's $1B Streaming Deal," New York Post, February 9, 2016, http://nypost.com/2016/02/08/nfl-looking-to-up-verizons-1b-streaming-deal/.

perhaps the thinking of Comcast in making a partnership with Netflix for their Xfinity platform that the parties found a way to make a win-win. Comcast makes the investment in their network and technology to give Netflix more visibility; and Comcast and Netflix partner together to market Comcast's superior platform for viewing Netflix. With such an offer, those customers who value Netflix above other video streaming apps may switch to Netflix. Or it may be done as a churn reducer or revenue saver. Comcast customers may be less likely to downgrade to a lower package or switch to another provider if they have a better Netflix experience on Comcast.

In practice, mobile operators need multiple business lines to cover the cost of infrastructure. The cost of voice and SMS are declining relative to the rise in traffic. Some operators face a two-thirds shortfall on their infrastructure. But the investment made as a result will support an ecosystem for a range of new services, connected cars, online education, telemedicine, IOT etc. That the investment can funded in part through entertainment to enable arguably more vital services is a defendable decision. Moreover if a subset of entertainment users can drive investment such that other users who have less ability to pay for services, then it is also a socially-beneficial and defendable decision.

That ISP purchase content which they subsequently offer to their customers would likely be evident of competitive markets. The ISPs can't compete on price alone, so they have to find other parameters to differentiate. To be sure, this is problematic for van Schewick as she only wants the ISPs to compete on the same commodity parameters, e.g. price, coverage, and network quality. But these parameters will generally be dominated by the incumbent network providers, thereby enforcing the market power which differentiation seeks to lessen. In reality consumers have other parameters on which they buy, e.g. customer service, ability to go to a retail store, brand identification, device promotions, bundles, and so on. Van Schewick considers these the improper parameters on which to select internet access,[549] but theories of consumer choice suggest that they are appropriate parameters.

[549] Personal interview, van Schewick, 31 August 2016

In point of fact, that market for mobile service may be more perfectly competitive that Internet content. Most mobile markets in the OECD have three or more mobile networks, with the US being one of the most competitive of any.[550] Such offers are the result of the need to differentiate not only among the mobile operators but from pay TV providers which have many more incumbent advantages. Consider that wireline providers offered seemingly unlimited broadband and video. Mobile networks are inherently constrained, so offering a popular service for free is the only way to differentiate in such a competitive mobile market.

In competitive markets, regulators have no advantage over consumers in selecting better bundles. If anything, if regulators pick the offers, consumers could accuse the telecom regulator of a "regulatory taking"—restricting consumer choice and reducing the range of product available.

Regarding the case of zero rating of proprietary cloud applications, the case came up in Slovenia, which was only the second country to make a net neutrality law, and the non-binding opinion of the Slovenian Competition Authority was that the zero rating of Telecom Slovenia's cloud service was not harmful to Google Drive or Dropbox. In fact it stimulated Slovenian application and content development, a goal of the EU's Digital Single Market.[551]

Zero rating harms users

BVS: When European ISPs start zero-rating certain applications or content, they often reduce overall bandwidth caps or increase the price of unrestricted bandwidth, as the European research firm Rewheel has shown. This is not surprising: the lower the bandwidth caps, the more attractive zero-rated applications become, so lower bandwidth caps motivate rich providers to pay for zero-rating. Thus,

[550] William Rogerson, "THE ECONOMICS OF DATA CAPS AND FREE DATA SERVICES IN MOBILE BROADBAND," August 17, 2016, http://www.ctia.org/docs/default-source/default-document-library/081716-rogerson-free-data-white-paper.pdf.

[551] Supra Layton, Calderwood 2015

zero-rating harms users (and the providers of applications that are not zero-rated) by reducing the amount or increasing the costs of bandwidth that users can use however they like. By contrast, when a Dutch regulator banned zero-rating, the provider KPN doubled its monthly bandwidth cap for mobile Internet access from 5 to 10 GB at no additional cost.

The statement likely reflects van Schewick's normative perspective which establishes net neutrality as the standard to evaluate internet practices. This is not an objective but rather a normative standard. From a competition perspective, consumer harm is observed when prices increase and output declines. In other words, consumer welfare lessens. Empirically it has not been demonstrated that consumers have experienced increased prices, lowered innovation, or lessened output from zero rating. Instead consumers experience a lowered or free price. Secondly zero rating has increased the traffic to various internet destinations; this has been shown with T-Mobile's free data programs, for example.

While a few van Schewick and a few net neutrality advocacy organizations have complained about such programs, the vast majority of consumers enjoy them. This is evidenced by their consumer satisfaction[552] and their behavior, switching to programs they prefer. This consumer choice van Schewick considers suspect. T-Mobile, for example, has seen considerable growth in their customer base since the launch of their zero rated Music Freedom and BingeOn streaming programs.[553] According to T-Mobile, customers utilizing Binge On streaming are watching more than two times more minutes per day from streaming services than before and have streamed over 190 million hours of video for free. T-Mobile customers stream more than

[552] John Tevs, "2016 U.S. Wireless Customer Care FS NC Performance Studies Vol 1," Text, J.D. Power, (January 27, 2016), http://www.jdpower.com/press-releases/2016-us-wireless-customer-care-fs-nc-performance-studies-vol-1.

[553] "P3 Insights Separate T-Mobile "Binge On" Fact from Fiction" P3 Group. January 15, 2016. http://www.p3-group.com/en/wp-content/uploads/2016/04/P3_Binge_On_Insight_Report_1-15-16.pdf

60 video services, which now represent a full 70 percent of all video they watch on their phones and tablets each month.[554]

T-Mobile won 8.3 million net new customers in 2015[555] in part from free video and music offers and is reported to have the highest rate of customer satisfaction among US mobile carriers, as measured by numerous reports and surveys.[556] It's unlikely that the FCC would ban such a program, as the evidence points to competition and consumer welfare. More generally, the FCC is unlikely to ban free data as there is a high poverty rate in the USA and a number of groups representing disadvantaged communities have lobbied the FCC to keep data free.[557]

Regarding KPN, that it increased its data cap comes at the expense of eliminating their lowest priced offer. This means that those with the least ability to pay now have less choice. However the richest users

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[554] Overall, T-Mobile has zero-rated 34PB of video traffic, which is the equivalent of 109 million hour-long DVD quality episodes of HBO's Game of Thrones. Although there were concerns that Binge On may throttle data through its optimization features, T-Mobile has since changed its policy allowing video service providers to opt-out.

[555] "T-Mobile Adds Over 8 Million Customers for Second Consecutive Year | T-Mobile Newsroom," T-Mobile, January 6, 2016, https://newsroom.t-mobile.com/news-and-blogs/t-mobile-adds-over-8-million-customers-for-second-consecutive-year.htm.

[556] John Legere, "It's Official. T-Mobile Is #1 in BOTH Customer Satisfaction & Network Speed! | T-Mobile Newsroom," T-Mobile, accessed November 12, 2016, http://newsroom.t-mobile.com/news-and-blogs/customer-satisfaction-network-speed.htm.

[557] "ACT NOW TO KEEP FREE DATA | Multicultural Media, Telecom and Internet Council," MMTC, accessed November 12, 2016, http://mmtconline.org/action-center/.

Marcella Gadson, "Understanding and Appreciating Zero-Rating," MMTC, 2016, http://mmtconline.org/WhitePapers/MMTC_Zero_Rating_Impact_on_Consumers_May2016.pdf.

rmendoza, "Zero-Rating Programs Provide One Form of Bridge across the Digital Divide," HTTP, April 14, 2016, http://httponline.org/2016/04/zero-rating-programs-provide-one-form-of-bridge-across-the-digital-divide/.

now have more data. This "regressive progressive ruling"[558] actually rewards the rich who already have ample access over the poor. It bears mention that the ban was placed on Vodafone's zero rated offer of HBOGo, which incidentally was never a threat to market leader Netflix, which can be verified by traffic analysis and mobile app measurement. That KPN responds as it did reflects the incumbent's larger network, so perversely the Dutch telecom regulator ACM has incentivized the incumbent at the expense of the entrant.

Van Schewick does not conduct any research in the document but references work by consultancy Rewheel, the methodology of which has been critiqued by respected economists. In any case the Rewheel study on zero rating only does not measure consumer harm. The same figures could be used to justify zero rating as pro consumer and pro-competitive efforts, particularly for corporate social responsibility arguments. While the debate on zero rating is new, the practice of zero rating is not. In fact half of the world's mobile operators[559] use some form of zero rating, and it has been around for more than a decade[560] with little to no controversy.[561] It is only with the shift to mobile broadband and its potential to disrupt established advertising revenue streams that the practice has become an issue.

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[558] Hurwitz, Gus. "Regressive Progressives at FCC." TechPolicyDaily.com September 16, 2016. http://www.techpolicydaily.com/communications/regressive-progressives-fcc/

[559] "MobileTrends Charging Report," 2014, http://www.allot.com/resource-library/mobiletrends-charging-report-h1-2014/.

[560] "Zero Rated WAP Traffic," Geekzone, accessed November 9, 2016, http://www.geekzone.co.nz/forums.asp?topicid=4895.

[561] Roslyn Layton and Silvia Monica Elaluf-Calderwood, "Zero Rating: Do Hard Rules Protect or Harm Consumers and Competition? Evidence from Chile, Netherlands and Slovenia," SSRN Scholarly Paper (Rochester, NY: Social Science Research Network, August 15, 2015), https://papers.ssrn.com/abstract=2587542.

Rewheel's report[562] states that a number of European countries want to ban zero rating, a report which van Schewick (and other advocates[563]) cite in policy discussions to support of hard net neutrality. But the assertion is not a fact; it is an interpretation from a meeting of the European Council in November 2014.[564] Based upon an unofficial translation of the meeting, Rewheel deduced that a set of national representatives to the Council expressed interest in restrictions on price discrimination. However such statements as made in the Council could not be found in the official proceedings from national countries from which the representatives come, and some of the representatives have changed from the Council in 2014 to today. Therefore it cannot be concluded, as Rewheel reports, that these countries wish to restrict differential pricing or zero rating at this time. In any case, the EU law stands at present and does not suggest such a restriction.

Zero-rating harms innovation and free speech.

BVS: Start-ups, small businesses, and low-cost speakers in Europe and elsewhere don't have money to pay for fast lanes; they don't have money to pay for zero-rating, either. But if some companies can pay to be zero-rated, those who can't pay will find it hard to compete. Thus, allowing ISPs to zero-rate websites or services against a fee creates the same problems for innovation and free speech as allowing ISPs to charge for fast lanes.

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[562] "Net Neutrality Is about the Price of Open Internet Access, More and More EU Governments Realize," Rewheel, December 1, 2014, http://dfmonitor.eu/downloads/Net_neutrality_about_price_open_internet_access_Dec2014.pdf.

[563] Benjamin Klass et al., "There Ain't No Such Thing as a Free Lunch," Canadian Radio-Television and Telecommunication S Commission, June 2016, http://www.cmcrp.org/wp-content/uploads/2016/04/CMCRP_Intervention_to_TNC_CRTC_2016-192_Jun2016.pdf.

[564] "Transport, Telecommunications and Energy Council," Council of the European Union, November 27, 2014, http://www.consilium.europa.eu/uedocs/cms_data/docs/pressdata/en/trans/145957.pdf.

First of all, there are ”fast lanes” all over the Internet today. They are called content delivery networks, bandwidth reservation systems, and other such technologies. If we did not have them, the internet would not work. These technologies exist at a range of price points, and are used by all manner of enterprises large and small. No one considers it discriminatory to buy their services. Delivery is just another input like electricity. No one suggests that startups should get electricity for free, even though it is an input.[565] There is no reason why quality of service should be any different.

Van Schewick is describing a legitimate set or practices and technologies in an inflammatory way to scare people into her preferred policy. Fast lanes is not even a correct description of what she is trying to describe. See the section on prioritization for further explanation.

Generally there is no fee for zero rating, but if there was, the price would be a function of supply and demand. An ISP can only charge a price if it offers a commensurate value for the service which the startup is willing to pay. If the ISP could deliver a startup in such a way that it could guarantee to lower the app’s cost of customer acquisition, then it would be worthwhile to pay a fee up to the price of the next marginal marketing strategy. At present startups are left to conduct marketing in a range of expensive and frequently ineffective means.

What Van Schewick is saying that only rich companies will pay for such a service, well, if that is the case, that it true for any service regardless of the provider. Van Schewick has no proof that will happen (or evidence that is has); it’s only a conjecture, but if such an outcome evolves and it is anticompetitive, there are plenty of laws to address it.

There is no doubt that wealthy companies can purchase a range of services, but if there is demand for such service by small companies,

[565] Michael L. Katz, “Wither U.S Net Neutrality Regulation,” May 15, 2016, https://techpolicyinstitute.org/wp-content/uploads/2016/05/MLKatzWitherUSNetNeutralityRegulation.pdf.

the opportunity leads competitors to offer the same or similar services at an attractive price point. This is true for any good or service. If a company goes to the trouble to create a service, it wants to maximize the buyers of that service. If the price is too high, then companies won't buy it, and the ISP will make no revenue.

ISPs generally don't offer such services because the transaction costs of making a deal with every possible end point on the Internet are too high. This is another reason why blocking content in general is not worthwhile. An ISP could block content for which it disagrees (religious, cultural, political), but this is not profit maximizing. It only makes sense in the case of religious ISPs such as JNet, which offers their customers a set of curated conservative Jewish content while filtering content deemed inappropriate. Indeed that net neutrality rules do not allow ISPs to tailor offers to their customers actually violates free speech. Net neutrality rules could well be struck down in the US because of free speech and First Amendment concerns because the law protects against government's interference in speech.[566]

Zero rating is likely a form of speech that is protected by the First Amendment of the Constitution.[567] Zero rating conforms to all aspects of the classic definition of marketing: product, price, place, and promotion.[568] Thus bans on zero rating may be bans on free speech. To be sure, "deception" and false advertising are not allowed, but the freedom to make an offer in the marketplace is a fundamental as speech itself.

The distinction between technical and commercial reasons is irrelevant for the First Amendment. Indeed for a network, technical and commercial concerns are one in the same. Thus some net

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[566] Brent Skorup and Christopher Koopman, "The FCC's Transaction Reviews and First Amendment Risks," SSRN Scholarly Paper (Rochester, NY: Social Science Research Network, June 4, 2016), https://papers.ssrn.com/abstract=2814643.

[567] "Advertising and the First Amendment," LawPublish, accessed August 5, 2015, http://www.lawpublish.com/amend1.html.

[568] McCarthy, Jerome E., 1960, Basic Marketing. A Managerial Approach. Homewood, IL: Richard D. Irwin.

neutrality rules against how operators price and manage their networks may be unconstitutional. Legal scholar Fred Campbell explains[569]

> It is constitutionally irrelevant that the content-related restrictions in the open Internet rules also implicate business concerns.[570] The Court has long held that the commercial nature of the press does not deprive it of First Amendment protection, because there is no constitutionally permissible way for the government to separate the business interests of the press from its editorial function.[571] The existence of "'commercial activity, in itself, is no justification for narrowing the protection of expression secured by the First Amendment,'"[572] in part because even early printers were capitalists who were regarded as innovators.[573] The combination of the profit motive "with other motives that were self-serving and altruistic, and even evangelistic, at times," played a role in the "rapid expansion of early printing industries.[574] The editorial and business interests of the press

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[569] Fred Campbell, The First Amendment and the Internet: The Press Clause Protects the Internet Transmission of Mass Media Content from Common Carrier Regulation, 94 NEB. L. REV. 2016. See also "CBIT White Paper: How Net Neutrality Invites the Feds to Ignore the First Amendment & Censor the Internet," Tech Knowledge, accessed November 9, 2016, http://techknowledge.center/blog/2015/06/cbit-white-paper-how-net-neutrality-invites-the-feds-to-ignore-the-first-amendment-censor-the-internet/. p 32-33, 51

[570] Bigelow, 421 U.S. at 818, quoting Ginzburg v. United States, 383 U.S. 463, 474 (1966). ("The existence of 'commercial activity, in itself, is no justification for narrowing the protection of expression secured by the First Amendment.'").

[571] See Tornillo, 418 U.S. 241, 258.

[572] Bigelow, 421 U.S. at 818, quoting Ginzburg v. United States, 383 U.S. 463, 474 (1966).

[573] Elizabeth L. Eisenstein, The Printing Press as an Agent of Change: Communications and Cultural Trans (Cambridge: Cambridge University Press, 1980).

[574] See id. at p. 23.

> have always been inextricably intertwined,[575] and the Press Clause has always forbidden government attempts to unravel them.[576]

While the court may recognize an argument for common carriage, this does mean free carriage. Thus an operator's discretion of how to charge for delivery is protected as well. Price differentiation is enshrined in almost every country through the post, with priority, regular, and reduced rate postage. It is understood that there is social value to give mass media and books a lower price of delivery because it supports communication, expression and the exchange of ideas.

> Moreover rather than declare such practices inherently harmful, however, the Supreme Court has upheld the government's right to engage in paid prioritization of the mail for the purpose of subsidizing particular forms of speech.[577]

In this way, it is no different for some Internet content to get the "book rate" or the zero rate. It supports overall expression.
In this respect Facebook's Free Basics realizes the very original conception of zero rating, a term[578] that comes from the international trade and tax policy of the European Economic Community in the 1950s. When value added tax (VAT) was imposed on goods distributed in what is today the European Union, certain "essential" items such as food, medicines, books, equipment for the disabled and were "zero rated" and not taxed. The essential information about health, education, employment is offered for free is defendable.

While broadband providers are considered common carriers and they must deliver communications, they need not do it for free. In U.S.

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[575] See id. ("It seems more accurate to describe many publishers as being both businessmen and literary dispensers of glory.").

[576] The Press Clause has not been amended since its initial ratification.

[577] Hannegan v. Esquire, Inc., 327 U.S. 146, 151 (1946).

[578] Harry Wallop, "General Election 2010: A Brief History of the Value Added Tax," April 13, 2010, http://www.telegraph.co.uk/news/election-2010/7582869/VAT-a-brief-history.html.

Postal Serv. v. Council of Greenburgh Civic Associations (1981), the court found that it was not incumbent on the postal service to deliver mail without postage. [579] Noting that the "soap box is not the letter box", government-regulated communications networks do not have traditional free speech obligations, and operators could argue that they need not deliver communications for which they are not compensated.

Given the documented value of such platforms for expression, it seems somehow inconsistent that people who have no internet access at all are better off if free data is banned. Indeed the potential options for expression are reduced. Free speech scholar Ellen P. Goodman observes,[580]

> Because connectivity itself is a means to expressive freedom, zero rating implicates expressive interests on both sides. This is particularly true when the services that have been zero rated(such as Facebook and Youtube) are actually speech platforms for users. Of course these users have speech interests as "listeners," derivative of the speech rights of edge providers. But they also have speech interests as speakers, and these are advanced by robust and affordable broadband access at the user end. The end-to-end theory at the center of net neutrality advocacy of course recognizes the importance of user participation in Internet speech circulation. However, the policy focus on edge provider neutrality compromises user speech interests where they may conflict with edge provider speech interests. Excessive concentration on edge provider equality and free speech interests tend to neglect user community inequality and free speech constraints. User interests are not purely derivative of edge provider interests.

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[579] Fred Campbell, "The First Amendment and the Internet: The Press Clause Protects the Internet Transmission of Mass Media Content from Common Carrier Regulation - Viewcontent.cgi," Nebraska Law Review, 2016, http://digitalcommons.unl.edu/cgi/viewcontent.cgi?article=2831&context=nlr.

[580] Goodman, Ellen P. "Zero Rating: Equality and Free Speech at the Other Edge - Draft 4/416." Forthcoming Colorado Technology Law Journal (2017), 2016. http://riipl.rutgers.edu/wp-content/uploads/goodman-zero-rating-draft-1.pdf.

> While neutral treatment of edge providers benefits users, so does free data. The utility of free data for consumers might well outweigh the disutility for certain classes of edge providers, at least in the short term.

Thus banning zero rating likely creates problems for regulators in that it violates free speech.

5.4 ENGINEERING CONCEPTS IN CONFLICT WITH NET NEUTRALITY

Different applications have different needs of the network. The growing restrictions and contradictions of net neutrality are at odds with the practices that engineers need to implement to make networks work. One of the key challenge for engineering is manage applications which are sensitive to delay. Banning accommodation tools and techniques make it difficult, if not impossible, for many applications to get the configuration of service they need in order to work.

5.4.1 VOICE AND VIDEO APPLICATIONS

In voice communications, delay[581] is an extremely important metric. In a recommendation[582] from The International Telecommunication Union (ITU), it is advised that a one-way maximum allowance of 400 milliseconds is acceptable for general network planning. However, there are further details within the recommendation that are important.

The ITU document includes a chart grading user satisfaction[583], based on the delay of voice traffic. The information it presents has ranges of

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[581] There are technical arguments about when to use the term "latency" and when to use the term "delay". For the purposes of this document, we only use the generic term "delay".

[582] ITU-T Recommendation G.114 "General Recommendations on the Transmission Quality for an Entire International Telephone Connection", 2003, One-Way Transmission Time. http://www.itu.int/rec/T-REC-G.114-200305-I

[583] Note: The satisfaction levels are not derived from actual user opinions. They are calculated from methods detailed in ITU-T Recommendation G.107 (2003).

delay times in relation to a particular level of user satisfaction. The results can be broken down as follows (all numbers are approximate):

- A delay over 550 milliseconds results in dissatisfaction among *nearly all* users.
- A delay between 390-550 milliseconds results in *many* dissatisfied users.
- A delay between 285-390 milliseconds results in *some* dissatisfied users.
- A delay between 200-285 milliseconds results in satisfied users.
- A delay between 0-200 milliseconds results in *very* satisfied users.

Furthermore, additional analysis of the chart curve finds that after a delay of approximately 125 milliseconds, the "very satisfied" rating begins to fall.

There is also a very important detail behind all of the numbers. The delays are not just discussing network delay. They are "mouth-to-ear" delays which, in addition to the network, would also include the endpoints use of buffering, scheduling, and processing. Acceptable *network* delay, therefore, would be smaller than the presented numbers and proportionate to the other delays introduced within the endpoints.

Network equipment manufacturer Cisco (noting the same ITU recommendation) suggests a requirement of 150 milliseconds (maximum) of one-way mouth-to-ear delay for voice traffic[584]. Cisco further advises on end-to-end and hop-by-hop jitter[585] requirements, and recommends packet loss should be no more than 1%.

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[584] Szigeti, Barton, Hattingh, and Briley. "End-to-End QoS Network Design", 2014, Chapter 10: Pg. 170.

[585] "Jitter is defined as a variation in the arrival of received packets." See: Wallace, Kevin. "Implementing Cisco Unified Communications Voice over IP and QoS (CVOICE)", 2011, Chapter 2: Pg. 258.

The reality is that voice services have very specific needs from a network. Simply adding voice traffic to the general best-effort packet path with equal treatment will result in unpredictable delay and jitter for the voice service. The delay can reach levels that are irritating or completely unacceptable to users. Unpredictably high levels of jitter also forces application developers to compensate for it, increasing overall delay.[586]

Video also has special requirements. Generally, the nature of video compression combined with the ability of users to visually detect missing packets creates challenges for the network[587] [588].

Streaming video-on-demand and general one-way broadcast video can be reasonably delayed. However, two-way interactive multimedia conferencing has stricter requirements. Cisco recommends a delay of 400 milliseconds (maximum) for one-way video streaming, and 200 milliseconds (maximum) for multimedia conferencing[589].

This technical reality and the need to ensure quality underpins VOIP pioneer Dan Berninger's lawsuit[590] against the FCC for the its Open Internet bans on prioritization technologies. Berninger needs to offer real time communications for his app, a service that allows users to communicate about the news in real time.

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[586] Szigeti, Barton, Hattingh, and Briley. "End-to-End QoS Network Design", 2014, Chapter 10: Pg. 170.

[587] Szigeti, Barton, Hattingh, and Briley. "End-to-End QoS Network Design", 2014, Chapter 10: Pgs. 172-173.

[588] In the case of compression, one could argue that leaving video uncompressed would actually improve network demand predictability and thus engineering precision, but at the cost of requiring much greater capacity.

[589] Szigeti, Barton, Hattingh, and Briley. "End-to-End QoS Network Design", 2014, Chapter 10: Pg. 176-177.

[590] "PETITION FOR STAY PENDING JUDICI AL REVIEW OF DANIEL BERNINGER, FOUNDER OF THE VOICE COMMUNI CATION EXCHANGE COMMITTEE," April 27, 2015, http://vcxc.org/documents/berningerstaypetition.pdf.

Modern gaming sometimes has components which are considered multimedia conferencing applications. Games can include voice and video chat to foster communication between players. In addition, Massively Multiplayer Online Games[591] (MMOs/MMOGs) have strict multi-endpoint synchronization requirements. When the synchronization is delayed, gameplay suffers and results in irritated game customers complaining of "lag" to both the gaming service and also their network provider.

There are some providers of general web sites and applications that view their uses as time-sensitive. Companies with such an opinion will often cite various time-studies to support their argument.[592] Debating the validity of whether one app or another is time-sensitive is only a matter of opinion. The reality is that if the application provider views time constraints as important, then the time constraints are important.

Best-effort is currently the default level of Internet service. This general service is good for non-time-sensitive use, such as classic-style Internet websites, terminals, and email. As explained in a paper[593] by Scott Shenker, "These applications are rather elastic in nature, in that they tolerate packet delays and packet losses rather gracefully, and so they are rather well served by the current Internet's best-effort service."

Opportunistic/Economy levels are sometimes described as "scavenger" traffic, and are intended for lower-priority data. If data has no immediate need for transmission across the Internet, then such

[591] "Massively Multiplayer Online Game," Wikipedia, November 3, 2016, https://en.wikipedia.org/w/index.php?title=Massively_multiplayer_online_game&oldid=747555680.

[592] Strangely, many companies cite time-studies to show support for network neutrality. Actually, such studies make clear that the application developers have an unfilled need for a time-sensitive traffic category on the network.

[593] Shenker, Scott. "Fundamental Design Issues for the Future Internet" September 1995, IEEE Journal on Selected Areas in Communications, Vol. 13, No. 7.

a lower class of service could be implemented. This type of traffic would typically be dropped first in cases of network congestion[594].

Network usage could also be scheduled by the user. By volunteering particular data transfers to be transacted at off-peak hours (perhaps for a price discount), overall network efficiency and experience are improved for all.

It is clear that different applications have different QoS needs. There is an abundance of literature on the topic, which is apparently being ignored by network neutrality advocates. It seems that in the network neutrality debate, the "key axiom" of "application primacy"[595] has been pushed aside: "The sole and entire point of building a high-performance network infrastructure is to support the distributed applications that need it."

5.4.2 NEUTRALITY DOES NOT ENSURE A QUALITY EXPERIENCE

Importantly, network neutrality cannot guarantee a quality experience for the Internet application user. If all IP packets are treated the exact same on an IP network as large as the Internet, some applications will suffer. Network operators, and thus application developers, simply cannot meet all the varied needs and give customers quality guarantees.

Measurement of overall service performance is generally known as *quality-of-experience* (QoE)[596]. Network technology standards

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[594] Szigeti, Barton, Hattingh, and Briley. "End-to-End QoS Network Design" (2014) Chapter 10: Pg. 180.

[595] James P. G. Sterbenz and Joseph D. Touch, High-Speed Networking: A Systematic Approach to High-Bandwidth Low-Latency Communication, 1 edition (New York: Wiley, 2001).Chapter 2: Pg. 20.

[596] Although, sometime the term used may be user-perceived-quality-of-service (PQoS), so as not to be confused with network-quality-of-service (QoS or NQoS). See: Lingfen Sun et al., Guide to Voice and Video over IP: For Fixed and Mobile Networks, 2013 edition (London ; New York: Springer, 2013). Chapter 6: Pg. 123.

organizations study QoE[597], and entire books have been written on the topic[598]. QoE has been important in the analysis of communication networks for quite a long time. It could be argued that the first basic network QoE measurement was called *grade-of-service* for basic telephony. It was simply the probability of a customer experiencing a network busy signal[599]. Today, and for packet-based services, QoE is a bit more complicated. Congestion doesn't create a network busy signal[600], it creates service degradation. Packets can be delayed, dropped, or arrive inconsistently.

QoE is currently defined by the ITU as application or service acceptability, as perceived by the end user[601]. QoE can be established in a variety of methods. One way is to question the users of the application, which usually results in a *mean-opinion-score* (MOS). Another way thought to measure experience is an estimation based on computing a score mathematically.

One assumption by some who take the mathematical approach is that if QoS measurements are good, then QoE is good.[602] Such persons usually pick a particular mathematical model with input from various performance measurements to result in a score. However, such a view and methods may be considered simplistic. Network optimization

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[597] For example, the ITU, the Broadband Forum, and the TeleManagement Forum all have explored QoE. See: Abdelhamid Mellouk, Said Hoceini, and Hai Anh Tran, Quality of Experience for Multimedia: Application to Content Delivery Network Architecture (Hoboken, USA: John Wiley & Sons, Inc., 2013), http://doi.wiley.com/10.1002/9781118649367.Chapter 2: Pgs. 12-13.

[598] Sebastian Möller and Alexander Raake, eds., Quality of Experience: Advanced Concepts, Applications and Methods, 2014 edition (New York: Springer, 2014).

[599] James Martin, Telecommunications and the Computer, 2nd edition (Englewood Cliffs, N.J: Longman Higher Education, 1977). Chapter 31: Pgs. 600-602.

[600] Perhaps packet networks should implement a network-resource-busy indicator for particular uses (also known as admission control).

[601] "P.10 : Vocabulary for Performance and Quality of Service," ITU, (2008), https://www.itu.int/rec/T-REC-P.10/en.

[602] Pathan, Sitaraman, and Robinson. "Advanced Content Delivery, Streaming, and Cloud Services", 2014, Chapter 11: Pg. 222.

consultant Martin Geddes[603] is particularly concerned by frequent usage of "speed" as a proxy for QoE along with average-packet-loss as a metric.[604]

Geddes has suggested use of an advanced mathematical QoE Measurement known as ΔQ,[605] which is a measure of deviation from ideal performance,[606] described as *quality attenuation*. For example, a Network operator could set "quality" characteristics for a particular category of traffic, or perhaps even a particular packet flow. Such would define the boundaries which, when surpassed, would be considered failure of the service. The ΔQ metric generally represents both delay and probability of failure of a particular service.

A frustrating reality exists for network operators. While some current or future methods of QoE-based network analysis and configuration may improve network performance, the network operator still cannot control all aspects that result in the actual quality as experienced by the end user. The only experience a network operator can really guarantee is a portion of QoE given between network demarcation points. Overall QoE is altered by hardware and software not controlled by the network operator, before a packet leaves a content

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603 "Martin Geddes is an authority on the future of the telecoms industry, ranging from emerging business models to new network technologies. He is a futurologist, writer, speaker, consultant, and technologist… He is formerly Strategy Director at BT's network division, and Chief Analyst and co-founder at Telco 2.0. Martin previously worked on a pioneering mobile web project at Sprint, where he was a named inventor on nine granted patents, and at Oracle as a specialist in high-scalability databases." See: "About Martin Geddes," Martingeddes, accessed November 9, 2016, http://www.martingeddes.com/about-us/.

604 Geddes, Martin. "How Should Regulators Measure Broadband Quality?", April 20, 2015, Blog post. See: http://www.martingeddes.com/how-should-regulators-measure-broadband-quality/

605 Geddes, Martin. "An Overview of ΔQ Metrics, Calculus and Algebra for Non-Mathematicians", October 28, 2015, Blog post. See: http://www.martingeddes.com/an-overview-of-%e2%88%86q-metrics-calculus-and-algebra-for-non-mathematicians/

606 Leahu, Lucian. "Analysis and Predictive Modeling of the Performance of the ATLAS TDAQ Network", 2013, Section 4.2.2: Pgs. 51-53 http://cds.cern.ch/record/1504817/files/CERN-THESIS-2013-004.pdf

provider, during any 3rd-party network transmission, and after the packet reaches customer equipment.

Simply stated, while QoE is important, network operators cannot guarantee total experience quality.

What they can do, is offer many different categories of traffic which are optimized to provide particular performance characteristics to types of applications. This puts accountability on application providers and end users. Application providers need to know exactly what network performance characteristics their application needs, and express that to the network operator. End users can pick categories based on application provider guidance and the user's experience. Otherwise, it can become convenient for application providers and end users to simply blame the network. Without any traffic characteristics requested by the application provider, there is no way to prove a performance failure. An application provider cannot, in using an extremely large and affordable network, simply accuse network operators of entire responsibility over QoE. Accountability is extremely important in commercial transactions, and there is no reason why Internet service should be any different.

If application providers want quality experiences for their users, then application providers and users need to communicate their differentiated needs to the network provider, and pay accordingly. Forcing network operators to simply treat all packets with "hope" of achieving undefined acceptable-delivery is a win for nobody. The application provider and the network operator both lose and have no accountability to each other, while the end user suffers. Without applications and users requesting defined performance from the network, and with no application performance accountability, there is no accurate mathematical measure of overall QoE.

Quality of experience is important, and network operators cannot adequately, accurately, and affordably provide their portion of it within the confines of network neutrality technology bans.

5.4.3 PHYSICAL NETWORK CONFIGURATION

One company's comments on network prioritization submitted to the FCC expressed that "The Commission should adopt a presumption against paid prioritization, because it is impossible to define a workable standard for prioritization that avoids degrading and harming other uses of the access service." [607] [608] Such comments (which narrowly assume a rigid network context of enabling primitive queueing algorithms on pre-existing links of unchanging capacity) are also only applicable to a specific physical network configuration.

One must consider the possibilities of a physical network configuration that varies from the simplified hierarchies presented as examples in many network study books. Categorized Internet traffic can be split off and sent down separate physical paths consisting of completely different cables, lengths, speeds, devices, and protocols for optimization of particular traffic characteristics. In such cases of physical separation there would be no capacity sharing by traffic categories whatsoever, thus making degradation impossible.

5.4.4 NOTE ON OVERPROVISIONING

These comments of the Vice President of Internet2[609] are often quoted by network neutrality advocates to suggest that overprovisioning of

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[607] Chris Riley, Alex Fowler, and Mozilla. "Comments of Mozilla", September 15 2014, Comments Before the U.S. Federal Communications Commission, Regarding GN Docket 14-28 & GN Docket 10-127, Section III. https://blog.mozilla.org/netpolicy/files/2014/09/Mozilla-NN-Reply-Comments-Sept-2014.pdf

[608] A previous version asked not for a "presumption", but for a complete ban. See: Chris Riley, Alex Fowler, and Mozilla. "Comments of Mozilla", July 15 2014, Comments Before the U.S. Federal Communications Commission, Regarding GN Docket 14-28 & GN Docket 10-127, Section III-C. https://blog.mozilla.org/netpolicy/files/2014/07/Mozilla-NN-Comments-July-2014.pdf

[609] Bachula, Gary.,Testimony before the United States Senate Committee on Commerce, Science, and Transportation, Hearing on Net Neutrality, February 7, 2006, http://www.commerce.senate.gov/pdf/bachula-020706.pdf

the Internet is a viable solution, "For a number of years, we seriously explored various "quality of service" schemes, including having our engineers convene a Quality of Service Working Group. As it developed, though, all of our research and practical experience supported the conclusion that it was far more cost effective to simply provide more bandwidth." He added,

"We would like to see Congress set a national goal of 100 megabits of symmetrical bandwidth, meaning the same speed for both uploaded and downloaded content, to every home and business and school in America in five years – and a gigabit (1000 megabits) in ten years. This is absolutely doable using coaxial cable and fiber to the home. That would allow plenty of bandwidth for telephone, video, email, and many other uses – and enable brand new uses that we cannot even imagine today.

It does not cost all that much, relatively, to upgrade a network once the basic wiring is in place – that's the big original cost. For example, a university campus in the Midwest that serves 14,000 students and faculty, recently estimated it would cost about $150 per port (per end user) to replicate their current 100 Mbps network for a five year period, or about $30 a year per user. To upgrade to 1000 Mbps (1 gigabit) it would cost $250, or about $50 per year. University campuses are like small towns or suburban neighborhoods. Once cable companies and companies like Verizon make their initial fiber investment, the relative cost of upgrading bandwidth to customers is small."

The problem with the experience of Internet2, and thus their resulting analysis, is the failure to address traffic aggregation and scale.

The Internet2's Abilene Network (the actual network referenced within the comments), at its maximum, had only 13 core nodes and just 14 links to connect them.[610] It was a test network. Contrast this to

[610] Internet2. "Abilene Network Operations Report" (January 22, 2007 – January 28, 2007) Abilene Network Operations Center at Indiana University. , accessed November 9, 2015, http://noc.net.Internet2.edu/uploads/tC/XW/tCXWDCYHVEut8VzBIHZnsQ/20070128.html

a recent U.S. Internet Infrastructure study[611] which identified 888 nodes[612] and 1258 long-haul fiber links.

The financial estimate of upgrading a customer Ethernet port to 1 gigabit service does not appear to include the reality that the customer traffic, after passing through the initial access circuit, is then aggregated with other traffic within the network. As more customers are upgraded, more back end infrastructure is needed. The Internet2 Vice President cited an example of a college campus serving 14,000 people. For comparison, Verizon has 6.5 million FiOS Internet customers[613]whose traffic could potentially be aggregated on to the Verizon network, and/or passed to and from other network operators. Providing all customers with adequate 1 gigabit service would require a massive expansion within the Verizon network. Aggregation and scale are very important factors.

There are also real-world traffic QoS implementations of near-equal scale to Internet2 that have achieved beneficial results. Sonus Networks, in a private-network WAN case study,[614] successfully implemented application-awareness and prioritization mechanisms for a financial institution. What was the result? The financial institution "…was able to run all inter-branch traffic on seven Gigabit Ethernet links at 90% utilization. This reduced WAN costs from $198,000 to

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611 Durairajan, Barford, Sommers, Willinger. "InterTubes: A Study of the US Long-haul Fiber-optic Infrastructure", 2015, SIGCOMM '15. http://pages.cs.wisc.edu/~pb/tubes_final.pdf

612 The number of nodes listed here was calculated by adding up nodes from table 1 in the study. The study authors' initial number of 267 "unique nodes" (presented in section 2.1) appears to not take into account that while multiple company links may end at the same street address, they terminate on separate equipment.

613 Verizon. "Verizon Reports Strong Customer Additions and another Quarter of Double-Digit Earnings Growth", October 21, 2014, News Release. http://www.verizon.com/about/news/verizon-reports-strong-customer-additions-and-another-quarter-double-digit-earnings-growth/

614 Sonus Networks. "State Street Bank Reduces Costs, Increases Network Utilization with Sonus VellOS", 2015, Sonus case study. http://www.sonus.net/sites/default/files/state-street-bank-reduces-costs-increases-network-utilization-with-sonus-vellos_1.pdf

$42,000 per month. Over a span of 36 months, WAN costs dropped from more than $7 million to approximately $1.5 million."

As one book's authors explains succinctly, "Though overdimensioning is not a real QoS method, it is a widely used solution due to its simplicity. This type of approach may lead, however, to a quite expensive solution with large networks." Ultimately, the overprovisioning of dumb capacity costs money in exponential proportion to the size of the network[615].

5.4.5 DPI AND USER CONTROL

It is repeatedly implied that deep-packet-inspection (DPI) is required to perform traffic categorization.[616] [617] Arguing that traffic categorization requires use of DPI is a faulty foundation of network-neutrality claims which declare that network operators are the judges and assigners of packets into categories.

DPI is function in which a network looks within a data packet to determine its contents. Many network neutrality advocates claim that the way traffic categorization works is by a network operator enabling DPI, looking into a packet, assessing the packet's content, and assigning the packet to a category based on what is found within. The assumption is that network operators are the sole deciders of how content is interpreted, and that such practices are gross privacy violations. The problem with the argument is its base assumption of categorization requiring DPI. DPI is absolutely not a necessary part of network traffic categorization. In fact, it is an inefficient and

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[615] Anttalainen and Jääskeläinen. "Introduction to Communications Networks", 2015, Chapter 7, section 7.5: Pgs. 272-273.

[616] Chris Riley and Robb Topolski "A Free Press/New America Foundation Policy Brief: The Hidden Harms of Application Bias", November 2009, http://www.freepress.net/sites/default/files/fp-legacy/The_Hidden_Harms_of_Application_Bias.pdf

[617] Chris Riley and Ben Scott. "Deep Packet Inspection: The End of the Internet as We Know It?", March 2009, Free Press. http://www.freepress.net/sites/default/files/fp-legacy/Deep_Packet_Inspection_The_End_of_the_Internet_As_We_Know_It.pdf

inaccurate way to assign packets into traffic categories, subject to being potentially defrauded. Its use is simply not needed nor recommended. But this myth perpetuates, and taints the network neutrality conversation. It is completely false.

One possible source of the DPI misunderstanding is non-technical persons misunderstanding the TCP/IP or OSI networking models. They may incorrectly assume that layers 1 (physical), 2 (link), and 3 (network) of the models are only present within a network operator's network. In reality, those layers are also present at the endpoints, and are required for any endpoint to be able to place packets on an IP network. Furthermore, layers 2 and 3 are generally configurable by common endpoint software.

Some of the most highly-used programming languages contain the ability to set a field within IP packets[618] which indicates the packets' category of service. Those that do not could add the ability. It is not impossible, nor even just theoretical. This can be done right now. Programmers already have the resources available to make the most of this opportunity. Applications, content-provider server programs, and web browsers could easily have settings, configurable by the user. Such settings would dictate the desired categories for packets before they are placed on the network. No DPI is needed, whatsoever.

Now, since exposing the imagined foundation of packet categorization requiring DPI (and thus also the claim that network operators "pick winners and losers"[619]) as invalid, we can finally move on to explaining how user-controlled traffic categorization actually works.

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[618] Java (and Android implementation), Microsoft C++, and Microsoft C# can directly configure the ToS/DSCP field. Python and POSIX (Linux, Apple, etc.) C sockets have the RAW socket option. See the various APIs for details.

[619] "Net Neutrality: A Free and Open Internet," The White House, accessed November 9, 2016, http://www.whitehouse.gov/net-neutrality.

The user, within an application's settings, can configure how their data should be handled[620]. For example, assume a multiservice communication application which offers VoIP calling, text messaging, picture sharing, document sharing, a live video feed, and multiuser turn-based gaming. Such requires disparate use of the network, optimized for different types of handling. The application may be loaded with defaults, but the user could customize the assignment of each offering into categories to provide maximum desired benefit. The data from the application is then placed into packets configured with the appropriate categories, and is handed off from the user device to the network. The network receives the packets, handles them as directed by the user, and bills the user based the network resource demands of each particular category of service. This is simply pay-for-what-you-use, and offers no preference to one user or another in any given category. In addition to metered billing, assumedly, network operators may also offer pre-determined bundles of bulk usage to a custom*er, or custom plans as well. It's all up to the customer. To summarize and restate: *In the proper practice of traffic categorization, the user would control the assignment of their data to the categories.*

When user control is a solution, people agree. In the U.S., prominent network neutrality advocates have acknowledged a possible user control exception to a ban on traffic prioritization[621] [622], at least one

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[620] Paul Ferguson and Geoff Huston, Quality of Service: Delivering QoS on the Internet and in Corporate Networks (New York, NY, USA: John Wiley & Sons, Inc., 1998).: Chapter 9: Pg. 192.

[621] "Rather, we can preserve the possibility of e2e systems by keeping intelligence out of the hardware design, but by building it into some software layers on an as-needed basis." See: Lemley, Mark and Lawrence Lessig, "The End of End-to-End: Preserving the Architecture of the Internet in the Broadband Era" (October 1, 2000) UC Berkeley Law and Economics Research Paper No. 2000-19. Pg. 19. http://cyberlaw.stanford.edu/e2e/papers/Lemley_Lessig_e2epaper.pdf

[622] "…the most reasonable short-term way is to maintain users' control over their own traffic" See: Chris Riley and Robb Topolski, "A Free Press/New America Foundation Policy Brief: The Hidden Harms of Application Bias," New America Foundation, Open Technology Initiative, November 2009, http://www.freepress.net/sites/default/files/fp-legacy/The_Hidden_Harms_of_Application_Bias.pdf.

has explained it technically[623], and one company (An extremely vocal network neutrality advocate) even openly supports user-controlled content blocking[624]. In addition, The U.S. Federal Communications Commission has stated in their "Open Internet" ruling that they favor network solutions which enable user control.[625] *User control is a way for network operators to move forward with prioritization.*

With user control of packet marking, categorization, and prioritization of packets, the Internet would remain End-to-End Argument compliant. No DPI or any other additional function is added within the network. All the packet classification and placement within traffic categories would be at the endpoints. The network simply acts as multiple virtual networks, transmitting the packets across as requested by the user.

Therefore, if user-controlled endpoint packet marking is ultimately pursued as a solution by network operators, the End-to-End Arguments are irrelevant to protests against implementation. End-to-End would be removed from the prioritization discussion, allowing for more attention to be given to the remaining issues regarding network neutrality.

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623 "… Imagine that the Internet layer offered different services with different bandwidth and delay characteristics to higher layers at the end hosts. The higher layers would choose the type of service they desired and would communicate that choice to the Internet layer through the Internet layer's service interface (e.g. by setting a type-of-service field)." (Barbara van Schewick, Internet Architecture and Innovation (Cambridge, MA: The MIT Press, 2012). Chapter 3: Pgs. 106-107

624 Denelle Dixon-Thayer, "Proposed Principles for Content Blocking," The Mozilla Blog, October 7, 2015, https://blog.mozilla.org/blog/2015/10/07/proposed-principles-for-content-blocking/.

625 "United States Federal Communications Commission (March 12, 2015) FCC 15-24, In the Matter of Protecting and Promoting the Open Internet, GN Docket No. 14-28, Part 139: Pgs. 61-62," FCC, March 12, 2015, http://transition.fcc.gov/Daily_Releases/Daily_Business/2015/db0312/FCC-15-24A1.pdf.

5.5 WHAT CAN BE SAID ABOUT THE OTHER PARTS OF THE VALUE CHAIN WITH SIGNIFICANT MARKET POWER, E.G. APPS, PLATFORMS, OPERATING SYSTEMS

One heterodox interpretation is that net neutrality is a policy designed to protect the market position of large and established Internet companies. It is interesting to review the position of one company, Alphabet (or Google), a leading net neutrality supporter. Net neutrality-justified bans on zero rating and sponsored data can be effective means to create an entrance barrier by ISPs and other providers into the advertising market. Moreover the requirement to treat all traffic equally means that consumers have to pay and accept advertising equally with valued content. Given that Google is the world's largest digital advertising platform, having net neutrality regulations are extremely valuable to protect Google's market position. Users are thus required to pay for ad traffic in their subscription whether they want it or not. Regulation built on two-sided markets would allow ISPs to extract revenue from the advertiser side and lower it on the consumer side. As such, net neutrality is frequently seen as an artificial subsidy from one side of the market to the other.

Internet advertising was a $50 billion industry in the US in 2014[626], on track to double by 2019. Its revenue exceeds that from ads on broadcast and cable TV by 25 percent. To be sure, internet advertising works well for many advertisers, largely on account of the better tracking and analytic abilities available with online channels, but many users feel "surveilled" under this paradigm.

The IAB tracks[627] growth driven primarily by the sale of ads in search, display, and on mobile platforms. A single company emerges as the

[626] Tim Peterson, "Digital to Overtake TV Ad Spending in Two Years, Says Forrester," Advertising Age, (November 4, 2014), http://adage.com/article/media/digital-overtake-tv-ad-spending-years-forrester/295694/.

[627] "IAB Internet Advertising Revenue Report," PricewaterhouseCoopers, April 2015,

overwhelming winner: Google. Over two-thirds of searches in the US are performed in Google, and Google takes the lion's share of advertising revenue. In the $19 billion mobile advertising market in 2014, Google earned 37 percent of the revenue. Globally Google earned $44 billion on advertising on its websites in 2014.[628]

While it allows ad blocking extensions to its Chrome browser, Google outlawed ad blockers from its Google Play app store in 2013. This makes it very difficult for every 4 out the 5 smartphone users (which incidentally use the Android operating system) to take advantage of ad blockers. This could be an anti-trust violation. It's no surprise that consumers welcomed Apple's incorporation of ad blocking functionality in its iOS9 operating system.[629]

Mobile advertising is now on track to consume 70% of all online ad revenues,[630] and the explosion of digital advertising is exacerbating differences in tax policy and reducing the amount that corporations pay in tax. For example, American ad servers base their European operators in the UK and Ireland where they can enjoy a favorable tax rate while delivering services across the EU.[631] Meanwhile local ad competitors have to pay (higher) taxes in the country where they are based.

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http://www.iab.net/media/file/IAB_Internet_Advertising_Revenue_Report_FY_20142.pdf.

628 "Annual Report for the Fiscal Year Ended December 31, 2015," 2016, Alphabet Inc./Google Inc, accessed November 12, 2016, https://abc.xyz/investor/pdf/20151231_alphabet_10K.pdf.

629 "Application Launch Changes," Developer Apple, accessed October 24, 2016, https://developer.apple.com/library/prerelease/content/releasenotes/General/WhatsNewInSafari/Articles/Safari_9_0.html.

630 Dave Chaffey, "Mobile Marketing Statistics 2016," Smart Insights, October 26, 2016, http://www.smartinsights.com/mobile-marketing/mobile-marketing-analytics/mobile-marketing-statistics/.

631 Toby Sterling and Tom Bergin, "Google Accounts Show 11 Billion Euros Moved via Low Tax 'Dutch Sandwich' in 2014," Reuters, February 19, 2016, http://www.reuters.com/article/us-google-tax-idUSKCN0VS1GP.

This current paradigm of internet advertising is based upon a keyword bid and pay-per-click model. This model is very granular, enabling relevant ads to appear next to highly specific search queries, but it requires a high level of skill and budget by experts to be successful. This model has the advantage of offering highly tailored and targeted transactions between users and advertisers, and advertisers and platforms. But this same technology also engenders a sense of "creepiness", that the technology is extremely intrusive and granular.

As the FTC describes, "Effective competition is about price, selection, and service." [632] If we look at the market for internet advertising, this is not the case today. Advertisers face increasing bid prices for keywords,[633] and the selection of ad serving platforms are limited; Google has a poor reputation for customer service, apart from its very best advertisers.[634] Though Google has made an effort to improve to win small and medium sized customers,[635] the vast majority of its revenue come from the largest companies in a few verticals.[636] Having little to no competitors, Google is able to increase bid prices significantly above marginal cost. Having more and different ad providers in the marketplace along with new ad delivery models would change some of these dynamics.

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[632] "Competition Counts," US Federal Trade Commission, May 27, 2016, https://www.ftc.gov/sites/default/files/attachments/competition-counts/zgen01.pdf.

[633] Mark Ballard, "AdWords Brand CPCs Rising? Here's Why And What You Can Do About It," Search Engine Land, July 23, 2015, http://searchengineland.com/adwords-brand-cpcs-rising-heres-can-225648.

[634] Allen Cheung, "Why Is Google so Abysmally Bad at Human-Based Customer Service? - Quora," accessed November 12, 2016, https://www.quora.com/Why-is-Google-so-abysmally-bad-at-human-based-customer-service.

David Rodnitzky, "Can Google AdWords Customer Service Be Saved?," Search Engine Land, November 19, 2012, http://searchengineland.com/why-does-the-smartest-company-in-the-world-have-the-dumbest-customer-service-139356.

[635] Micah Solomon, "Google Customer Service Steps Into The Spotlight," Forbes, May 5, 2014, http://www.forbes.com/sites/micahsolomon/2014/05/05/google/.

[636] "The Top 10 Industries That Contributed Most to Google Earnings | WordStream," WordStream, accessed November 9, 2016, http://www.wordstream.com/articles/google-earnings.

The online advertising market has also become highly concentrated through numerous mergers and acquisitions in the ad tech industry, as well as the massive shift of advertising spending from offline to online. The reality is that much of the technology running in the background is owned and operated by just a few large entities. The Google content network is a perfect illustration. It is a platform technology underpinning millions of websites and news outlets. To be sure, the ability to serve a tracked ad across millions of digital destinations is beneficial for advertisers, but this scale is also a concern for privacy advocates.[637]

It does not appear that the trend will change soon. The IAB also notes that Internet advertising has grown more than any other advertising channel in the last 21 years.[638] Their report shows that the largest ad platforms are getting more concentrated. The top 10 ad-selling companies commanded 75% of revenues in Q4 2015, an increase of the prior year. With the top 11-25 ad sellers losing market share over the same period, now down to 9 percent. The IAB notes, "Despite the emergence of a few heavyweights in internet advertising publishing, the concentration of top-10 revenue has remained relatively unchanged over the past ten years, fluctuating between 69% and 75%."[639]

While many cheered the banning of differential pricing in India, the ruling has the perverse effect of enshrining a Google advertising monopoly. Leading mobile industry analyst Richard Windsor declares of the India, "game may already be over for the home grown

[637] Electronic Privacy Information Center- www.epic.org, "Online Tracking and Behavioral Profiling," Electronic Privacy Information Center, accessed November 12, 2016, https://epic.org/privacy/consumer/online_tracking_and_behavioral.html.

[638] "IAB Internet Advertising Revenue Report," PricewaterhouseCoopers, (April 2016), http://www.iab.com/wp-content/uploads/2016/04/IAB-Internet-Advertising-Revenue-Report-FY-2015.pdf.

[639] Ibid

alternatives."[640] Further, eMarketer has reported[641] the dominance of Google in both a US and global perspective:

> This year, eMarketer predicts, 30.9% of net digital ad revenues will go to Google. Facebook will be in second place with 12.0%. Google's lead is even stronger as a share of worldwide net search ad revenues, at 55.2%. Google also takes in a third of all mobile internet ad revenues in the world, and mobile is helping to power the company's overall ad revenue growth rate. This year, for example, Google's net worldwide mobile internet ad revenues are expected to rise more than four times as fast as its ad revenues overall. By 2018, mobile ad streams will still be growing nearly twice as quickly as the total.
>
> YouTube also figures significantly in Google's worldwide ad revenue growth. Net ad revenues at the video site were up 40.6% last year, and will continue to grow by 21.1% this year—more than twice the overall growth rate for ad revenues at Google. YouTube revenues are growing more quickly in the US than elsewhere in the world, and are accounting for a larger share of Google's ad revenue stream there each year. This year, eMarketer forecasts, YouTube will continue 10.8% of Google's net US ad revenues, up from 9.1% last year. By 2018, the end of our forecast period, that share will rise to 12.4%.

A look at Google's 2015 annual financial report[642] is telling. Google earned $45 billion in 2014 and $52 billion in 2015, strictly from its

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640 Windsor, Richard "Google vs. Facebook – Almost the Final Frontier," Radio Free Mobile, August 5, 2016, http://www.radiofreemobile.com/google-vs-facebook-almost-the-final-frontier/.

Windsor, Richard, "Google – From Russia with Love Pt. II," Radio Free Mobile, August 15, 2016, http://www.radiofreemobile.com/google-from-russia-with-love-pt-ii/.

641 "Google Ad Revenue Growth to Drop to Single Digits This Year," eMarketer, (April 20, 2016), http://www.emarketer.com/Article/Google-Ad-Revenue-Growth-Drop-Single-Digits-This-Year/1013853.

website advertising. Additionally, Google posted revenues of $14.5 billion in 2014 and $15 billion in 2015 from Google Member Networks website advertising. It is not just the revenue and market share of Google that is a concern, but rather its ubiquity. Google's share of presence on the top 100 websites has increased from 74 in 2012 to 92 in 2015.[643] Google tracking is present on 92 of the top 100 most popular websites, and on 923 of the top 1,000 websites.[644]

The Google domination story continues beyond online advertising. According to ComScore, Google's Android operating system commands 53% of the worldwide mobile market[645] and Google Search, 64% of desktop search.[646] Google's Chrome web browser accounted for 56.75% of all browser usage[647], and Gmail scores with 56.4% of US websites using mail technology.[648] An assiduous accounting of Google's search engine, operating system, browser, and

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642 "Alphabet Investor Relations," Alphabet Investor Relations, accessed November 9, 2016, https://abc.xyz/.

643 Ibrahim Altaweel and Nathaniel Wood, "Web Privacy Census v 3.0", Presented at PrivacyCon, Washington D.C.," January 14, 2016, https://www.ftc.gov/system/files/documents/public_events/776191/part_1_privacycon_slides.pdf.

644 Ibid

645 Elizabeth Weise and Edward Baig, "Apple, Android, BlackBerry Phones: What Can't Be Hacked?," USA TODAY, February 29, 2016, http://www.usatoday.com/story/tech/news/2016/02/26/apple-android-blackberry-phones-what-cant-hacked/80935692/.

646 "comScore Releases August 2015 U.S. Desktop Search Engine Rankings," comScore, Inc, September 16, 2015, http://www.comscore.com/Insights/Market-Rankings/comScore-Releases-August-2015-U.S.-Desktop-Search-Engine-Rankings.

647 "Top 5 Desktop, Tablet & Console Browsers from Oct 2015 to Oct 2016," StatCounter Global Stats, accessed November 12, 2016, http://gs.statcounter.com/.

648 "Email Providers Market Share Report," Competitor Analysis in United States, Datanyze, accessed November 9, 2016, https://www.datanyze.com/market-share/email-providers/United%20States.

193 products, services and tools has been described as a Google "Inner-net" regime.[649]

A related issue is the degree to which many small and startup companies struggle to achieve advertising success with Google. Many small and medium-sized advertisers frequently don't participate because it is too expensive and complex, and their businesses lack the scale to take advantage of such platform technology. Findability in the search engine requires extensive budget not just for paid search but the murky world of search engine optimization (SEO)[650] and app store optimization (ASO). Companies frequently hire consultants and agencies for such a task. However, Google can make a change to its algorithm, resulting in traffic and rank disappearing overnight. There is a tremendous need for a more transparent, predictable experience for small and mediums-sized advertisers.

Ivang describes that losing rank in the search results is not just an issue for small companies.[651] Large companies such as Interflora UK have experienced losing the bulk of their traffic overnight when Google finds out that entities have purchased links to get inbound traffic, a "black hat" SEO technique which Google punishes. He suggests that companies are compelled to purchase advertisements to ensure that at least some channel of traffic reaches their website.

In addition, Google gives preference to websites which already have more traffic, so this has the perverse effect of strengthening the

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649 Scott Cleland, "Search + Android + Chrome = Google's Gatekeeper Inner-Net Regime," The Precursor Blog, February 24, 2016, http://www.precursorblog.com/?q=content/search-android-chrome-google%E2%80%99s-gatekeeper-inner-net-regime.

650 "SEO for Small Business? | Andreas.com," accessed November 9, 2016, http://andreas.com/seo-for-small-business/.

651 Reimer Ivang, "Så Galt Går Det Når Du Ikke Har Styr På Din SEO-Partner - Computerworld," ComputerWorld, May 1, 2013, http://www.computerworld.dk/blog/executive/224875/saa-galt-gaar-det-naar-du-ikke-har-styr-paa-din-seo-partner.

destinations that are already strong. [652] Google's CFO Patrick Pichette made a joke at an investors event about "feeding the winners and starving the losers" with regard to business lines within Google,[653] but this idea also applies to the company's advertisers. Those advertisers that do well are rewarded; those that don't, are punished. In practice a large number of advertisers try and leave Google, but there are few options for other advertising platforms that deliver similar scale and reach.

This problem will only be exacerbated by recent changes Google has made to its platform.[654] Beginning in February 2016, Google phased out the traditional list of ads on the right side of the page. Instead, Google now puts only a couple of ads at the top of the page which look similar to "natural" search results. Users click on the ads, frequently not knowing they are ads.

The right side of the page is used for Knowledge Graph results which provide the most authoritative informative result for the search query (frequently a Wikipedia entry), and for Product Listing Ads, which are generally consumer products from well-known brands and companies. These changes have the impact of increasing competition for bids, which increases the bid price and Google's revenue. It also forces out the small advertisers, those which can't afford higher bids and don't have the time or skills to operate the complex AdWords engine. To its credit, Google now offers an automated version of its ad engine for

652 "Search Results For 'build It' | Andreas.com," accessed November 9, 2016, http://andreas.com/?s=build+it.

653 Owen Thomas, "Google CFO Hints at Future: "Starve the Losers"," Gawker, accessed November 9, 2016, http://gawker.com/5064903/google-cfo-hints-at-future-starve-the-losers.

654 "No More Right-Side Ads at Google," Andreas.com, accessed November 9, 2016, http://andreas.com/no-more-right-side-ads/.

small business, but at least one agency advises against using the platform, citing that the benefits of the platform don't scale down.[655]

A number of academics have documented their concerns about Google from a user perspective,[656] but in spite of the overwhelming evidence of its market power, there has been little successful antitrust action against the company. The European Union has tried unsuccessfully for a decade,[657] but Google's market share has increased consistently. In fact, Google enjoys significantly greater market share in the EU than the US.[658] In the US the revolving door between Google and the Obama administration is an open secret,[659] a relationship that has supported the company on many policy issues

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[655] Andrew Lolk, "Does AdWords Express Sabotage Small Business Owners Before They Even Get Started?," April 27, 2016, http://blog.whitesharkmedia.com/adwords-express-sabotages-small-business-owners.

[656] Chris Jay Hoofnagle, "Beyond Google and Evil: How Policy Makers, Journalists and Consumers Should Talk Differently about Google and Privacy," First Monday 14, no. 4 (March 17, 2009), http://firstmonday.org/ojs/index.php/fm/article/view/2326.

Joseph Turow, Media Today: Mass Communication in a Converging World, 5 edition (New York: Routledge, 2013).

Primal Wijesekera et al., "Android Permissions Remystified: A Field Study on Contextual Integrity," in Proceedings of the 24th USENIX Conference on Security Symposium, SEC'15 (Berkeley, CA, USA: USENIX Association, 2015), 499–514, http://dl.acm.org/citation.cfm?id=2831143.2831175.

Siva Vaidhyanathan, The Googlization of Everything:, 1 edition (Berkeley: University of California Press, 2011).

[657] Nicholas Hirst, "Margrethe Vestager vs Google (Round 3)," POLITICO, July 14, 2016, http://www.politico.eu/article/margrethe-vestager-vs-google-round-3-antitrust-battle-search-mobile-and-advertising/.

[658] Matt Rosoff, 2014 Nov. 29, and 429 36, "Here's How Dominant Google Is In Europe," Business Insider, accessed November 9, 2016, http://www.businessinsider.com/heres-how-dominant-google-is-in-europe-2014-11.

[659] "Google Transparency Project," accessed November 9, 2016, http://googletransparencyproject.org/.

including Open Internet, WCIT-12, and importantly, a cancelled antitrust probe by the Federal Trade Commission.[660]

While net neutrality can be studied at face value as a doctrine to protect users rights, one heterodox interpretation is that public relations scheme to protect the revenue of large Internet companies such as Google and Netflix and curtail new entrants. Such interpretations are consistent with Olson's theory of collective action.[661] Olson described a situation within a political system where there are concentrated benefits and diffuse costs. In such cases, relatively small groups are more effective to work collectively to secure a set of political benefits as the costs to organize a large group are higher and the task more difficult. In the BEREC consultation on net neutrality guidelines, 7 of the 14 official stakeholders had Google as a funder or members.[662] The specific groups advocate for particular regulatory interpretations of net neutrality that happen to support Google, bans on zero rating and sponsored data, bans on paid prioritization, and banning of network level ad blockers.

5.6 OTHER ASSUMPTIONS OF NET NEUTRALITY

5.6.1 HOMOGENEOUS USER AND CONTENT

A related set of assumptions underlie the theory with regard to the homogeneity of users. For one, Wu's conception of the Internet is

[660] David DayenDavid DayenApril 22, "Google's Remarkably Close Relationship With the Obama White House, in Two Charts," The Intercept, April 22, 2016, https://theintercept.com/2016/04/22/googles-remarkably-close-relationship-with-the-obama-white-house-in-two-charts/.

[661] Mancur Olson, The Logic of Collective Action: Public Goods and the Theory of Groups, Second Printing with New Preface and Appendix, Revised edition (México etc.: Harvard University Press, 1971).

[662] An email from BEREC on July 8, 2016 provided the official list of stakeholders from the December 2015 meetings which defined the scope of the EU net neutrality guidelines. The list was reviewed for its supporters, members, and funders. For more information: "The Moment of Truth - a Portrait of the Fight for Hard Net Neutrality Regulation by Save The Internet and Other Internet Activists," Strand Conult, 2016, http://www.strandconsult.dk/sw7153.asp.

predicated on that of an early adopter, that of a male aged 18-30 using a desktop to play games and download files on peer-to-peer networks, quite reflective of his own Internet use. While that archetypal user still exists, users are far more diverse, including children or the elderly. Moreover they use a range of devices, primarily not computer desktops or laptops. Moreover the applications are quite varied. In addition to the diversification of human users, the number of machine users on the Internet is already larger than humans and is growing. Going forward Wu's anthropocentric assumptions would apply to increasingly smaller percentage of the Internet users.

The new paradigm of Internet of Things and 5G calls the assumptions of net neutrality into question. 5G is the next mobile standard which allows fiber fast speeds and capacity to the mobile phone, 10 gigabits per second or 100 times the speed of 4G. There is no way to realize the next generation of mobile network evolution with rules that insist that all data be treated the same. The essence of 5G is speed, capacity, and quality all integrated with intelligence. A 5G network instantly optimizes and customizes the network for the ideal user experience.[663]

The same social, economic, and technical assumptions for other networks don't necessarily hold in a 5G perspective. For example millennials are not necessarily interested in the vast set of use cases for 5g and they only want to pay for the services they use.[664] This could constrain the ability to invest and deliver networks as well as require the flexibility of business models to fill the gap. Similarly the paradigm of interactions are changing. "The ICT-based service encounter no longer should be seen as neutral or transparent tool, as in existing literature, but as an independent element that essentially transform the service encounter. This is important for the design of

[663] Nicolai Devantier, "5G Bliver Så Potent Og Anderledes at It-Sikkerhed Skal Tænkes Helt Om," Computerworld, October 19, 2015, http://www.computerworld.dk/art/235264/5g-bliver-saa-potent-og-anderledes-at-it-sikkerhed-skal-taenkes-helt-om.

[664] Lene Tolstrup Sørensen et al., "World Wireless Research Foundation Publication," October 6, 2016, http://vbn.aau.dk/en/publications/millennial-users-in-a-5g-context(45144322-b679-46bc-a395-7df4924a1e94).html.

future automated and intelligent ICT- based services," [665] note Skouby and Sørensen.

Under net neutrality content on the internet is assumed to be interchangeable and that users value all content the same, and that just having more is better. While there may be some users who could fit this idealized paradigm, this is clearly not the case. Such reasoning leads to another myth of the "singular internet experience." The discussion on net neutrality is frequently linked to the call for "universality of access on the Internet"[666] and the demand for "all the Internet for all people" or that all Internet users should be able to access the content of the "whole Internet" on identical terms. While these are noble and aspiration goals, they make assumptions that users value all content the same and that all users are the same. This view suggests the single Internet experience, an ideal archetypal way to access the Internet. Such a view effectively says if one cannot access the Internet in that ideal way, at all times and in all circumstances, then one should not access it all. And indeed, one should be forbidden from accessing the Internet under less than pure circumstances. And if data is offered for free it diminishes the experience. It is the view that all content is equal and as such all access should be equal.

Jonathan Donner, leading scholar in the area of Information and Communication Technologies for Development (ICT4D) recently published *After Access Inclusion, Development, and a More Mobile Internet.* [667] He explores these questions in the book and an

[665] Jannick Kirk Sørensen and Knud Erik Skouby, "Characterization of ICT Services in a beyond 2020 Perspective," 2015, http://vbn.aau.dk/en/publications/characterization-of-ict-services-in-a-beyond-2020-perspective(57dbe181-fa83-47ef-a669-5826430e943b).html.

[666] Arjuna Sathiaseelan, Gareth Tyson, and Soumya Sen, "Exploring the Role of Smart Data Pricing in Enabling Affordable Internet Access," 2015, http://www.cl.cam.ac.uk/~as2330/docs/SDP15.pdf.

[667] Jonathan Donner, "After Access," MIT Press, November 2015, https://mitpress.mit.edu/after-access.

interview[668] presenting a conceptual framework for understanding effective use of the Internet by those whose "digital repertoires" contain exclusively mobile devices. Donner rejects the "Panglossian" view that mobile technologies are silver bullets for the problems that afflict the developing world and instead suggests that we should recognize both the potentials and constraints in the shift to a more mobile internet. Access should not be equated with effectiveness,[669] he notes. While Donner rejects the idea of the singular internet experience, he suggests some alternatives for the current debate.

> There's no single archetypal user that represents the majority of people in the world. So there's no single experience which I could point to that would kind of say, well this is how the rest of the world uses it and it's different from how we use it. There's a lot of heterogeneity. The zero rating brouhaha, tension, crisis, however we want to call it, is only because of the metered mindset and that is only because that the only way you can allocate spectrum is to have people and have mobile network operators and charge by the bit for it. If we had a different internet with more Wi-Fi and more access points in train stations and more people with home connections and maybe someday with satellites and drones taking the pressure off the mobile channel then this zero rating conflict will go away.

Wifi and train access points are on the rise in the developing world, as are drones, balloons, and satellites to help support backhaul infrastructure demand. Interestingly these are projects supported by companies such as Google and Facebook, which they tout as part of their global connectivity goals. It is welcome that companies are

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[668] John Balz, "A Conversation about the Mobile Internet with Jonathan Donner," Medium, April 4, 2016, https://medium.com/@jpbalz/a-conversation-about-the-mobile-internet-with-jonathan-donner-d671a4077a59#.whk5av469.

[669] Supra Donner

playing a greater role to support connectivity through infrastructure provision (shrewdly by avoiding those points which are regulated), but it alludes to a key issue presented by mobile operators from the beginning, that content providers should play a greater role in to reduce the burden on the end user.

There is an opposite and equally compelling view that people want to purchase a plan that is tailored to their needs and budget, that they don't want to pay for data they don't use, points they don't touch, or destinations they will never see—nor desire to see. Indeed the insistence that every plan must access every point on the Internet is in fact "pure bundling"[670], an act of obliging people to pay for data they don't want. It may be a competition violation. In the case of the unconnected who are forced to pay for Internet access to all points which are overwhelmingly to content in languages and subjects irrelevant to them, this may indeed be welfare-reducing. If some data is offered for free, (especially for the reason to help first time users understand why they should adopt the Internet), it does not diminish the experience, rather it enriches the experiences. It seems inconsistent to accept the heterogeneity of content and users on one hand and then demand a uniformity of offer on the other.

[670] Supra Howell, Layton 2017

5.6.2 REGULATORS ARE EXPERT, INDEPENDENT, AND COMPETENT WHEN IT COMES TO NET NEUTRALITY

The explosion of net neutrality rulemaking puts a new responsibility in front of operators, one for which they are not necessarily skilled, resourced, or even motivated to address. To be sure, there are many outstanding regulatory professionals who are up to the task, but others are employed by the sheer happenstance of political appointment. Net neutrality philosophy also assumes not only that regulators are expert and independent but that rules can be codified to control and direct application innovation and that regulators can and monitor these vast activities and discern what is proper and what is not. Robin Mansell suggests that such regulation empowers a pre-ordained elite.[671]

The very diversity of the rules themselves and their implementations suggest that regulators have diverging views, and if anything, many of them are reluctant to take on new regulatory mandates. The Danish and Dutch regulators are cases in point. The Danish authorities saying the market for communications networks is competitive and that no more regulation is needed and should move as much as possible to ex post competition law[672] versus that of the Dutch approach that "some things just have to be regulated."[673] This hardly seems to be the place of intellectual consensus that underpins the justification to rollout a new set of regulatory requirements.

In any event, the burgeoning of new rules also suggest that there will be more lawsuits. In spite of their best intentions, regulators may find themselves in the crosshairs of litigation. The cost and demand of

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[671] Robin Mansell, Imagining the Internet: Communication, Innovation, and Governance, 1 edition (Oxford: Oxford University Press, 2012).

[672] "The Digital Single Market Strategy," Erhvervsstyrelsen, August 25, 2015, https://erhvervsstyrelsen.dk/sites/default/files/media/nordisk_positionspapir_august_2015.pdf.

[673] "Visie & opinie Speech Fonteijn bij the IBA Conference, Amsterdam | ACM.nl," Visie & opinie, (June 6, 2016), https://www.acm.nl/nl/publicaties/publicatie/15872/Speech-Fonteijn-bij-the-IBA-Conference-Amsterdam/.

litigation takes resources away from other important regulatory activities, not to mention the social cost for taxpayers and citizens who may suffer from a disconnect of regulatory priorities, e.g. lack of spectrum being allocated, failure to reform of universal service, banning of consumer centric business models and practices etc.

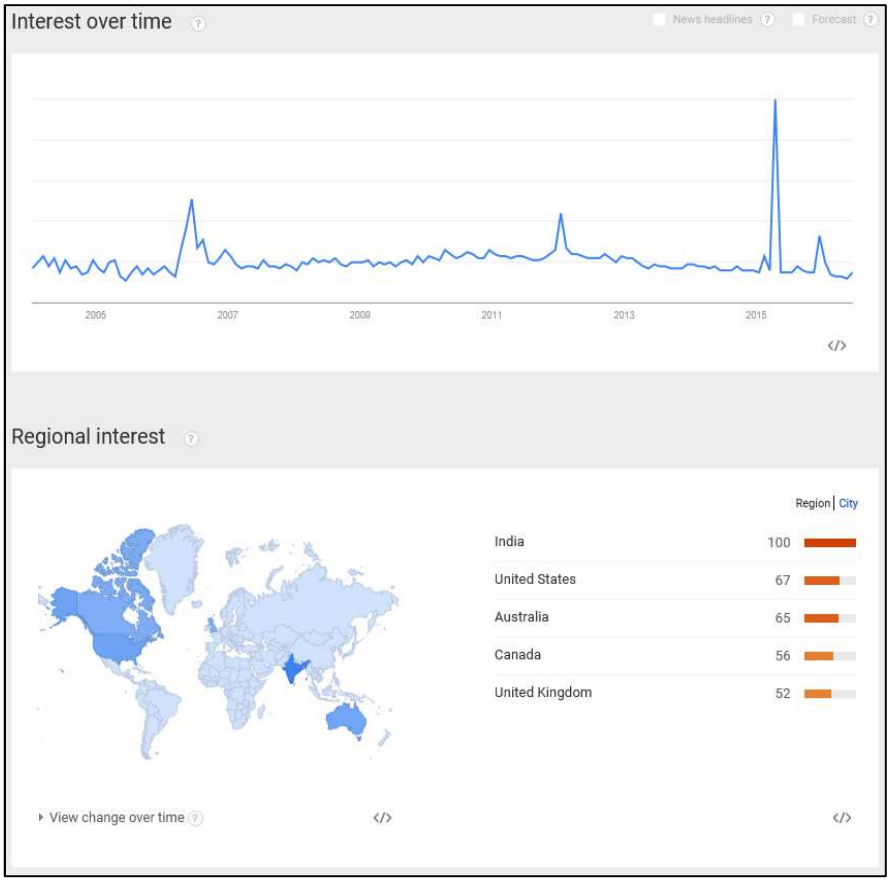
5.7 THE ROLE OF TRANSNATIONAL ACTIVISM IN NET NEUTRALITY POLICY

The burgeoning of net neutrality rules around the world is probably not the result of widespread violation by broadband providers or the need for more app innovation, but rather transnational activism. Today's Internet activism or cyberactivism represents a marked change from traditional political action, particularly on telecom policy. The process and implementation of telecom regulation was historically a sober domain, but no longer. A telecom regulator can receive millions of emails from activists around the world for or against a particular policy, challenging the standards of objectivity and independence.

The various organizations and coalitions associated net neutrality are frequently well-funded and increasingly becoming transnational. For example "Save The Internet" campaigns have targeted Internet policy in the United States, European Union, and India.[674] The management and target of the campaign may be based in Washington or Brussels, its participant are global. The following figure show interest over time for Save the Internet searches at key moments in the net neutrality debate such as 2006 initiative with Congress, the FCC's Open Internet rulemaking, and the EU Parliament vote on net neutrality.

[674] One must consider Australia and Canada as highly prospective countries for the expansion of such campaigns.

Figure 55: Google search trends for "Save The Internet"[675]



[675] "Google Trends," Google Trends, accessed November 9, 2016, https://www.google.com/trends/explore.

5.7.1 BRIEF HISTORY OF THE WORD "ACTIVIST"

There is no doubt that activism is an expression of the freedom of speech and enterprise. Activism has an interesting history from its emergence as a policy to support "armed neutrality" during World War I; to its being incorporated into the various movements for women's, workers', and oppressed people's rights and to anti-war, pacifist, and anti-corporate efforts; and today, to a strategy employed by corporations as a means to supplement public relations and as professional full-time occupation.

An activist refers to one who engages vigorously and directly for political change. While any person may write letters or participate in political processes to bring focus to particular issues and polices, the difference with activist is the form of "direct" action such as boycotts, rallies, marches, strikes, sit-ins and so on. Activists have incorporated the Internet to amplify their mobilization and communication efforts. This includes the used of digital tools (email, social media, electronic petitions, video, podcasts, online fundraising etc) to achieve political goals. The historical derivation of the word activist has an interesting relevance for today's net neutrality debate.

The term activist was first used in Sweden during World War I to refer to a political faction, sympathetic to Germany with royal, cultural, and ethnic ties from the prior century, that wanted to align with the Central Powers (Germany/Prussia, Austria-Hungary, and the Ottoman Empire), culminating in the policy of "neutrality".[676] Interestingly the "activists" challenged the groups advocating for social democracy, pacifism, and women's rights.

While "neutrality" as a concept may have the connotation as an unassailable position today, the reality is more complicated. While the dictionary term "neutrality" means not taking sides, impartial, or unbiased, neutrality in the political context has come under revision, as historians and scholars challenge the notion the "armed neutrality

[676] Sofi Qvarnström, "Sweden | International Encyclopedia of the First World War (WW1)," accessed November 9, 2016, http://encyclopedia.1914-1918-online.net/article/sweden.

paradox"[677] of Sweden and Switzerland during the 20th century wars. "Essentially transfers of military technology to Sweden and Switzerland, which were needed to make their neutrality credible, effectively undermined the very credibility that they were supposed to ensure," note historians Nilsson and Wyss.[678]

5.7.2 THE TOOLS AND TECHNIQUES OF TRANSNATIONAL ACTIVISM

Sidney Tarrow is a leading professor of political science and sociology and developed a compelling framework to understand *transnational activism.* [679]The movement can be seen in the larger context as being comprised of individuals, corporations, and non-governmental organizations that are focused on restructuring politics while transforming national norms and practices on a global scale.[680]

Tarrow identifies the dynamics of transnational activism as

- Transnational Activism
- Internalization
- Diffusion
- Scale Shift
- Externalization
- Transnational Coalition Forming

Internalization

As Tarrow describes, *internalization* is the response to foreign or international pressure within domestic politics. It can result in a

[677] Mikael Nilsson and Marco Wyss, "The Armed Neutrality Paradox: Sweden and Switzerland in US Cold War Armaments Policy," Journal of Contemporary History, March 23, 2015, 22009414564804, doi:10.1177/0022009414564804.

[678] Ibid

[679] Sidney Tarrow, "The New Transnational Activism," Cambridge University Press, August 2015, http://www.cambridge.org/co/academic/subjects/politics-international-relations/comparative-politics/new-transnational-activism.

[680] Sanjeev Khagram, James V. Riker, and Kathryn Sikkink, Restructuring World Politics: Transnational Social Movements, Networks, And Norms, 1 edition (Minneapolis: Univ Of Minnesota Press, 2002).

contentious triangle structure of the people, their governments, and international institutions. The model was developed by studying activists' objections to national austerity programs required by international loan organizations such as the IMF and World Bank. The elements include pressure applied by the international organization made on the country; implementation of the policy by the national government; protest by an activist group; and the response from the national government, whether it be repression, concession, or brokerage between the international organization and the nation's people. A salient example is President Obama's YouTube video[681] from November 14, 2014 in which he "urged the "Federal Communications Commission (FCC) to take up the strongest possible rules to protect net neutrality, the principle that says Internet service providers (ISPs) should treat all internet traffic equally." The video was picked up by net neutrality activists around the world as justification to promulgate hard net neutrality rules.[682]

Diffusion

The transfer of claims of contention from one place to another is *diffusion*. Claims that net neutrality violations were occurring in the United States were copied by other countries. Tarrow describes how diffusion works in transnational activism:

> With the expansion and greater availability of electronic communication, shifting the scale of contention has become both easier and more rapid. The Internet can also become a tool of collective action, for activists and others who use their skills and artistic talents to disrupt the communication processes of their opponents. Because many social movements lack consistent, hierarchal organizing structures, it is only a short step to regarding the Internet itself as a form of organization. The group website, with very little need for formal organization behind it, can be used as a node for organizing protest campaigns.

[681] The White House, President Obama's Statement on Keeping the Internet Open and Free, 2014, https://www.youtube.com/watch?v=uKcjQPVwfDk.

[682] This investigation details the example of Slovenia, but the video has been used in policy debates in other countries as well.

An example of diffusion is the crowdsourced net neutrality reporting tool Respect My Net.[683] European users can can enter "violations", of which 67 are noted as "verified" cases. Invariably the issues involve small mobile operators with free offers of music, video, and social media. Respect My Net is maintained by the French net neutrality advocacy La Quadrature du Net and is partially funded by the Open Society Foundation. La Quadrature organized a letter[684] to BEREC with signatories from network neutrality groups located in Africa, Asia, North America, South America, and Central America, along with International organizations such as AccessNow.

Scale Shift

Scale shift is a change in the number and level of coordinated contentious actions to a different focal point, involving a new range of actors, different objects, and broadened claims. Tarrow provides a model of scale shift beginning with local action followed by coordination, the joint planning of collective action and the creation of instances for cross-spatial collaboration. This is done through brokerage (the practical mechanism of bridge-building between organizations) and theorization (the abstraction of core ideas taken from one reality and then applied to another).

This then leads to *claim-shift* and *target-shift*, as claims and targets move from one level or party to another. There is also an *identify-shift*, in which the boundary between political actors shift and their relations adjust. It can also be observed that activists become micro-celebrities, gaining renown in their local as well as global networks.

It can be observed how a variety of Internet activist groups coordinate to send a mass of automated messages to public consultations (especially telecom consultations) for or against a particular policy, creating the appearance of a mass movement when in fact it could be

683 "Respect My Net," [!] Respect My Net, accessed November 11, 2016, https://respectmynet.eu/.

684 "Global Open Civil Society Letter to the Body of European Regulators of Electronic Communication (BEREC) in Support of Strong Net Neutrality Guidelines," May 2, 2016, https://www.laquadrature.net/files/NN_letter_BEREC_20160502.pdf.

between 2 and 3 key agents organizing a response. As an example, a content analysis study[685] of comments submitted to the FCC's Media Ownership Online Docket # 02-121 revealed,

> . . . major coordinated campaigns employing the use of form letters dominated the FCC's online comment submission process. The initial analysis of where the comments were submitted from and when they were submitted, with the findings revealing that submissions came from all fifty states, for numerous days at a time, hinted at the idea that perhaps a considerable number of Americans were really engaged in the FCC's process. While the findings of the content analysis do not suggest that the public that participated was apathetic by any means, the fact that the overwhelming majority of submissions came via form letter (or were modifications of a form letter) points to what perhaps could be termed a "partial" form of engagement. This is not to denigrate the public's involvement; indeed the decision as to the value of these comments rests with the FCC. That being said, one would assume that the value of the coordinated campaign would likely be in the sheer number of individuals that clicked to submit the form letters, and not in the words that were communicated, suggesting what could be termed perhaps this "partial" engagement.

Externalization

The vertical projection of domestic claims of contention onto international or foreign actors is *externalization*. Such behavior was observed in 2014 during the outpouring of comments by parties outside the U.S. (such as the European Digital Rights organization, or EDRi[686]) that were submitted to the U.S. Federal Communications Commission Open Internet proposal. This international influence trend further continued with the EU BEREC's proposed rules. An

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685 Jonathan Alan Obar, "Democracy or Technocracy? An Analysis of Public and Expert Participation in Fcc Policymaking," July 29, 2010, https://etda.libraries.psu.edu/catalog/11468.

686 "EDRi - Response to FCC Consultation," FCC, accessed November 9, 2016, https://ecfsapi.fcc.gov/file/7521479150.pdf.

open letter[687] was crafted and sent to BEREC concerning their forthcoming European Union telecommunications regulations. The correspondence demanded particular action on network neutrality issues and included signatures from 17 non-EU-based network neutrality groups located in Africa, Asia, North America, South America, and Central America, in addition to five organizations such as AccessNow that deem themselves to be "international".

Transnational Coalition Forming

Non-hierarchical coordination of networks among actors in different countries with similar claims is *transnational coalition forming*. Tarrow observes, "Coalitions are collaborative, means-oriented arrangements that permit distinct organizational entities to pool resources in order to effect change", adding that coalitions use framing, trust, credible commitments, management of difference, and selective incentives to ensure endurance.

This model includes *brokerage* between originators and adopters, *mobilization* by activists, and *certification* by authoritative actors. Net neutrality is a global movement organized under a number of sophisticated coalitions, including Save the Internet and the Dynamic Coalition on Net Neutrality. In this way, knowledge, ideology, strategy, and tactics can be imparted from one group to another. For example, Free Press and the Mozilla Foundation in the United States *broker* a set of trainings and white label campaigns, which other organizations can *mobilize* in their respective countries. *Certification* is provided by the formalization of rules by regulatory and legal authorities. The goal of these coalitions is to create harmonized net neutrality laws worldwide, which would ban blocking, throttling, traffic management, paid prioritization, zero rating, and sponsored data.

[687] "Global Open Civil Society Letter to the Body of European Regulators of Electronic Communication (BEREC) in Support of Strong Net Neutrality Guidelines."

Examples of such transnational coalitions are "Save the Internet" in the EU[688], and, on a larger scale, the coalition members listed on the website of the Global Net Neutrality Coalition.[689] Global campaigns are self-reinforcing through "the boomerang effect,"[690] the circumvention of "domestic indifference or pressure by transferring debate to the international level."

5.7.3 ACTIVISM AS AN INDUSTRY

A franchise is the authorization to license a product, concept or service under a brand name. Just as McDonalds has enabled billions to be served with signature golden arches and burger and fries menu, Save the Internet, Mozilla, Public Knowledge, and other groups offer "white label" campaigns to activist entrepreneurs. They offer net neutrality tools in a box so to speak, with code banks, teach-ins, and tool kits, local activists can kick start their own efforts. There is no need to re-invent the wheel and build an "authentic" campaign from the ground up if one can simply leverage proven messaging and techniques.

An activist is one who advocates vigorously for or against a political cause. The archetype of the person taking time off from work to take a bus to Washington for a protest has given way to professional activists

688 Arbeitskreis Vorratsdaten Österreich, "Save the Internet," SaveTheInternet, accessed November 9, 2016, https://savetheinternet.eu/.

689 "Status of Net Neutrality Around the World," AccessNow, accessed November 9, 2016, https://dejiaccessnow.carto.com/viz/4f239c60-356f-11e5-b01c-0e853d047bba/embed_map.

690 Margaret E. Keck and Kathryn Sikkink, "Transnational Advocacy Networks in International and Regional Politics," Harvard, accessed November 9, 2016, http://isites.harvard.edu/fs/docs/icb.topic446176.files/Week_7/Keck_and_Sikkink_Transnational_Advocacy.pdf.

W. Lance Bennett et al., Transnational Protest and Global Activism, ed. Donatella della Porta and Sidney Tarrow (Lanham, MD: Rowman & Littlefield Publishers, 2004).

with master's degrees[691] and full-time employment, and consultancy contracts. Activists are available for hire to plan and execute political action for corporate interests.[692] Activism has been further professionalized with the integration of online marketing technology. As companies use digital tools and tactics to gather leads and sales online, activists use the same or similar technologies to win political victories and advance legislation.

To be sure, *cyberactivism* is much more than traditional activism simply taking place online. The Internet, being a resource that has only recently (in historical terms) been leveraged by the general public, has increasingly enabled various advocacy groups to significantly extend their reach. A 2011 study[693] found that "advocacy groups are using the Internet to accomplish organizational goals, and have been doing so for more than ten years."

Further, it is possible that particular activities are undertaken expressly to degrade the value of various Internet entity assets, such as app store or website vandalism, when activists downgrade the ratings of a mobile app to pressure its publisher into a particular action.

Cyberactivism is an important trend in the digitization of political movements, because it enables people to conveniently participate on single issues. It makes participation simple, easy, and frequently anonymous. Internet activists may be simply asked to read some bullet points, fill out an online form, and click to send. Such methods can be effective to gather supporters at low cost, overwhelm policymakers with messages, and create the appearance of a mass campaign.

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691 "School of Geography: MA in Activism and Social Change," accessed November 9, 2016, http://www.geog.leeds.ac.uk/study/masters/courses/ma-in-activism-and-social-change/.

692 "Activist Consultancies - Google Search," accessed November 9, 2016, https://www.google.dk/?gws_rd=cr&ei=HxwjWPDzIIGyswGqmr2QAQ#q=activist+consultancies.

693 Jonathan A. Obar, Paul Zube, and Cliff Lampe, "Advocacy 2.0: An Analysis of How Advocacy Groups in the United States Perceive and Use Social Media as Tools for Facilitating Civic Engagement and Collective Action," SSRN Scholarly Paper (Rochester, NY: Social Science Research Network, November 8, 2011), https://papers.ssrn.com/abstract=1956352.

This apparent ease has earned the critique of "slacktivism,"[694] devaluing traditional activism in which people put their reputation and sometimes their life on the line; for example, protesters in the U.S. civil rights movement endured physical violence, imprisonment, etc. Internet activism is a relatively risk-free proposition for the participant, and people can safely and anonymously engage across a range of issues. It can even produce an oversized body of citizen expression, which is not representative of the very real needs of the populace. A prime example of this was when the U.S. government was petitioned in 2012 to build a real Death Star from the Star Wars movie.[695] The petition received wide attention and enough signatures to qualify for a government response.

A leading provider of such services is Micah White (co-founder of the Occupy movement), who runs Boutique Activist Consultancy[696] to provide "discreet service to political mavericks, emergent movements, and creative activists" and is the author of *End of Protest*.[697] The goals of his professional service include maintaining the authenticity of the appearance of activism while incorporating digital tools and management practices to professionalize and scale the practices around the world. His consulting firm offers a robust set of services such as the following:

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694 "Slacktivism," Wikipedia, October 28, 2016, https://en.wikipedia.org/w/index.php?title=Slacktivism&oldid=746609063.

695 "This Isn't the Petition Response You're Looking For | We the People: Your Voice in Our Government," accessed November 9, 2016, /petition/secure-resources-and-funding-and-begin-construction-death-star-2016.

Katie Rogers, "Boaty McBoatface: What You Get When You Let the Internet Decide," The New York Times, March 21, 2016, http://www.nytimes.com/2016/03/22/world/europe/boaty-mcboatface-what-you-get-when-you-let-the-internet-decide.html.

696 "We Win Lost Causes," Boutique Activist Consultancy, accessed November 9, 2016, http://activist.boutique/.

697 "The End of Protest: A New Playbook for Revolution by Micah White of Occupy Wall Street," Micah White, accessed November 9, 2016, https://endofprotest.com/.

- Protest Innovation
- Activism & Movement Strategy Workshops
- Campaign Direction
- Movement Storyline
- Research & Insights
- Novel Protest Methods
- Full-Service Social Movement Creation

White, while implementing such measures, warns of overuse of digital tactics. He notes:

> Is protest broken? Movements ranging from Black Lives Matter to environmentalism are leaving activists frustrated. Meanwhile, recent years have witnessed the largest protests in human history. Yet these mass mobilizations no longer change society. Now activism is at a crossroads: innovation or irrelevance. . .Over time, the Internet becomes harmful because things start to look better online than in real life. This happened with Occupy. The protest looked better on Facebook than it did in the streets. This is negative because people start to prefer the online experience to the real world.

Just how successful can online protests be to effect change when they are not so much "alive in the streets" as they are alive in in living rooms? After the digital protest has become passé, will tomorrow's users simply roll their eyes and scroll by, as the tired digital marketing gimmicks now employed by cyberactivists wear down with time? White directly compares current activism efforts to marketing strategy:[698]

> The trouble is that this model of activism uncritically embraces the ideology of marketing. It accepts that the tactics of advertising and market research used to sell toilet paper can also build social movements. This manifests itself in an inordinate faith in the power of metrics to quantify success.

[698] "Clicktivism Is Ruining Leftist Activism," The Guardian, August 12, 2010, sec. Opinion, https://www.theguardian.com/commentisfree/2010/aug/12/clicktivism-ruining-leftist-activism.

Thus, everything digital activists do is meticulously monitored and analyzed. The obsession with tracking clicks turns digital activism into clicktivism. Clicktivists utilize sophisticated email marketing software that brags[699] of its "extensive tracking" including "opens, clicks, actions, sign-ups, unsubscribes, bounces, and referrals, in total and by source". And clicktivists equate political power with raising these "open-rate" and "click-rate" percentages, which are so dismally low that they are kept secret. The exclusive emphasis on metrics results in a race to the bottom of political engagement. Gone is faith in the power of ideas, or the poetry of deeds, to enact social change. Instead, subject lines are A/B tested and messages vetted for widest appeal. Most tragically of all, to inflate participation rates, these organizations increasingly ask less and less of their members. The end result is the degradation of activism into a series of petition drives that capitalize on current events. Political engagement becomes a matter of clicking a few links. In promoting the illusion that surfing the web can change the world, clicktivism is to activism as McDonald's is to a slow-cooked meal. It may look like food, but the life-giving nutrients are long gone.

Digital activists hide behind gloried stories of viral campaigns and inflated figures of how many millions signed their petition in 24 hours. Masters of branding, their beautiful websites paint a dazzling self-portrait. But, it is largely a marketing deception. While these organizations are staffed by well-meaning individuals who sincerely believe they are doing good, a bit of self-criticism is sorely needed from their leaders.

The truth is that as the novelty of online activism wears off, millions of formerly socially engaged individuals who trusted digital organizations are coming away believing in the impotence of all forms of activism. They will offer phone-based, alternate reality, and augmented reality alternatives.

[699] "ActionKit: Tools to Build a Movement," accessed November 9, 2016, http://actionkit.com.

Another criticism is that Internet activism, while purporting to be the voice of the people, can ultimately marginalize certain groups. People without digital access or skills (frequently minority populations and the elderly) can't and don't participate. One observation is that leaders of the current US and EU digital activist campaigns, to a large extent, are elite and educated, and frequently white. The net neutrality debate and its ideas and assumptions about the Internet and what kind of access is appropriate were studied by communication and media scholar Maria Löblich who suggests that the positions of stakeholders aligns primarily with race and class.[700] Using Giddens's theory of structuration which posits a set of relationships between human agents and social structures,[701] she researched 13 US internet advocacy organizations and their documentation to regulatory authorities during the Open Internet rulemaking period in 2014. She critiques that assumption of journalists that "communication advocacy and activism as a unified front" and notes the wide cleavages between the various public interest community groups and consumer/civil liberties groups. "The assumption of unity "glosses over the real, and often sharp, conflicts" among civil society organizations." Her research explains why zero rating may not be a unifying theme among stakeholders, which both claim to support end users.

Löblich observes that the advocacy groups themselves "represent a highly professionalized field of collective action, which hardly fits the criteria of a social movement" and that a "typical civil advocate works inside the Beltway was dressed in a business suit and sat in front of a computer" and invariably "holds a law degree." She describes how a professional advocates' workday is organized around regulator's notice-and-comment system with e-mails, phone calls, and meetings; writing policy papers and filings; visits to the regulator etc. She organized the advocacy groups into four categories: Believers (Public Knowledge, Open Technology Institute, and Free Press), Cyber

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[700] Maria Löblich, "Dissent and Political Participation: The Many Faces of Communication Policy Advocacy and Activism: Dissent and Political Participation," Communication, Culture & Critique 9, no. 3 (September 2016): 395–416, doi:10.1111/cccr.12113.

[701] David Gauntlett, "Media, Gender and Identity: An Introduction," 2002, http://www.theory.org.uk/giddens2.htm.

Enthusiasts (Electronic Frontier Foundation), Mobilizers (Media Justice and Center for Rural Strategies), and Reframers (National Association for the Advancement of Colored People and League of United Latin American Citizens) and noted that their positions tended to reflect the particular race and class of their constituencies and staff.

> The Believers and the Cyber Enthusiast are both based on White middle-class users who adopted the Internet years ago, and who can afford Internet access and devices. For them, the key issue was individual rights, as opposed to rights for specific racial groups or socioeconomic classes which were claimed by the Mobilizers and the Reframers. To start, these differences have to do with the fact that the constituencies of both the Mobilizers and the Reframers lag behind in Internet adoption, and often are not able to afford Internet access. According to Giddens, these differences are related to the structures of domination and legitimation that people of color and low-income groups have experienced for a long time. Race and class also explain why the Mobilizers and the Reframers have developed specific routines. The Mobilizers developed a grassroots approach and encouraged their constituency to participate in the Open Internet proceeding. In contrast, the Reframers regard close partnerships with media and telecommunications corporations—a legacy of the mid-20th-century civil rights struggle that civil rights organizations originally developed to hold companies accountable and foster diversity—as indispensable to changing the structures of the communication system). Both groups have emphasized that they do not want other organizations such as the Believers to speak on their behalf, because these would not represent their interests. The Mobilizers and the Reframers were aware

> of "the noticeable lack of people of color within media advocacy organizations."

It is significant that the Minority Media Telecom Council, an advocacy group from the Reframers category, supports zero rating, noting "The digital elite can afford to intellectualize the value of free data, but for communities of color it can mean an affordable digital connection to the future. This is even more true for small, multicultural businesses that rely on mobile connections to reach their audiences."[702] A number of advocacy groups in the Believers category support the global efforts against zero rating and declared victory when a ban was imposed in India. However this position was critiqued by another advocacy organization saying, "Ideological purity is easy…when it doesn't cost you anything."[703]

Cyberactivism on a global could not be achieved without a significant investment in digital tools and technologies. This includes a database of users and associated marketing and communications technologies to engage the user bases. Activists organizations and political parties have honed these tools over the last decade with regard to net neutrality. A 2006 article[704] describes net neutrality as "the brainchild of the likes of Google and Amazon.com, which want to offer consumers things like high-speed movie downloads, but don't want to pay the network operators a fee to ensure what in the industry is called "quality of service"– i.e. , ensuring the consumer gets what he pays for quickly and reliably."

The article then describes the founding of a "Data Warehouse" by Hillary Clinton political adviser Harold Ickes, a fundraising list

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[702] Supra MMTC

Rose Mendoza, "Zero-Rating Programs Provide One Form of Bridge across the Digital Divide," April 14, 2016, http://httponline.org/2016/04/zero-rating-programs-provide-one-form-of-bridge-across-the-digital-divide/.

[703] "The Zero Access Country Club," accessed November 9, 2016, http://nointernetforpoorpeople.com.

[704] "Selling the Internet Rope," The American Spectator, March 27, 2006, http://spectator.org/47224_selling-internet-rope/.

service and data mining operation. The $11.5 million investment was supported primarily by Soros, Google and Amazon. Former Democratic National Committee Director of Engineering Nick Gaw explains in a video[705] how the data warehousing function runs on Amazon Web Services to enable Democratic party members to be elected at local and national level and to mine the information of its voters. Gaw[706] is now the Senior Technology Advisor for Avaaz.org[707], an online platform to conduct online activist campaigns including European campaigns against Brexit and Monsanto's Glyphosate. The website notes some 44 million members. Avaaz was founded by Brett Solomon,[708] now Executive Director of Access, a net neutrality advocacy.

An insight to the value to such systems was highlighted in article about WikiLeaks emails between Presidential candidate Hillary Clinton and her campaign manager John Podesta, in which Alphabet Chairman Eric Schmidt helped the Hillary campaign with its election tech, proposing to build individual voter dossiers,

> But Schmidt's outline gave clues to the basic tech challenges he foresaw building on Obama's 2012 effort. Clinton, he said, would need to push vendors and her staff to move their technology to the cloud so it would scale more easily and to avoid expensive investments in servers. And he saw the need for new tools to integrate the various datasets—voter files, social media profiles, cable box records—into one system.

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[705] "AWS Case Study: Democratic National Committee," Amazon Web Services, Inc., accessed November 9, 2016, //aws.amazon.com/solutions/case-studies/democratic-national-committee/.

[706] "Nick Gaw," LinkedIn, accessed November 9, 2016, https://www.linkedin.com/in/nick-gaw-9ba9b4a.

[707] "Avaaz - The World In Action," Avaaz, accessed November 9, 2016, https://secure.avaaz.org/campaign/en/front/?pv=300.

[708] "Brett Solomon," World Economic Forum, accessed November 9, 2016, https://www.weforum.org/people/brett-solomon/.

> "Key is the development of a single record for a voter that aggregates all that is known about them," he wrote. "In 2016 smart phones will be used to identify, meet, and update profiles on the voter….[q]uite a bit of software is to be developed to match digital identities with the actual voter file with high confidence."[709]

This investigation could not determine whether broadband providers employ such strategies, but it is doubtful. In any case, the telecom industry appears to be outmatched by net neutrality activists in funding, digital sophistication, and coordination with other advocacies.

Transnational activism was on display in the US when FCC Chairman Wheeler announced that based upon the command of "4 million Americans"[710] that the FCC would implement Open Internet rules. A fact check reveals that not only were at least a quarter of the responses against Internet regulation,[711] but hundreds of thousands of responses came from non-Americans outside of the US, in addition to a significant part of the comments being unintelligible and unrelated to the proceeding.[712] President Obama echoed the 4 million number on the White House website,[713] and created his own YouTube video instructing the FCC to make the toughest rules possible, a highly

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[709] Tim Fernholz, "Leaked Emails Show Eric Schmidt Played a Crucial Role in Team Hillary's Election Tech," Quartz, accessed November 11, 2016, http://qz.com/823922/eric-schmidt-played-a-crucial-role-in-team-hillarys-election-tech/.

[710] "STATEMENT OF CHAIRMAN TOM WHEELER Protecting and Promoting the Open Internet, GN Docket No. 14-28.(FCC, n.d.), https://www.fcc.gov/article/fcc-15-24a2.

[711] Shawn McCoy, "FACT CHECK: Was the FCC Influenced by 4 Million Americans?," InsideSources, March 19, 2015, http://www.insidesources.com/fact-check-fcc-influenced-4-million-americans/.

[712] William Rinehart, "A Semantic Network Analysis of The Network Neutrality Debate," SSRN Scholarly Paper (Rochester, NY: Social Science Research Network, March 31, 2015), https://papers.ssrn.com/abstract=2587849.

[713] "Net Neutrality: President Obama's Plan for Free and Open Internet." https://www.whitehouse.gov/net-neutrality Accessed November 10, 2016.

unusual intervention reported to have been conducted as a "secret and parallel FCC."[714] As the White House website demonstrates, Obama Administration made net neutrality as campaign pledge in 2007, a critical move to get the support of the NetRoots Nation[715] and later a strategy that aligned with the business interests of Google[716] and Netflix.[717]

SavetheInternet.eu is a key stakeholder for BEREC, which opened its press conference[718] by noting that the organization delivered the bulk of the 480,000 of the "unprecedented" number of submissions to a BEREC consultation. While BEREC describes its consultation process as "transparent and inclusive," it will publish only 46% of the total comments received as Save the Internet respondents frequently choose to make their submissions confidential.

All told, BEREC reports just 1000 substantive submissions which responders read the guidelines and made original comments.[719] The FCC reported a similar number of limited number of substantive comments amidst the avalanche of clicktivism.

In India, Save the Internet activists efforts including 1 million emails to the Telecom Regulatory Authority precipitated a two year ban on

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[714] Gautham Nagesh and Brody Mullins, "Net Neutrality: How White House Thwarted FCC Chief," Wall Street Journal, February 5, 2015, sec. US, http://www.wsj.com/articles/how-white-house-thwarted-fcc-chief-on-internet-rules-1423097522.

[715] John McQuaid, "The Netroots: Bloggers and the 2008 Presidential Campaign," accessed November 9, 2016, http://niemanreports.org/articles/the-netroots-bloggers-and-the-2008-presidential-campaign/.

[716] See generally GoogleTransparencyProject.org,

[717] Jorgensen, Mark "The Envy of Frank Underwood," InsideSources, March 1, 2015, http://www.insidesources.com/envy-frank-underwood/.

[718] "Presentation at the Net Neutrality Guidelines Press Conference," Berec, August 30, 2016, http://berec.europa.eu/eng/document_register/subject_matter/berec/others/6166-presentation-at-the-net-neutrality-guidelines-press-conference.

[719] Supra BEREC press conference

differential pricing.[720] The decision appears to contravene India's Telecom Tariff Order (TTO),[721] the source of authority which TRAI uses to justify its action. The TTO notes the need to stimulate competition (specifically to support entrant telecom providers and reduce the power of incumbents), the requirement of the "social objective" of encouraging low users of telecom to get connected and use the system more intensively; and the provision of enhanced flexibility for pricing and giving alternative tariff packages to customers. India *was* considered one of the great regulatory success stories. Because of the reforms to unleashing market forces, mobile subscriptions increased 500-fold and prices dropped more than 95 percent.[722] This story is a textbook example of the value of good telecom regulatory policy.

A forthcoming paper by Sharada Srinivasan[723] based upon personal interviews with TRAI regulatory staff suggests that TRAI banned differential pricing because it did not have the expertise to address the questions of zero rating. She also notes that a lawsuit is in the works by the nation's trade association for mobile operators which notes the lack of justification rooted in any sort of empirical evidence, which goes against the transparency in framing regulations that is mandated by section 11 (4) of the act that sets up the regulator. On October 25, 2016 TRAI is reported[724] to have held an open house on free data

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[720] "Prohibition of Discriminatory Tariffs for Data Services Regulations." TRAI February 9, 2016

[721] "Regulation: Telecom Regulatory Authority of India," accessed November 9, 2016, http://www.trai.gov.in/content/Regulation/0_2_REGULATIONS.aspx.

[722] Colin Blackman and Lara Srivastava, 10th Anniversary Telecommunications Regulation Handbook, vol. March 2011 (infoDev | The World Bank | The International Telecommunication Union, n.d.), http://www.infodev.org/articles/10th-anniversary-telecommunications-regulation-handbook.

[723] "Penn Law Faculty: Sharada Srinivasan," accessed November 9, 2016, https://www.law.upenn.edu/cf/faculty/sharadas/.

[724] "Recommendations on Free Data Architecture Soon: TRAI," News18, October 26, 2016, http://www.news18.com/news/tech/recommendations-on-free-data-architecture-soon-trai-1305232.html.

architecture, with the idea to develop a regime in which free data can be employed for a range of actors in the Internet ecosystem. This would suggest that the regulator is attempting to facilitate a pro-consumer and pro-innovation solution for zero rating and free data and perhaps obviate a lawsuit.

Google supported activists led the charge against Facebook in India,[725] saying that the poor should not have free Facebook. But it does not appear that activists have a problem with the poor getting "free Google", as the Android platform which is effectively the only operating system in India delivering the lion's share of content and earning greater part of ad revenue. Google's ad revenue in the country exceeds $1 billion annually and accounts for 70 spent of all digital spend in the country, an effective "monopoly."[726] Leading mobile industry analyst Richard Windsor declares that it "was lobbying by Alphabet-funded advocates that was largely responsible for Free Basics being blocked by the Indian regulator…"[727] He explains Google's strategy in India "one of the last remaining Internet wildernesses" with 1.3bn people where only 35% of the population (462m) have access to the Internet,

> Google is way ahead of all of its competitors and in particular, has been able to keep Facebook from getting real traction. Google's strategy has been to begin with Android and it has cleverly managed to move user awareness from the Android software to its app store Google Play. 4 years ago, Indian shoppers would clamor for an Android device but now they have become more sophisticated and are demanding Google

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"Trai to Come out with Recommendation for Free Data Architecture Soon," Tech2, October 26, 2016, http://tech.firstpost.com/news-analysis/trai-to-come-out-with-recommendation-for-free-data-architecture-soon-343449.html.

[725] "The Zero Access Country Club," accessed November 9, 2016, http://nointernetforpoorpeople.com.

[726] Sagar Malviya, "Google Alphabet India Reports 35% Increase in Yearly Revenue," The Economic Times, December 14, 2015,http://economictimes.indiatimes.com/tech/internet/google-alphabet-india-reports-35-increase-in-yearly-revenue/articleshow/50164758.cms?intenttarget=no.

[727]Supra Windsor, Richard "Google vs. Facebook – Almost the Final Frontier."

Play. Much to the dismay of Indian handset makers, this has meant that they have been effectively forced to produce Google Ecosystem devices, leaving their own Indian ecosystems[728] to wither and die on the vine. The next stage for Google is to increase the number of users that have access to the Internet as these users will almost certainly use Android and Google's services. In this regard Google is offering free WiFi at 24 railway stations with the intention to expand to 100 by year end and 400 in the medium term. Following on from this, Google intends to launch its Internet balloons (Project Loon) to offer free access to Indian users but it must get past the regulator first. This is where Facebook came a cropper as its Free Basics service was blocked by the Indian regulator on the grounds of net neutrality giving Google a free pass.

Windsor concludes that India the "game may already be over for the home grown alternatives."[729]

5.7.4 THE VALUE PROPOSITION ACTIVISTS OFFER THEIR FUNDERS

The rise of Internet activism can also be explained by the school of public choice economics which has criticized the received wisdom that regulators work in the "public interest" to promote the "common good."[730] Rather people are motivated by self-interest subject to incentives and constraints. They challenge the view that there are meaningful groups such as "the community" or "the people" who make decisions. Rather they focus on "collective action" of special interests , which tend to be small homogeneous groups which are more effective to supply pressure and support to policymakers than are large groups with diffuse interests. Smaller groups have a greater

[728] "Micromax Yu – The Bollysystem.," Radio Free Mobile, November 25, 2014, http://www.radiofreemobile.com/micromax-yu-the-bollysystem/.

[729] Supra Windsor , "Google vs. Facebook – Almost the Final Frontier." And "Google – From Russia with Love Pt. II."

[730] William Shughart, "Public Choice: The Concise Encyclopedia of Economics," Library of Economics and Liberty, accessed November 9, 2016, http://www.econlib.org/library/Enc/PublicChoice.html.

stage in particularized policy decisions, can organize more cost-effectively, and can more effectively eliminate the free rider problem when benefits are distributed to parties which do not contribute.

Watchdog.org describes[731] that the Ford Foundation uses net neutrality advocacy as a way to protect is portfolio which is heavily invested in Google and other Silicon Valley stocks. This world's second largest foundation earned $1.65 billion in 2007 on investments in YouTube and received nearly 220,000, valued at more $100 million. Holdings also include 3 million shares of Google company stock; $5 million of stock in Microsoft, $5 million in Oracle, and $2 million invested in more than 480 companies to net more than $402 million in 2012 based on stock investments alone.[732]

Perhaps the single largest supporter of net neutrality is Hungarian billionaire currency trader George Soros, known as the "Man Who Broke the Bank of England" who made USD $1 billion with a short sale of USD $10 billion British pounds during the Black Wednesday in 1992[733] and has a personal net worth of $23 billion. One of his signatures has been to parlay the concept of "open" to a variety of ventures, such as open government, open internet, and open borders.

Like Ford, Soros' Open Society also appears to use net neutrality as strategy to protect its financial portfolio. A copy of the recent 13F form of the Open Society Foundation notes significant holdings of stock in Alibaba, Alphabet, Amazon, Broadcom, EBay ($94 million) PayPal ($106 million), and Level3 Communications ($173 million). The foundation also holds stocks of Time Warner Cable and Charter Cable. It is significant to note that the FCC denied Comcast the ability buy TimeWarner but Charter Cable, by agreeing to significant "Open

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[731] Josh Peterson and Yael Ossowski, "Ford Foundation Pours Millions into Net Neutrality to Reap Profit," Watchdog.org, December 15, 2014, http://watchdog.org/187392/ford-foundation/.

[732] "Tax Return," Ford Foundation, 2012, http://www.fordfoundation.org/pdfs/about/2012_tax_return.pdf.

[733] Andrew Beattie, "How Did George Soros 'break the Bank of England'?," Investopedia, September 9, 2008, http://www.investopedia.com/ask/answers/08/george-soros-bank-of-england.asp.

Internet" concessions such as not to add data caps or usage-based pricing to subscriptions,[734] was approved to acquire the company for $66 billion, a sum $21 billion greater than suggested by Comcast. The Soros and Open Society funded Free Press campaigned[735] vigorously against the attempted Comcast-TimeWarner merger, but the deal was evidently enabled by former Free Press counsel Marvin Ammori who explained how his new employment at Charter would make the pending merger an acceptable network provider for the Open Internet.[736]

There is no doubt that telecom industry lobbying is significant. Open Secrets reports some $90 million spent in 2015 in the US by some 87 firms (this includes pro-net neutrality groups such as Level3 Communications and INCOMPAS with almost $2 million).[737] However this amount has been declining in recent years, and net neutrality comprises a fraction of the total spend and activities. In fact total telecom industry lobbying pales in comparison to the spend of just two foundations, Ford and Open Society, which have spent almost $200 million on net neutrality in recent years.[738] The support of tech companies such as Google, Netflix, and so on is additional.

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734 "Commission Approves Charter, TWC and Bright House Merger," Federal Communications Commission, May 10, 2016, https://www.fcc.gov/document/commission-approves-charter-twc-and-bright-house-merger.

735 "Join the Fight to Stop the Comcast-Time Warner Cable Merger," Free Press, accessed November 9, 2016, http://www.freepress.net/resource/105883/join-fight-stop-comcast-time-warner-cable-merger.

736 Author: Marvin Ammori Marvin Ammori Business, "Here's How Charter Will Commit to an Open Internet," WIRED, June 25, 2015, https://www.wired.com/2015/06/heres-charter-will-commit-open-internet/.

737 "Lobbying Spending Database Telecom Services," OpenSecrets, 2015, https://www.opensecrets.org/lobby/indusclient.php?id=B09&year=2015.

738 Joseph Rossell, "Soros, Ford Foundations 'Lavish' $196 Million to Push Internet Regulations," Media Research Center, February 2, 2015, http://archive2.mrc.org/articles/soros-ford-foundations-lavish-196-million-push-internet-regulations.

American telecom firms likely spend significantly with regard to litigation against net neutrality, for example 9 lawsuits were filed against the FCC for its 2015 Open Internet Order.

5.7.5 SAVE THE INTERNET CAMPAIGN IN THE UNITED STATES

Origins of the U.S. Campaign:

The original Save the Internet campaign began in the United States, coordinated by Free Press.[739] George Soros provided seed money to Free Press with a $200,000 grant in 2004, and $400,000 in 2005 through his Open Society Institute, with the mission to "assure greater fairness in political, legal, and economic systems."[740] Co-founder Robert McChesney observed, "At the moment, the battle over network neutrality is not to completely eliminate the telephone and cable companies. We are not at that point yet. But the ultimate goal is to get rid of the media capitalists in the phone and cable companies and to divest them from control…Any serious effort to reform the media system would have to necessarily be part of a revolutionary program to overthrow the capitalist system itself."[741]

While records show the website domain savetheinternet.com registration in 1999,[742] Internet archives of the actual website site start at April 23, 2006[743]. The website detailing the coalition was officially

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739 "Save the Internet : Frequently Asked Questions," April 23, 2006, http://web.archive.org/web/20060423161657/http://www.savetheinternet.com/%3Dfaq.

740 Ann Veigle, "New Lobbying Tactics Up Ante in Net Neutrality Fight," COMM DAILY, December 10, 2009.

741 "Yep, They Said It," accessed November 9, 2016, http://mediafreedom.org/yep-they-said-it/.

742 "WHOIS Lookup - Domain Whois Search, Availability, and Information | eNom," accessed November 9, 2016, http://www.enom.com/whois/default.aspx.

743 "Internet Archive Wayback Machine," accessed November 9, 2016, http://web.archive.org/web/*/savetheinternet.com.

launched by Free Press the following day, on April 24, 2006.[744] "Free Press has become a juggernaut in the District of Communications. By utilizing digital tools early and often, the Free Press team has built a machine that can deliver results," note Christopher Parandian, a former industry lobbyist.[745]

Figure 56: Original Heading and Navigation Bar of savetheinternet.com[746]

The earliest campaign singularly addresses the issue of network neutrality[747], and it outlines the aims of the coalition as follows:

> The SavetheInternet.com Coalition was formed to prevent Internet gatekeepers from blocking or discriminating against new economic, political, and social ideas. We are mobilizing millions of Americans to urge Congress to preserve the free and open Internet.[748]

The original coalition consisted of 44 members shown on the following figure.

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[744] "Save the Internet : Join Us," April 23, 2006, http://web.archive.org/web/20060423013452/http://www.savetheinternet.com/=coalition.

[745] Supra footnote 51

[746] "Save the Internet :," April 23, 2006, http://web.archive.org/web/20060423161758/http://www.savetheinternet.com/.

[747] "Save the Internet :," April 23, 2006, http://web.archive.org/web/20060423161758/http://www.savetheinternet.com/.

[748] "Save the Internet," April 23, 2006, http://web.archive.org/web/20060423161718/http://www.savetheinternet.com/blog/.

Figure 57: Original "Save The Internet" Coalition

The SavetheInternet.com Coalition is made up of dozens of groups from across the political spectrum that have banded together to save the First Amendment of the Internet: network neutrality. No corporation or political party is funding our efforts.

Join the Coalition

Charter Members:

Professor Lawrence Lessig — Stanford
Professor Timothy Wu — Columbia
Free Press — Coalition Coordinator
Gun Owners of America
Craig Newmark — Craigslist.com Founder
Professor Glenn Reynolds — aka blogger Instapundit
MoveOn.org Civic Action
Consumers Union
American Library Association
Consumer Federation of America
Public Knowledge
Common Cause
U.S. PIRG
Center for Digital Democracy
Association of Research Libraries
The Service Roundtable — small business network
Afro-Netizen
Loyola University Chicago, Department of Communications
Educause
New Organizing Institute
Covenant College
Community HIV/AIDS Mobilization Project
Association for Community Networking
Amazing Kids
CCTV Center for Media and Democracy
Alliance for Community Media
Professor Susan Crawford
Center for Creative Voices in Media
Community Technology Centers
FreeNetworks.org
Media Access Project
Media Alliance
The Agonist
NYC Wireless
AcornActive Media Foundation
Californians Against Waste
Chicago Media Action
CUWiN
National Video Resources
Illinois Community Technology Coalition
Ohio Community Computing Network
Ask-Wi.com, Inc.
Peacefire
Quicksilver Communications

Growth of the U.S. Campaign:

Less than one month after the launch in 2006, some 750 groups organized under the banner "Save the Internet" delivered 1 million e-mail petitions to Capitol Hill "urging lawmakers to preserve the current practice that all Internet traffic should get the same treatment."[749] A later coalition list in 2008 stated, "The SavetheInternet.com Coalition is more than 1.5 million everyday people who have banded together with thousands of non-profit organizations, businesses, and bloggers to protect Internet freedom."[750] The 2008 coalition (short) document only lists a coalition of 79 members; however the full list is much larger.[751] It also states that Free Press was still the Coalition Coordinator at that time.[752]

[749] Tom Abate and Chronicle Staff Writer, "SPEED BUMPS ON THE INFORMATION HIGHWAY," SFGate, June 18, 2006, http://www.sfgate.com/news/article/SPEED-BUMPS-ON-THE-INFORMATION-HIGHWAY-2516873.php.

[750] "Coalition Members," Save the Internet, accessed November 9, 2016, http://www.savetheinternet.com/sites/default/files/resources/coalition_members.pdf.

[751] "Save the Internet : Members," September 19, 2008, http://web.archive.org/web/20080919041927/http://www.savetheinternet.com/=members.

[752] "Coalition Members," Save the Internet, accessed November 9, 2016, http://www.savetheinternet.com/sites/default/files/resources/coalition_members.pdf.

Figure 58: 2008 savetheinternet.com Coalition List

The SavetheInternet.com Coalition is more than 1.5 million everyday people who have banded together with thousands of non-profit organizations, businesses and bloggers to protect Internet freedom.

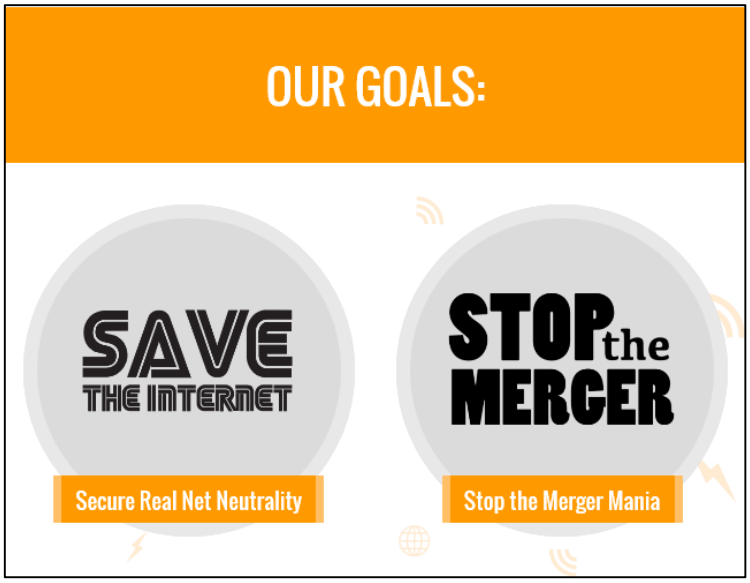
Free Press -- Coalition Coordinator
Professor Lawrence Lessig -- Stanford
Professor Timothy Wu -- Columbia
Gun Owners of America
Craig Newmark -- craigslist.org Founder
Professor Glenn Reynolds -- aka Blogger Instapundit
MoveOn.org Civic Action
Consumers Union
American Library Association
Parents Television Council
Consumer Federation of America
Office of Communication of the United Church of Christ, Inc.
Public Knowledge
Common Cause
Christian Coalition of America
Democracy for America
Electronic Retailing Association
American Civil Liberties Union
National Association of State PIRGs (U.S. PIRG)
SEIU
Rethinking Schools
Parent-2-Parent
Center for Digital Democracy
Afro-Netizen
The Agonist
Alliance for Community Media
Amazing Kids
AcornActive Media Foundation
Association of Research Libraries
Association for Community Networking
Scott Bradner -- Harvard Technology Security Officer
Brave New Films
Californians Against Waste
CCTV Center for Media and Democracy
Center for Creative Voices in Media
Chicago Media Action
ColorofChange.org
Community HIV/AIDS Mobilization Project
Community Technology Centers
Computer Professionals for Social Responsibility
Consumer Action
Consumer Project on Technology
Professor Susan Crawford -- Online legal expert
CUWiN
Democracy in Action
Educause
Feminist Majority
FreeNetworks.org
Future of Music Coalition
Game Overdrive
Grand Rapids Institute for Information Democracy
Internet2
David Isenberg -- Harvard Berkman Center
Independent Press Association
Kansas City Anti-Violence Project
Media Access Project
Media Alliance
MediaChannel.org
Sascha Meinrath -- Community Internet Pioneer
Music for America
National Video Resources
New Organizing Institute
NYC Wireless
Ohio Community Computing Network
OpenPrivacy
Open Security Foundation
Personal Democracy Forum
Prometheus Radio Project
P2Pnet
grand Rapids Hip Hop Coalition
Quicksilver Communications
Reclaim the Media
Scott Kurtz -- Cartoonist
Teaching Matters
The International Webcasting Association
The Service Roundtable -- Small Business Network
David Weinberger -- Harvard Berkman Center (Joho the Blog)
Women's Institute for Freedom of the Press
Working Assets

View the Full List of Coalition Members at www.savetheinternet.com/=members

The U.S. Campaign Today:

Today, savetheinternet.com states its goals are to "Secure Real Net Neutrality" and "Stop the Merger Mania."

Figure 59**:** Stated Goals of savetheinternet.com



No current coalition member list appears to be available, and the site is still being run by Free Press.

Figure 60: Statement at Bottom of savetheinternet.com[753]

Funding of the U.S. "Save the Internet" Campaign:

The U.S. campaign is presumably financed solely by Free Press and/or the Free Press Action Fund organizations. The organizations primarily receive donations totaling in the millions from various funds, foundations, and trusts.

In addition net neutrality has been funded by prestigious organizations such, the MacArthur Foundation, the Wallace Global Fund, and the Hewlett Foundation for advocacy organizations and as lobbyists for net neutrality policies.[754] Following is a list of some of Free Press's recent funders.

[753] "Save the Internet | Free Press," March 8, 2016, http://web.archive.org/web/20160308114530/http://www.savetheinternet.com/sti-home.

[754] "Re: Notice of Ex Parte Communications, WC Dockert No. 14-28," Ford Foundation, June 12, 2014, https://ecfsapi.fcc.gov/file/7521306031.pdf.

Figure 61: Free Press Top Donors (Anon. not included) 2013-2015[755]

Brett Family Foundation	Peter B. Lewis Philanthropy
Carsey Family Foundation	Rockefeller Brothers Fund
Craigslist Charitable Fund	Rockefeller Family Fund
CS Fund / Warsh-Mott Legacy	Rockefeller Philanthropy Advisors
Democracy Fund (Omidyar Group)	San Francisco Foundation
Dudley Foundation	Schwab Charitable Fund
Evolve Foundation	Sixteen Thirty Fund
Fidelity Charitable Gift Fund	Solidago Foundation
Fidelity Charitable Trust (Bright Horizon Fund)	Steve and Paula Child Foundation
Ford Foundation	Sy Syms Foundation
Foundation to Promote Open Society	The Democracy Fund
Geraldine R. Dodge Foundation	The Kaphan Foundation
Holthues Trust	Tides Foundation
Hugh M. Hefner Foundation	Tomkins Family Foundations
Lederer Foundation	Vanguard Charitable Trust
New Venture Fund (Media Democracy Fund)	Voqal Funding Group
Overbrook Foundation	Wallace Global Fund
Park Foundation	William B. Wiener, Jr. Foundation
Paul Gallant Foundation	Woodcock Foundation
Pechet Foundation	Working Assets/CREDO

[755] Free Press 2013 end of year review, 2014, 2015 annual reports: Free Press, "What We Do," Free Press, accessed November 9, 2016, http://www.freepress.net/about.

Figure 62: Free Press Total Gifts, Grants, Contributions, and Membership Fees 2009-2015[756]

2009	2010	2011	2012	2013	2014	2015	*TOTAL*
$3,57 7,203	$4,29 1,484	$2,86 4,048	$2,12 4,782	$3,73 5,707	$1,53 2,084	$2,43 8,062	*$20,56 3,370*

5.7.6 SAVE THE INTERNET CAMPAIGN IN EUROPE

The next significant "Save the Internet" campaign emerged in Europe. Current registration records show savetheinternet.eu as established Dec 16, 2013[757], and the first Internet archive entry of the website is Dec 31, 2013.[758]

[756] Free Press IRS Form 990 from years 2013, 2014, 2015: Ibid.

[757] "EURid Whois," accessed November 9, 2016, https://whois.eurid.eu/en/?domain=savetheinternet.eu.

[758] "Save the Internet - Contact Your Parlamentarian Today!," December 31, 2013, http://web.archive.org/web/20131231150533/http://savetheinternet.eu/.

Figure 63: Original Heading of savetheinternet.eu website[759]

While the website registration record is not disclosed[760], judging from their 2013 annual report[761], EDRi (a self-described association of European rights organization[762]) was the founder of the European campaign. "We launched a portal for our "Save The Internet" campaign, in cooperation with EDRi members Bits of Freedom, IFNF, Digitale Gesellschaft, and observer member La Quadrature du Net: http://savetheinternet.eu."

The European campaign was originally an association of five organizations.

[759] "Save the Internet - Contact Your Parlamentarian Today!," December 31, 2013, http://web.archive.org/web/20131231150533/http://savetheinternet.eu/.

[760] "EPAG.de," accessed November 9, 2016, https://www.epag.de/.

[761] "Annual Report," EDRi, 2013, https://edri.org/wp-content/uploads/2014/04/EDRi_Annual_Report_2013.pdf.

[762] "About - EDRi," March 4, 2016, http://web.archive.org/web/20160304231109/https://edri.org/about/.

Figure 64: The savetheinternet.eu attribution at bottom of website on Dec 31, 2013[763]

The initial issue raised by the European campaign was to eradicate what was considered loopholes in proposed network neutrality law. At the time, the target legislation was a proposal for regulation of telecommunications in the EU as a single market.[764] There were three specific issues:

- The undefined term "specialised services" as an exception to the proposed regulations.
- Interpretation of the freedom of users to choose discriminatory services.
- The lack of definition for the term "serious crime" or the measures to prevent it.

[763] "Save the Internet - Contact Your Parlamentarian Today!," December 31, 2013, http://web.archive.org/web/20131231150533/http://savetheinternet.eu/.

[764] "Laying down Measures Concerning the European Single Market for Electronic Communications and to Achieve a Connected Continent," EU, (September 3, 2013), http://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A52013PC0627.

Growth of the European Campaign

In their 2014 annual report,[765] EDRi stated,

> In 2014, we carried out several activities to raise awareness on this issue, published analysis of the proposed legislation, drafted crucial amendments and met with policy-makers across the political groups. We published an FAQ for citizens on the draft Regulation and promoted our "save the internet" portal: http://savetheinternet.eu. It contributed to over 20,000 faxes being sent to the European Parliament by concerned citizens. In the course of the year, we held several meetings on the "Telecoms single market" dossier with national permanent representations to the EU

When one reads the next item from EDRi's 2014 annual report, it appears to be the evidence of transnational network neutrality activism:

> Net neutrality was also an issue on the other side of the Atlantic. Since these discussions have repercussions in Europe, we responded to a consultation launched by the U.S. Federal Communications Commission, and we spoke at a RightsCon panel on "net neutrality – how to identify discriminations and advance solutions" that took place in the U.S. in March 2014.

The report goes on further to state that in November 2014, "EDRi joined forces with other civil society organizations to relaunch the savetheinternet.eu." The resulting savetheinternet.eu relaunch included a modification of the contested issues.[766]

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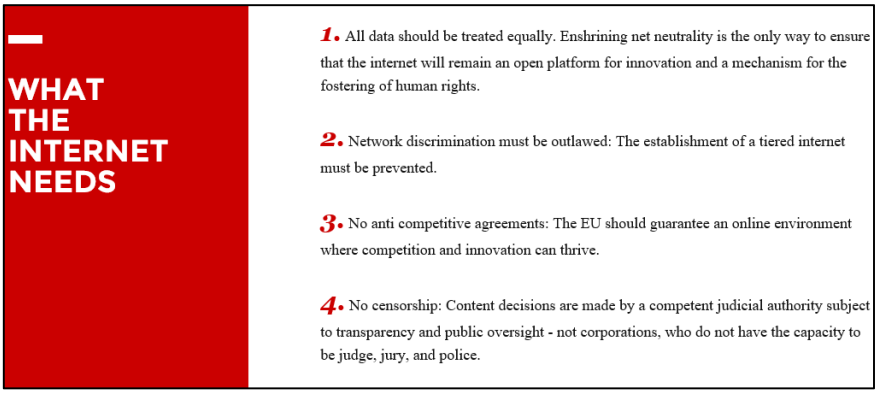
[765] "Annual Report," EDRi, 2014, https://edri.org/wp-content/uploads/2013/09/EDRi_Annual_Report_2014.pdf.

[766] "Save the Internet," December 7, 2014, http://web.archive.org/web/20141207234846/https://savetheinternet.eu/.

Figure 65: Re-launched savetheinternet.eu issues (December 2014)



Per the savetheinternet.eu website[767] in early 2016, the legislative outcomes desired by the European "Save the Internet" campaign were not reached. However, the website stated further that it had a remaining path to achieve their goals:

> The BEREC guidelines have to be prepared between now and July 2016. These guidelines will be based on a consultation that is open for everyone. This is the step in which the fight for net neutrality that was key to successes in both the U.S. and in India.

The continued 2015 activities of the campaign and discussion of the legislative outcomes are also covered in EDRi's 2015 annual report.[768]

The European Campaign Today:

The 2016 savetheinternet.eu website[769] addressed the ongoing BEREC consultation period on proposed network neutrality regulations.

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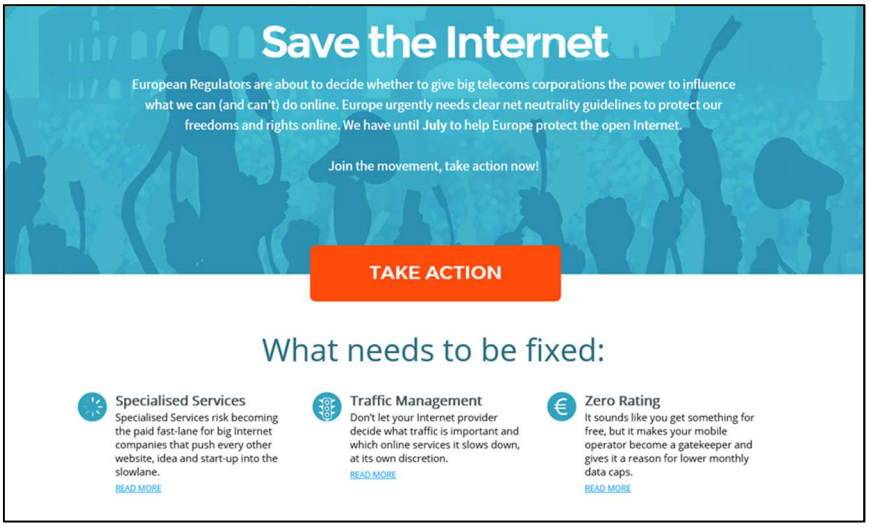
[767] "Save the Internet - Contact Your Representative Today!," March 11, 2016, http://web.archive.org/web/20160311065438/http://savetheinternet.eu/.

[768] "Annual Report," EDRi, 2015, https://edri.org/files/Annual_Report_2015_Final.pdf.

[769] Arbeitskreis Vorratsdaten Österreich, "Save the Internet," SaveTheInternet, accessed November 8, 2016, https://savetheinternet.eu/.

Figure 66: savetheinternet.eu (June 2016)



The campaign centers on three main areas of concern in the proposed EU regulations and the proposed revisions are referenced in Free Press documents:

- Specialized Services
    - The savetheinternet.eu campaign is pushing for all new specialized services to be judged to meet *all* five proposed safeguards before even being allowed to be offered to customers. Further, they state that "if a comparable service exists in the open internet, then a specialized service should not be granted."
- Traffic Management
    - The campaign wants the hierarchy on traffic management contained within the proposed regulations to become part of the official rules, thus dictating congestion management practices.
- Zero Rating
    - The campaign sees zero-rating as a clear violation of network neutrality, and they would like the practice to be banned.

The savetheinternet.eu website urges the use of their questionnaire tool to notify national regulators and BEREC to "protect net neutrality." The questionnaire tool is a combination of checkboxes and open questions, which then generates an email based on the user's selections and input. The email is then submitted by BEREC from the individuals email account. The questionnaire addresses a variety of topics. It goes beyond the three main areas of concern outlined above, seeking input on transparency, definitions of "commercial practices", and use of deep-packet inspection. The current organizational membership of the EU "Save the Internet" campaign has grown, and the website is now offered in various European languages.

Figure 67: Organizational membership of savetheinternet.eu (June 2016)[770]

[770] Ibid.

Funding of the European Campaign:

The European campaign is presumably financed by its founder, the EDRi organization. EDRi receives donations from many sources. Their corporate donors include Google, Mozilla, Twitter, Intel, and Yelp (among others).[771] Following is a list of EDRi's recent funding.

Figure 68: EDRi Budget Sources 2014-2015

Source	2014	2015
Foundations	€ 260,667	€ 277,845
Foundations (Prior Yr. Overdue)	€ 104,433	€ 0
Corporate	€ 23,053	€ 40,306
Individuals	€ 9,807	€ 29,644
Member/Observership Fees	€ 24,761	€ 26,857
Non-Corporate	€ 0	€ 15,720
Projects	€ 0	€ 21,544
Other (Tax Rmbrsmnts., Rent)	€ 32,272	€ 15,357
TOTAL	*€ 454,993*	*€ 427,273*

5.7.7 ACCESSNOW

AcesssNow is one of the founding coalition members behind the EU "Save the Internet" campaign and currently bills itself as an international advocacy organization.[772] As one can see in the map portion of the graphic below, AccessNow is located in a variety of countries:

[771] EDRi Annual reports for years 2014, 2015: "About," EDRi, accessed November 8, 2016, https://edri.org/about/.

[772] Interestingly, they also contribute rent to EDRi. See earlier EDRi annual report reference (2015)

Figure 69: About AccessNow[773]

AccessNow is active in a few different areas, but its section on "Net Discrimination" is related to network neutrality:

Figure 70: accessnow.org section on "Net Discrimination"[774]

AccessNow is funded by a wide variety of foundations and corporate interests, as follows:

[773] "About Us," Access Now, accessed November 8, 2016, https://www.accessnow.org/about-us/.

[774] "Net Discrimination Archives," Access Now, accessed November 8, 2016, https://www.accessnow.org/issue/net-discrimination/.

Figure 71: AccessNow Funding Sources 2012-2016 (June 7, 2016)[775]

Funder	USD$ 2012-16	Funder	USD$ 2012-16
Sida	4,805,674	Global Movement Donations	35,166
Google	1,200,000	ICANN	35,000
The Sigrid Rausing Trust	987,615	Knight Foundation	35,000
Oak Foundation	460,000	Swedish Ministry of Foreign Affairs	35,000
Oxfam Novib	435,539	London Media Trust	25,000
John Templeton Foundation	350,000	Mozilla Foundation	25,000
Mozilla	320,000	Yelp	25,000
The 11th Hour Project	300,000	Yahoo!	20,000
Ford Foundation	275,000	New America Foundation	16,245
Voqal	221,250	Hamish Parker	15,870
Anonymous Donation	195,000	New Venture Fund	15,000
Facebook	175,000	AnchorFree	10,000
Humanity United	160,000	BSA	10,000
Microsoft	150,000	Dropbox	10,000
Swedbank	118,556	Ebay	10,000
IDRC	114,633	New America Foundation (OTI)	10,000
RightsCon.org	113,749	New IT Foundation	10,000
LinkedIn	102,500	Silicon Valley Community Fund	10,000
Skype	95,000	Web We Want	10,000
Media Democracy Fund	60,000	SecDev Foundation	9,982
Twitter	60,000	Private Internet Access | London Trust Media	5,000
Internet Society	57,500	The Minneapolis Foundation	5,000
Dutch Ministry of Foreign Affairs	49,982	Asia-Pacific Network Information Centre	3,943
Anne Coombs	40,777	Access Now	3,000
Hivos	40,000	All Out/Purpose	2,500

[775] Derived from data on AccessNow website: "Funding," Access Now, accessed November 8, 2016, https://www.accessnow.org/financials/.

In addition to their EU "Save the Internet" efforts, AccessNow also maintains the domain[776] for the thisisnetneutrality.org website.

Figure 72: Global Net Neutrality Coalition homepage

The thisisnetneutrality.org website is home to 74 "Global Net Neutrality Coalition" members.[777]

[776] Whois search at: "Your Public Interest Registry | Buy, Sell, Register .ORG .NGO .ONG IDNs Domain Names," PIR, accessed November 8, 2016, http://pir.org/.

[777] "Status of Net Neutrality Around the World," Thisisnetneutrality, accessed November 8, 2016, https://dejiaccessnow.carto.com/viz/4f239c60-356f-11e5-b01c-0e853d047bba/embed_map.

Figure 73: The 74 members of the Global Net Neutrality Coalition

AccessNow	Article19	EFF	Greenpeace	Web We Want
Witness	FreePress	OTI	Public Knowledge	CELE
Fundacion Via Libre	Derechos Digitales	Venezuela Inteligente	Bits of Freedom	Digitale Gesellschaft
Kictanet	DigitalRights Foundation	IT for Change	Korean Progressive Network Jinbonet	Network neutrality User Forum of Korea
Software Freedom Law Center	EDRi	Social Media Exchange	ACUI	Data Roads Foundation
Initiative Fur Netzfreiheit	La Quadrature Du Net	Just Net Coalition	CC-META	BNNRC
Internet Policy Observatory Pakistan	Internet & Digital Ecosystem Alliance	OpenMedia.ca	OpenMedia International	Acceso Libre
Paradigm Initiative Nigeria	Pen International	Digital Defenders Partnership	Movimento MEGA	Open Knowledge Foundation Germany
Baaroo	Alternatif Bilisim	The Heliopolis Institute	Index on Censorship	Freifunk
Cronaca Libera	Jordan Open Source Association	Society for Knowledge Commons	Free Software Movement of India	International Modern Media Institute
CyberArabs	Art 34bis	Unwanted Witness	Digital Rights Association, Morocco	Hivos
Demokrasya	Wlan Slovenija	Rudi International	Press Union of Liberia	Zimbabwe Human Rights NGO Forum
R3D	Greenhost	Filipino Freethinkers	TEDIC	Fundacion Karisma
Dakila	Hiperderecho	Media Matters for Democracy	EngageMedia	Kaya Labs
Share Foundation	CIPESA	I Freedom Uganda	Fight for the Future	

5.7.8 PAST SIMILARITIES OF THE "SAVE THE INTERNET" CAMPAIGNS IN THE UNITED STATES & EUROPE

Interestingly, even while pursing legislative efforts in separate regions, for some time there were curious similarities between the U.S. and EU campaigns. Of first notice was the website interfaces, which (at the time) contained identical words in similar layouts, and with a similar color scheme:

Figure 74: Navigation Bar of savetheinternet.com[778]

Figure 75**:** Navigation Bar of savetheinternet.eu[779]

Up to Spring 2016, the two sites had also defined the issue of network neutrality in similar terms. Although there were modest variations in

[778] "Save the Internet | Free Press," March 4, 2016, http://web.archive.org/web/20160304051401/http://www.savetheinternet.com/sti-home.

[779] "Save the Internet - Contact Your Representative Today!," March 11, 2016, http://web.archive.org/web/20160311065438/http://savetheinternet.eu/.

content, language, and presentation, the arguments presented were nearly identical.[780]

Campaign Claim #1 – Network Operators Want to Limit Freedom of Speech

Per the U.S. campaign website network neutrality section, "What You Need to Know Now"[781]:

> Net Neutrality means an Internet that enables and protects free speech. It means that Internet service providers should provide us with open networks — and should not block or discriminate against any applications or content that ride over those networks. Just as your phone company shouldn't decide who you can call and what you say on that call, your ISP shouldn't be concerned with the content you view or post online.

Per the EU campaign website, "Why is Net Neutrality Important?"[782]:

[780] Notable exception is invoking skin color as a net neutrality issue in the U.S.: "Net Neutrality: What You Need to Know Now | Free Press," March 4, 2016, http://web.archive.org/web/20160304065648/http://www.savetheinternet.com/net-neutrality-what-you-need-know-now.

[781] "Net Neutrality: What You Need to Know Now | Free Press," March 4, 2016, http://web.archive.org/web/20160304065648/http://www.savetheinternet.com/net-neutrality-what-you-need-know-now.

[782] "Save the Internet - Contact Your Representative Today!," March 11, 2016, http://web.archive.org/web/20160311065438/http://savetheinternet.eu/.

Figure 76: EU Campaign, Freedom of Speech Issue

Campaign Claim #2 – Customers and Content Creators Will be Unfairly Discriminated Against and Forced to Pay More to Network Operators

Per the U.S. campaign website network neutrality section, "What You Need to Know Now":

> Without Net Neutrality, cable and phone companies could carve the Internet into fast and slow lanes. An ISP could slow down its competitors' content or block political opinions it disagreed with. ISPs could charge extra fees to the few content companies that could afford to pay for preferential treatment — relegating everyone else to a slower tier of service.

Per the EU campaign website, “Why is Net Neutrality Important?”:

Figure 77: EU Campaign, Discrimination and Cost Issue

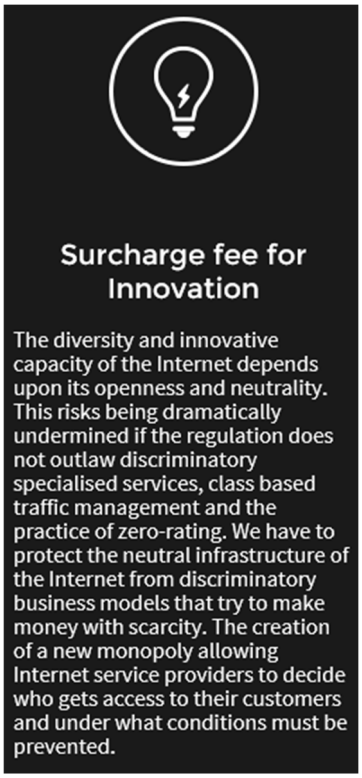
Campaign Claim #3 – Internet Innovation Will Suffer, and Is Threatened by Network Operators

Per the U.S. campaign website network neutrality section, “What You Need to Know Now”:

> It’s because of Net Neutrality that small businesses and entrepreneurs have been able to thrive on the Internet.
>
> No company should be able to interfere with this open marketplace. ISPs are by definition the gatekeepers to the Internet, and without Net Neutrality, they would seize every possible opportunity to profit from that gatekeeper control.

Per the EU campaign website, “Why is Net Neutrality Important?”:

Figure 78**:** EU Campaign, Innovation Issue



In July 2016 the websites have been slightly updated. Free Press updated the American website with a timeline of the “victory” of net neutrality being held up in court, and expeditiously requesting a donation to keep the fight going should it come to Congress or the Supreme Court. The EU version focuses on the BEREC process and a changed color scheme.

5.7.9 SAVE THE INTERNET CAMPAIGN IN INDIA

The Indian campaign has evolved from its first iteration to focus on issues of net neutrality, censorship, privacy and innovation. The official domain information[783] shows savetheinternet.in was registered in September of 2012. Interestingly, the domain registration is not in the name of any organization, but of a single individual, Pranesh Prakash, former attorney for the Creative Commons India and founder of India's Center for Internet & Society.[784] The first Internet archive record is recorded on April 13, 2015.[785] The campaign's initial issue was to collect arguments in favor of network neutrality, in response to a TRAI (Telecom Regulatory Authority of India) consultation paper on the regulatory framework for over-the-top Internet services.[786] In just 24 hours the group was able to mobilize 27,000 emails to TRAI in response to the consultation. [787] The issue appears to have exploded upon the plans of Airtel to introduce zero-rating.[788]

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783 "Whois Lookup | Registry.In," Registry, accessed November 8, 2016, https://registry.in/whois/savetheinternet.in.

784 "Pranesh Prakash," LinkedIn, accessed November 11, 2016, https://www.linkedin.com/in/praneshprakash.

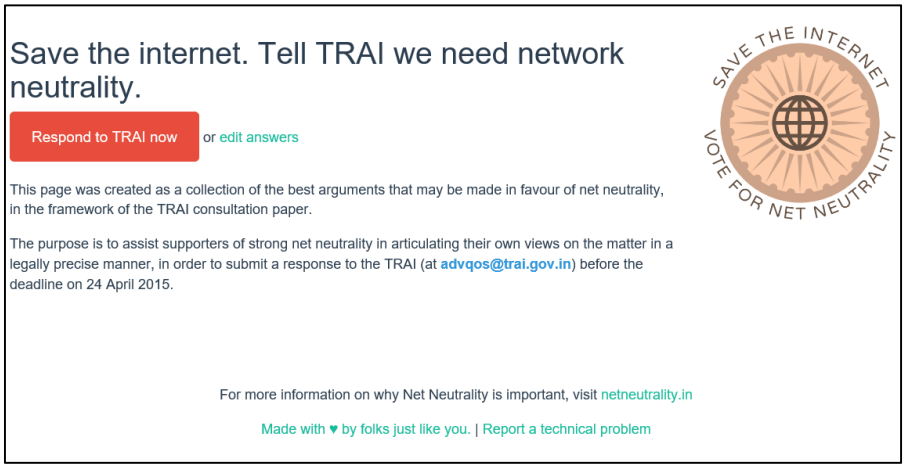
785 "Save The Internet!," April 13, 2015, http://web.archive.org/web/20150413054725/http://www.savetheinternet.in/.

786 Jawahar Marg and Mahanagar Bhawan, "Consultation Paper On Regulatory Framework for Over-the-Top (OTT) Services," Trai, March 27, 2015, http://www.trai.gov.in/WriteReaddata/ConsultationPaper/Document/OTT-CP-27032015.pdf.

787 Kim Arora, "Fight for Net Neutrality Unites Internet | Gadgets Now," Gadget Now, April 13, 2015, http://www.gadgetsnow.com/social/Fight-for-net-neutrality-unites-internet/articleshow/46896316.cms.

788 Jon Russell, "Bharti Airtel Fuels Net Neutrality Fire In India With Free Access To Partner Apps," TechCrunch, April 6, 2015, http://social.techcrunch.com/2015/04/06/bharti-airtel-airtel-zero-india/.

Figure 79: Save the Internet India (first iteration)



The group also maintains a Github project member list[789] and was also focused on a TRAI consultation paper regarding differential pricing.[790] They adopted a specific definition of network neutrality as follows,[791]

> Net neutrality requires that the Internet be maintained as an open platform, on which network providers treat all content, applications and services equally, without discrimination. This includes ensuring that network providers do not supply any competitive advantage to specific apps/services, either through pricing or Quality of Service.

They also addressed the "Free Basics" zero-rated offering from Facebook.[792] Further, the campaign reported that it had moved[793]

[789] "Netneutrality/savetheinternet.in," GitHub, accessed November 8, 2016, https://github.com/netneutrality/savetheinternet.in.

[790] "Prohibition of Discriminatory Tariffs for Data Services Regulations."

[791] "What Is Net Neutrality?," March 10, 2016, http://web.archive.org/web/20160310104121/http://blog.savetheinternet.in/what-is-net-neutrality/.

[792] "Free Basics," March 10, 2016, http://web.archive.org/web/20160310104127/http://blog.savetheinternet.in/free-basics/.

towards the creation of an "Internet Freedom Foundation", with the registration[794] of a new website[795] (internetfreedom.in) by an individual named Nikhil Pahwa, with no organization listed.

The group has since upgraded the web properties in time for TRAI's pre-consultation paper on network neutrality, offering an editable pre-formed consultation letter email submission tool. A picture of the new site is below.

Figure 80: Updated Internet Freedom Foundation website and SaveTheInternet.in[796]

[793] Save The Internet, "We Have Moved to @iffsti. Follow Us There!," microblog, @neutrality_in, (February 20, 2016), https://twitter.com/neutrality_in/status/703075813277609984.

[794] "Whois Lookup | Registry.In," accessed November 5, 2016, https://registry.in/whois/internetfreedom.in.

[795] "Internet Freedom Foundation," February 18, 2016, http://web.archive.org/web/20160218081607/http://www.internetfreedom.in/.

[796] "SaveTheInternet.in," Internet Freedom Foundation, accessed November 11, 2016, https://internetfreedom.in/campaigns-savetheinternet/.

The website also has a page on Innovation which discusses intellectual property issues and licensing regimes being too strict for innovators, noting "The chilling effects on online content by overbroad intellectual property laws is well documented."[797]

Funding of the Indian Campaign:

Information on the funding of the Indian campaign has been hard to discern, though the site notes that it receives funds from users.

5.7.10 PUBLIC KNOWLEDGE

Like Free Press, Public Knowledge is a similar special interest group focusing on a narrow set of telecom issues. Google is a key funder, and its co-founder Gigi Sohn was a program officer for the Ford Foundation. In addition to their domestic efforts and offerings such as their "advocacy toolkit",[798] Public Knowledge advocates transnationally. They have an International team which is dedicated to influencing Internet policy across the globe as they describe,

> Public Knowledge is working in collaboration with organizations, advocates, and users from around the world, especially in Latin America and the Global South, to provide support and capacity building on local, regional, and global internet issues. As the internet becomes more politicized and business and government interests attempt to increase their representation in negotiations and fora, it is crucial that the civil society movement be expanded to protect the public interest and internet rights both domestically and abroad.
>
> PK is also dedicated to helping educate domestic and international activists to notice the signs of and prevent

[797] "Innovation. Internet Freedom Foundation," Internet Freedom Foundation, accessed November 11, 2016, https://internetfreedom.in/issues-innovation/.

[798] "Public Knowledge Advocacy Toolkit," accessed November 5, 2016, http://pkadvocacy.tumblr.com/?og=1.

policy laundering on issues that impact consumers, such as privacy and intellectual property. [799]

PK targets Latin America with an online "Open Internet" course entirely in Spanish.[800] PK notes "The first round of the course, which concluded in June 2015, hosted 30 participants, from advocates, to judges, to journalists, from various countries in Latin America, with the top performers gaining professional development opportunities to further their advocacy careers."[801]

One stated goal of Public Knowledge is to "train" the next generation of global Internet activists and to promote Public Knowledge's particular Internet vision.[802]

5.7.11 MOZILLA

There is no doubt that amidst the shifting winds of consumers' usage requirements of the Internet, for some existing entities have been caught off-guard. As network operators attempt to introduce

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[799] "Public Knowledge's International Team," Public Knowledge, accessed November 5, 2016, https://www.publicknowledge.org/issues/international.

[800] Melanie Penagos, "PK Empowers Latin American Digital Rights Activists with Its First Open Internet Course," Public Knowledge, July 14, 2015, https://www.publicknowledge.org/news-blog/blogs/pk-empowers-latin-american-digital-rights-activists-with-its-first-open-int.

"Un Curso de Public Knowledge En Colaboración Con P2PU," Open Internet, accessed November 5, 2016, http://open-internet-p2pcourse.org.

"Open Internet Course," Public Knowledge, June 2016, https://www.publicknowledge.org/open-internet-course.

[801] Melanie Penagos, "Public Knowledge Calls for New Applicants for Our Open Internet Course," Public Knowledge, May 23, 2016, https://www.publicknowledge.org/news-blog/blogs/public-knowledge-calls-for-new-applicants-for-our-open-internet-course.

[802] Natalie Green and Carolina Rossini, "Training the Next Generation of Digital Rights Advocates," Public Knowledge, February 20, 2015, https://www.publicknowledge.org/news-blog/blogs/training-the-next-generation-of-digital-rights-advocates.

diverse network capacity allocation solutions (in response to developing user needs) and some established players may felt threatened.

Consider the possible fate of Firefox, Mozilla's web browser. Already forced to compete with a multitude of mobile browsers[803] and networked applications, the potential of also competing within a context of advanced IP network options may be an existential threat to its business model. Detailed understanding and the ability to implement application functionality to embrace these network enhancements is not a widely available skill-set. Entities such as Mozilla have likely either misunderstood the exact promise of such technologies, which can customize packet delivery to the satisfaction of end users, or found themselves unable to compete effectively in the real-time multimedia technology arena. Whereas Google made WebRTC (a real-time voice/video system for the web) available five years ago[804], Mozilla's records detail, WebRTC implementation in Firefox appears to have only begun at the end of 2014[805] and was not available until release 40[806] which was not deemed an official release until quite recently, August 2015.[807]

Quite possibly, in an Internet context without the impending doom of network neutrality technology restrictions, countless startups with appropriate expertise and effort could have released products surpassing the capabilities of Firefox (and even the base WebRTC technology itself) years ago. By "investing" in network neutrality, Mozilla has bought time and the chance to live another day. The

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803 "10 Best Mobile Browsers," Tom's Guide, May 12, 2016, http://www.tomsguide.com/us/pictures-story/408-best-mobile-browser.html.

804 "WebRTC @5 – Google Grupper," Google Groups, accessed November 5, 2016, https://groups.google.com/forum/#!topic/discuss-webrtc/I0GqzwfKJfQ.

805 "Feature Board for WebRTC," Mozilla, accessed November 5, 2016, https://mozilla.aha.io/published/b40393012432847d857ee68299a8a82f?page=2.

806 "Media/WebRTC," MozillaWiki, accessed November 5, 2016, https://wiki.mozilla.org/Media/WebRTC.

807 "Calendar - MozillaWiki," accessed November 5, 2016, https://wiki.mozilla.org/RapidRelease/Calendar.

realities of users' network performance requirements are currently boiling over, precisely as Mozilla's real-time audio/video skills are being honed. It shall prove fascinating behavior if Mozilla's position on network neutrality now transitions to a more lenient position, in light of their growing ability to actually implement the functionality of diverse packet handling for a variety Internet media.

While Mozilla frequently presents itself as a non-profit, according to U.S. tax documents,[808] the Mozilla Foundation directly controls the Mozilla Corporation – a for-profit entity with substantial vested interest in government policy pertaining to the Internet. Mozilla engages in global advocacy in many forms, on a variety of Internet topics. For example, their web fellows program having placed fellows in Canada, Chile, Kenya, the European Union, and the United States. Many of Mozilla's fellows[809] in 2015 were transplants from other network neutrality advocacy organizations such as Free Press, the Open Technology Institute, and Public Knowledge.

Further, Mozilla maintains a Github site[810] for "Tools for Activism", with various open and free software and services to assist in conducting digital activist campaigns. They also offer Mozilla clubs and "hives", marketed as community resources[811]. However, most intriguing is their educational offerings such as the "Net Neutrality Teaching Kit",[812] and Net Neutrality training modules[813]. Mozilla's net neutrality training for the relevant country. They describe,

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808 "Mozilla_Foundation Public Disclosure," Mozilla, 2014, https://static.mozilla.com/moco/en-US/pdf/2014_Mozilla_Foundation_Fed_990_Public_Disclosure.pdf.

809 "Netpolicy/advocacy/openwebfellows - MozillaWiki," Mozilla, accessed November 5, 2016, https://wiki.mozilla.org/Netpolicy/advocacy/openwebfellows.

810 "Mozilla/toolsforactivism," GitHub, accessed November 5, 2016, https://github.com/mozilla/toolsforactivism.

811 "Community - Mozilla Learning," accessed November 5, 2016, https://learning.mozilla.org/en-US/community.

812 "Net Neutrality Teaching Kit," Mozilla Webmaker, accessed November 5, 2016, https://keyboardkat.makes.org/thimble/LTQzNjIwNzM2MA==/net-neutrality-teaching-kit.

> This module is all about teaching you about Net Neutrality: why it's important, who is influencing public policy, and how YOU can make a difference. We want you to be able to teach others so that we can all protect the Web we want. We are in a fight for the future of the Internet. By participating, you are part of #TeamInternet.

Also Mozilla encourages users to throw net-neutrality-themed "maker parties":[814]

> A small Maker Party is a fun way to spend an hour exploring the Web as a platform for change. Gather your family, friends, or interested participants and explore Net Neutrality and take action to protect the open web.

5.7.12 ANALYSIS OF SAVETHEINTERNET.EU TARGETED TO EU TELECOM REGULATORS

As part of this investigation, a trance of emails from SavetheInternet.eu for the BEREC net neutrality consultation was obtained from a European telecom regulator and subsequently analyzed in July 2016. At the time the Savetheinternet.eu was formatted to stimulate comment in the BEREC consultation with a set of preformed questions and answers. The platform offers seamless dynamic content for the petition in multiple European languages. Users have the option to submit the pre-formed answer or they can submit original answers. Users overwhelming chose to respond with the pre-formed answers.

Approximately 709 mails were sent to the following 28 regulators, each representing a EU nation. Thus each mail was replicated 28 times, helping to inflate the responses from these 709 individuals into 20,000 mails. While the coding of SavetheInternet.eu was

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[813] "What Is Net Neutrality?," Webmaker Training, accessed November 5, 2016, https://training.webmakerprototypes.org/en/net-neutrality/concepts/.

[814] "Host a Maker Party (Net Neutrality)," Mozilla Webmaker, accessed November 5, 2016, https://laura.makes.org/thimble/LTIwMDkzMzEyMA==/host-a-maker-party-net-neutrality.

subsequently updated, a part of BEREC's reported 480,000 mails were achieved through this technique.

Figure 81: Mail forwarding list of European regulators from SavetheInternet.eu

1. nn@rtr.at (Austria)
2. info@bipt.be (Belgium)
3. info@crc.bg (Bulgaria)
4. KMU@hakom.hr (Croatia)
5. info@ocecpr.org.cy (Cyprys)
6. podatelna@ctu.cz (Czech Republic)
7. erst@erst.dk (Denmark)
8. info@konkurentsiamet.ee (Estonia)
9. kirjaamo@ficora.fi (Finland)
10. Consommateurs@arcep.fr (France)
11. info@bnetza.de (Germany)
12. ncrtv@otenet.gr (Greece)
13. info@nmhh.hu (Hungary)
14. info@comreg.ie (Ireland)
15. info@agcom.it (Italy)
16. sprk@sprk.gov.lv (Latvia)
17. rrt@rrt.lt (Lithaunia)
18. info@ilr.lu (Luxembourg)
19. info@mca.org.mt (Malta)
20. uke@uke.gov.pl (Poland)
21. info@anacom.pt (Portugal)
22. international@ancom.org.ro (Romania)
23. roman.vavro@teleoff.gov.sk (Slovakia)
24. info.box@akos-rs.si (Slovenia)
25. info@cnmc.es (Spain)
26. pts@pts.se (Sweden)
27. info@acm.nl (Holland)
28. contact@ofcom.org.uk (United Kingdom

Of the mails analyzed, at least 30 percent were from American senders. As the announcement of the guidelines, BEREC noted that it considers all submissions equally, so that a submission from a person in the USA has equal weight as one from the European Union. Following are examples of some of the respondents which were

identified by matching their email to the corresponding Facebook profiles.

Stephanie Shaw[815] is an American living in California is a former employee of Californian local government and evident Bernie Sanders supporter.

Figure 82**:** American user in BEREC consultation

[815] "Stephanie Shaw," Facebook, accessed November 5, 2016, https://www.facebook.com/stephanie.shaw.12576?fref=ts.

Daniel Grantham,[816] is an American who lives in Hawaii. His Facebook page features posts noting the EU Save the Internet effort, support for Black Lives Matter and Bernie Sanders, support for "food democracy", and advocacy against Monsanto.

Figure 83: American user in BEREC consultation

[816] "Daniel Grantham," Facebook, accessed November 5, 2016, https://www.facebook.com/daniel.grantham.758?fref=ts.

Charlie Berger[817] is a retired software engineer living in Colorado. His Facebook page includes posts about policy violence and President Obama.

Figure 84**:** American user in BEREC consultation

[817] "Charlie Berger," Facebook, accessed November 5, 2016, https://www.facebook.com/profile.php?id=100008753852614&fref=ts.

The content of the form letter on Save the Internet's petition include the same arguments proposed by Barbara van Schewick. Similar provisions and requirements which she was noted in the FCC rulemaking appear in the Save the Internet comments, for example that Open Internet rules are need to ensure low cost of innovation and that ISPs interfere openness through with economic and technical discrimination. A paragraph on class-based traffic management also echoes her discussion. Her argument that transparency is not sufficient to ensure an Open Internet is also noted.

The specific questions are:

1 Should the ISP be allowed to monitor your traffic, including its content (e.g. through deep packet inspection) for the purpose of traffic management?
2 How much should your ISP be able to interfere with your Internet connection - for example to throttling or prioritise certain types of online traffic (video, P2P, etc)?
3 What could be the positive and negative impacts of specialised services on future innovation and openness of the Internet?
4 Is there a demand for specialised services? Which services should be allowed this special treatment?
5 What information would you like to receive about your Internet connection, such as its speed, quality of service or how your traffic is managed?
6 Is there a demand for "commercial practices" such as zero rating? Could these limit
your rights as an end-user? Please provide examples.

When sending the petition, users almost always use the default response which follows.

> The diversity and innovative capacity of the Internet ecosystem is built upon the low cost of innovation and low barriers to market entry. These principles ensure that from day one, every enterprise, startup or non-commercial service – no matter how small or well-funded – has the potential to reach a global audience in a manner equal to their competitors. This driving force for the prosperity and diversity of the online

economy is only ensured by an open, neutral and non-discriminatory Internet. When ISPs are allowed to interfere with the decisions of their customers by economic or technical discrimination, this essential freedom is lost. According to Recital 1 of the Regulation on net neutrality, the legislation has to be interpreted in light of these goals.

The Regulation allows specialized services only under strict safeguards. Article 3(5) and Recital 16 require the optimisation of specialised services to be objectively necessary for the functionality of key features of the service. This cannot be the case with services that can also function on the open, best effort Internet. Furthermore, Recital 16 prevents specialised services from being used as circumvention of the general net neutrality traffic management rules. Any deviation from these safeguards to widen the applicability of the concept of specialised services would inevitably result in increased market entry barriers and thus weaken the innovative potential of the Internet as a whole.

Transparency cannot, as proposed by the Commission in its initial draft of the Regulation and subsequently rejected, be considered an antidote to anti-competitive behavior in itself. Transparency has limited scope in fixing problems, particularly in this context.

Economic discrimination (zero rating) interferes with my right under Article 3(1) to access and, in particular, to distribute information freely. When an ISP discriminates between providers of content, applications and services via an Internet access service by making them unequally accessible, this constitutes an arbitrary interference in the essence of my right. Furthermore, this practice restricts my rights under the Charter of Fundamental Rights (Articles 11, 15(2), and 16). Therefore, economic discrimination must not be allowed under the BEREC guidelines.

The Regulation has very clear rules on what constitutes reasonable traffic management. According to Article 3(3), all

> traffic management should be done in an application agnostic way, if possible. Class-based traffic management harms competition; it risks unintended damage to specific applications; it can discriminate against encrypted traffic; it creates uncertainty for content application and service providers; it stifles innovation; it can harm individual users, and can create regulatory overload. Therefore, applying class-based traffic management in situations where application agnostic traffic management would suffice is neither necessary, proportionate, transparent for the user, nor non-discriminatory.

Certain activist groups were able to gain distinct negotiating power as part of the BEREC Net Neutrality Stakeholder dialogue on 15-16 December 2015,[818] a closed-door meeting which BEREC used to craft the net neutrality guidelines. The following information is based upon an email request to BEREC to identify the participants in the meeting. The BEREC meeting featured 5 representatives for the ISP associations and equipment manufacturers, 5 from content and application providers, and 4 from "consumer and end user organizations and civil society."

Of the 14 official stakeholders, 7 have Alphabet funding, notably 3 of the 4 civil society organizations. Digital Europe's members[819] include Google, Microsoft, and Amazon. CCIA is an American computer industry lobbying organization known for key members[820] Google, Netflix, Amazon, and Microsoft. The C² Coalition is backed by Google and Microsoft.[821] Allied for Startups has an number of

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818 "Statement on BEREC Work to Produce Guidelines for the Implementation of Net Neutrality Provisions of the TSM Regulation," Berec, December 15, 2015, http://berec.europa.eu/eng/document_register/subject_matter/berec/press_releases/5588-statement-on-berec-work-to-produce-guidelines-for-the-implementation-of-net-neutrality-provisions-of-the-tsm-regulation.

819 "Corporate Members," Digital Europe, accessed November 5, 2016, http://www.digitaleurope.org/About-Us/Corporate-Members.

820 "Members," CCIA, September 7, 2012, http://www.ccianet.org/about/members/.

821 "c2 Coalition," Communications & Connectivity Coalition, accessed November 5, 2016, http://c2coalition.eu/.

members, many of which receive soft money from Google, including Engine which hosts a Google Policy Fellow.[822] Google funds EDRi and Access. ISOC cooperates with Google in studying the Internet and received a grant for this work.[823] The remaining organization is the EU-funded European Consumer Organization (BEUC), which supports the European Commission in a lawsuit[824] against Google. Netflix funds two of the organizations, ECTA and CCIA. Google has representation in all three categories; Netflix in 2; and broadband providers only in 1.

Figure 85: Official stakeholders in BEREC net neutrality consultation (*denotes Google funding)

Associations of ISPs and Equipment manufacturers (5)	Content and application providers (CAPs) (5)	Consumer and End-User organisations and Civil Society (4)
Cable Europe	ACTE	Access*
Digital Europe*	CCIA*	BEUC
ECTA	C^2 *	EDRi*
ETNO	EBU	ISOC*
GSMA Europe	Allied for Startups*	

[822] "Host Organizations – Policy Fellowship – Google," accessed November 5, 2016, https://www.google.com/policyfellowship/hosts.html#toc-tab8.

[823] "Google.org Awards Grant to the Internet Society to Advance Internet Exchange Points in Emerging Markets," Internet Society, February 25, 2013, https://www.internetsociety.org/news/googleorg-awards-grant-internet-society-advance-internet-exchange-points-emerging-markets.

[824] "Google Antitrust Investigation," Www.beuc.eu, accessed November 11, 2016, http://www.beuc.eu/digital-rights/google-antitrust-investigation.

5.8 WHY IS THERE NOT MORE EMPIRICAL RESEARCH AND INVESTIGATION OF NET NEUTRALITY AND ITS STATED LINK TO NET NEUTRALITY?

There is certainly a substantive body of literature on net neutrality from law and communications disciplines. This literature discusses theoretical, legal, and historical aspect of the policy. In economics there are many quantitative but theoretical papers using game theory and econometrics to model the outcome of net neutrality to welfare and revenue, but not necessarily to innovation. Innovation in general is hard to measure. While that might explain why there is not so much measurement, it might also suggest that policymakers be cautious before asserting that net neutrality supports innovation, especially if it is hard to measure.

This paper represents one method to measure innovation, but it has some important limitations. For one, there is a relatively small group of people who have the skills to use and interpret data traffic analytics. The analytics tools are designed for trade professionals, not ideally for researchers or policymakers. The expense of tools is also an issue, and they are marketed to enterprise users, not typically academics or regulators. It could also be an issue is that the analytics companies themselves may be reluctant to license their tools for public policy measurement, particularly if the findings were incorporated in political or legal debates. Similarly I find that some app developers can sometimes feel reluctant to discuss net neutrality for fear if something they say something that accidentally impugns net neutrality, they would be the unwitting target of activists. This fear of backlash can also make research difficult.

In a few instances regulators have conducted evidenced-based assessments of net neutrality, but no specific studies that could estimate outcome to innovation vis-à-vis the policy. For example Ofcom, the UK telecom regulator, conducted a comprehensive assessment[825] of network traffic management detection tools and

[825] "Traffic Management Detection Methods and Tools - Ofcom," Ofcom, August 5, 2015, https://www.ofcom.org.uk/research-and-data/technology-research/2015-reports/traffic-management.

found none of them reliable for regulatory purposes. Ofcom has worked with a detailed regulatory impact assessment framework[826] since 2005. This may explain why the regulator preferred a soft approach to net neutrality with a code of conduct, believing that strict rules could have negative consequences.

A paper produced by Oscar Saens de Miera Berglind of the study center of the Federal Institute of Telecommunications, the Mexican regulator, examined the the practice of zero-rating on mobile broadband demand. He presents a regression model based on panel data of price, income, platform competition, and cost conditions, as well as the presence of zero rating, He finds that the presence of zero rating "is a statistically significant determinant of mobile broadband demand." [827] He concludes that zero rating should be offered as a *complement* to data plans along with requirements that ISPs not be allowed to refuse dealings with particular content providers.

More generally regulatory impact assessments (RIA) have been widely adopted in OECD countries.[828] RIAs consist of They consist of a defined process and steps of (1) problem definition; (2) identification of alternative options; (3) data collection; (4) comparison of options; (5) preferred policy options, and (6) monitoring and evaluation of indicators. The OECD itself notes that "RIA within an appropriate systematic framework can underpin the capacity of governments to ensure that regulations are efficient and effective in a changing and complex world."[829] They add that though there is successful implementation, RIA poses administrative and technical challenges.

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[826] "Better Policy Making - Ofcom's Approach to Impact Assessment - Ofcom," Ofcom, June 26, 2010, https://www.ofcom.org.uk/consultations-and-statements/better-policy-making-ofcoms-approach-to-impact-assessment.

[827] Oscar Saenz de Miera Berglind, "The Effect of Zero-Rating on Mobile Broadband Demand: An Empirical Approach and Potential Implications," International Journal of Communication 10, no. 0 (May 15, 2016): 18.

[828] "Regulatory Impact Analysis - OECD," accessed November 11, 2016, http://www.oecd.org/gov/regulatory-policy/ria.htm.

[829] Ibid

While it's likely regulators support evidenced-based assessment and impact analysis, in practice it does not always happen. Renda offers some explanations including procedural and organizational challenges, the regulatory process being chaotic and last-minute, the lack of adequate governance arrangement, civil servants detesting additional administrative burdens, lack of skills amongst administrators, a lack of transparency in the administration, and a lack of accessible public information. [830]

These challenges are part and parcel of the "knowing-doing gap" [831] which plagues organizations of all kinds, particularly when it comes to using data to inform decisions. Individuals and organizations may not have the skills or budget to conduct measurement. They might not know what study, or what they want to study might not be able to be measured with the available tools. Moreover measurement frequently introduces information that is unpopular, embarrassing, or controversial. Under these circumstances, it can be understood why measurement is avoided.

One of the main reasons to conduct an empirical assessment is to ensure credible and legal regulation. The FCC's 2015 Open Internet Order was challenged with 9 lawsuits, and while upheld by the DC Circuit 2-1, a scathing dissent[832] from Justice Williams for the lack of empirical assessment in the justification for rules may in part bring a rehearing. Indeed Tim Brennan's the FCC chief economist at the time of the Order's release, noted that the rulemaking process was an

[830] Andrea Renda, "Using Regulatory Impact Analysis to Improve Decision-Making in the ICT Sector," Centre for European Policy Studies, (2014), https://www.itu.int/en/ITU-D/Conferences/GSR/Documents/GSR2014/Discussion%20papers%20and%20presentations%20-%20GSR14/Session%207%20GSR14%20-%20Discussion%20paper%20-%20RIA.pdf.

[831] Jeffrey Pfeffer and Robert I. Sutton, The Knowing-Doing Gap: How Smart Companies Turn Knowledge into Action, 1 edition (Boston, Mass: Harvard Business School Press, 2000).

[832] "US Telecom et Al v. FCC. United States District Court of Appeals," June 16, 2016, https://www.cadc.uscourts.gov/internet/opinions.nsf/3F95E49183E6F8AF85257FD200505A3A/%24file/15-1063-1619173.pdf.See p. 116

"economics free zone."[833] He later corrected his statement to to say the order was wrong, unsupported, and irrelevant.[834]

Faulhaber and Singer explore what they see as a worrying trend in "The Curious Absence of Economic Analysis at the Federal Communications Commission: An Agency in Search of a Mission."[835] They note a lack of cost benefit analysis not just for net neutrality, but the set top box proceeding, special access, and privacy rulemakings. They point out that the agency conducted no cost benefit for its Open Internet rules, and submitted to Congress in March 2015 noting the Order should generate gross benefits of $100 million in edge investment annually without any back up calculation.[836] Separately this amount is a scintilla of the revenue of the Internet industry and the amount that broadband providers invest in infrastructure annually.

In its letter to Congress, the FCC reminds that it is not required to conduct cost benefit analysis. However Faulhaber and Singer say that this is no longer tenable. "There is no reason why the Department of Labor, the Environmental Protection Agency, the Consumer Financial Protection Bureau, and a host of other agencies should be required to perform cost-benefit analysis, while the FCC is free to embrace populism a guiding principle."[837] Mark Jamison notes similarly that the FCC demonstrates "institutional weakness" by disengaging from

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[833] L. Gordon Crovitz, "'Economics-Free' Obamanet," Wall Street Journal, January 31, 2016, sec. Opinion, http://www.wsj.com/articles/economics-free-obamanet-1454282427.

[834] Tim Brennan, "Perspectives from FSF Scholars," June 28, 2016, http://www.freestatefoundation.org/images/Is_the_Open_Internet_Order_an_Economics_Free_Zone_062816.pdf.

[835] Gerald Faulhaber and Hal J. Singer, "The Curious Absence of Economic Analysis at the Federal Communications Commission: An Agency in Search of a Mission," Calinnovates, July 10, 2016, https://ecfsapi.fcc.gov/file/10711657902329/FaulhaberSinger_FINAL%20TO%20FILE.pdf.

[836] "FCC. CONGRESSIONAL REVIEW ACT ABSTRACT WG Docket No.14-28; FCC15-24," March 12, 2015, http://www.progressivepolicy.org/wp-content/uploads/2015/04/20150403-CRA-Abstract-Open-Internet-Order.pdf.

[837] Supra Faulhaber, Singer

economic analysis and being openly political in its decisions.[838] Jamison directs the University of Florida, Public Utility Research Center, an institute which teaches regulation and infrastructure policy.[839] It alumni include representatives from over hundreds of the world's telecom and utility regulators.

If measured by the number of comments received by telecom regulators, net neutrality represents the most politicized of rulemaking. The following section explores the role of advocacy in rulemaking. While advocacy may come from multiple actors, there is an unprecedented level of sophistication and coordination in activism.

[838] Mark A. Jamison, "Emerging Institutional Weaknesses in US Regulation?," September 19, 2016, http://www.rpieurope.org/Publications/JamisonM.pdf.

[839] "Public Utility Research Center," Warrington, accessed November 11, 2016, http://warrington.ufl.edu/centers/purc/.

6 CONCLUSIONS

6.1 CONTRIBUTIONS OF THIS THESIS

This thesis investigated the degree to which net neutrality rules (depending on their instrumentation) stimulates the development of mobile applications. Some correlation was found between countries with soft net neutrality rules and mobile app innovation. While there may be other important outcomes for net neutrality, this investigation did not find support for hard net neutrality rules and an increase in mobile app innovation. Indeed that a number of countries create significant mobile app innovations with no net neutrality rules suggests that greater work needs to be done to test and theorize the role of net neutrality regulation to mobile app innovation.

This thesis has made two contributions. It has supplemented the academic literature with an empirical investigation of net neutrality rules and their relationship to mobile app innovation. The work offers scholars and policymakers another perspective to consider when thinking about the relationship of actors in a complex system and the expectation for the outcome of rulemaking. It also exposes the limitations of prevailing net neutrality.

The second contribution is to highlight the lack of measurement for net neutrality policy, particularly for its assertions of supporting innovation. Having a more robust framework for measurement would likely force scholars and policymakers to test their assumptions, temper the proposed goals, and refine the the proposed policies to better match the stated objectives.

There is no doubt that many policymakers would welcome measuring their net neutrality policies but face barriers to doing so. This thesis highlights a number of barriers to measurement such as the fitness of tools, the expense of measurement, and the limited expertise of knowing what information is important.

It could also be that policymakers do not measure on purpose for fear of revealing information that does not support their chosen policy path.

6.2 IMPLICATIONS FOR RULEMAKING

The results of this thesis question the wisdom of imposing hard rules on one actor in a complex, integrated, multi-sided Internet markets. Following are other options to consider.

Option 1: Extend hard rules to entire Internet ecosystem

One option is to extend the same hard open internet rules to other Internet actors, as there is significant evidence that edge providers have the ability and incentive to harm openness. The stumbling block to this is that telecom regulators don't necessarily have the authority to police actors other than licensed telecom operators. Extending rules would likely require updating national laws first.

Option 2: Extend hard rules to only to players with monopoly power

A related option could be to extend rules only to those players with controlling monopoly power if such power emerges and is exploited to the harm of customers. Such *ex ante* regulation could be appropriate when a firm is a natural monopoly, and there is a need to address monopoly pricing, poor service quality, and an obligation to serve. [840] Such a measure would require the application of economic analysis to characterize the market and its participants.

Option 3: Adopt soft net neutrality rules

This thesis finds support for soft net neutrality rules and mobile app innovation. Soft rule regimes employ multistakeholder models and codes of conduct. In fact regulators have the most experience and longest running track record with these methods. Countries which

[840] Roslyn Layton and Mark Jamison, "Beyond Net Neutrality: Policies for Leadership in the Information, Computing, and Network Industries," AEI, June 14, 2016, https://www.aei.org/publication/beyond-net-neutrality-policies-for-leadership-in-the-information-computing-and-network-industries/.

opted for this approach (Nordic countries, Switzerland, UK, Japan, and South Korea) have experienced a high level of mobile innovation. Moreover limited violation has occurred these regimes. Moreover rules have not been litigated.

An important question is whether soft rules should be applied to a single actor or the ecosystem as a whole. While it was not the focus of this thesis, a glaring reality emerges when looking at the data: two app stores are the essential gatekeepers for mobile apps. That this point rarely enters into the Open Internet discussion seems suspect and this would seem an appropriate area to address with further research.

Regulators have significant comments on record over the years noting the downside of "one-sided Internet policy". For example as part of the FCC's 2009 NPRM on Open Internet rules, MIT's David Clark, William Lehr ,and Steve Bauer, supported[841] the FCC's efforts to establish "clear regulatory guidance" with "general guidance rather than overly detailed specifications because the Internet continues to evolve." They reiterated the value of the core of soft rules, the heart of Tim Wu's recommendation which was embedded in the FCC's "Four Freedoms"[842] of 2005: the rights of end users to access content, to use applications of their choice, and to connect with the devices of their choice. They also support competitive choice in different components of the value chain.

However they critiqued the FCC's narrow focus on broadband providers and imposition of obligations applicable only to them, as they are not the only market actor whose behavior would pose a threat

[841] David Clark, William Lehr, and Steve Bauer, "Before the Federal Communications Commission Washington, D.C. 20554," FCC, accessed November 5, 2016, https://ecfsapi.fcc.gov/file/7020373725.pdf.

[842] Michael Powell, "Preserving Internet Freedom: Guiding Principles for the Industry," Silicon Flatirons Symposium, February 8, 2004, https://apps.fcc.gov/edocs_public/attachmatch/DOC-243556A1.pdf.

to an open and healthy Internet. Lehr reiterated[843] this view in 2014 in the FCC's third attempt to make rules

Lehr describes FCC's third attempt at rules as reliance on an "overly simplistic 2-sided market model that fails to recognize the inherent complexity of the Internet ecosystem" and its failing to account for interdependencies in the system.[844] He explains that "Internet openness depends on open access to broadband, devices, applications, content, and other services (i.e., non-access ISP and other value-added services)," and warns that one-sided rules could lead to misidentification of problems and remedies that "distort market incentives and accentuate the potential risk of harms from agents not constrained by the rules, while perversely weakening the potential for access ISPs to mitigate those harms."[845]

To demonstrate the need for Open Internet rules across the ecosystem, he provides four significant examples between 2009-2014 when content providers such as Viacom, News Corp, and CBS, otherwise engaged in bona fide negotiations with multichannel video programming distributors (MVPD) such as TimeWarnerCable, Cablevision, and Bright House Networks, over carriage rights and retransmission consent, would use threats and/or used the punishment of blocking content or refusing to supply content as a means of extracting preferable agreements.[846] Similarly this paper observed how Netflix, in a secret and ostensible attempt to pick winners among ISPs, purposely sent a lower quality video stream of its content to mobile subscribers of AT&T and Verizon while sending superior versions to Sprint and T-Mobile.

Option 4: Employ vigorous competition across all actors to police net neutrality violations

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[843] "Before the Federal Communications Commission Washington, D.C. 20554," FCC, July 17, 2014, https://ecfsapi.fcc.gov/file/7521683605.pdf.

[844] Ibid

[845] Ibid

[846] Ibid

If in the fact Internet and its plays the whole system needs oversight, competition law may be appropriate. Net neutrality type violations are well-theorized within antitrust (restrictive agreements, vertical/horizontal constraints, market concentration etc) and policed by competition authorities. Already in 2006 the Federal Trade Commissions, the American competition authority, indicated that it was up to the task to police net neutrality concerns across the ecosystem.[847] Moreover employing an antitrust framework, with its emphasis on empirical and economic analysis and consumer welfare, is arguably superior to manage net neutrality.[848] Separately this could address the issue of the lack of evidence for rulemaking in a number of countries.

Moreover if is accepted that convergence--the coming together of communication, computing, and content--has been ongoing for for almost half a century, then it follows that there should be a *convergence* in the rules that govern the ecosystem. Oddly enough, while Internet markets are converging, the regulatory response in the US and EU has been to increase the silos of regulation.

Concepts such as common carriage, long retired in other industries, are resurrected by telecom regulators to justify an expanding role of a subset of the converged system. One explanation is that the FCC survives, indeed thrives, despite its declining relevance as an economic regulator because the it has succeeded to rebrand itself as a social regulator, a feat it accomplishes by blurring the lines of

[847] "Broadband Connectivity Competition Policy," FCC, (June 2007), https://www.ftc.gov/sites/default/files/documents/reports/broadband-connectivity-competition-policy/v070000report.pdf.

[848] Joshua Wright, "Broadband Policy & Consumer Welfare: The Case for an Antitrust Approach to Net Neutrality Issues," FCC, April 19, 2013, https://www.ftc.gov/sites/default/files/documents/public_statements/broadband-policy-consumer-welfare-case-antitrust-approach-net-neutrality-issues/130423wright_nn_posting_final.pdf.

common carriage and private carriage or "quasi–common carriage."[849]

The FCC calls its rulemaking "adapting and modernizing to keep up with the times"[850] and issues notices at will. This would be laudable if its activities were authorized by Congress, but they are not. The FCC is only supposed to issue new rules when Congress updates telecommunications laws.[851] While Congress is well overdue on an update to the 1996 Telecommunications Act, this should not empower the FCC to make up rules as it sees fit.

In any case the evidence in this thesis should support policymakers to overhaul long overdue communications laws and modernize them for the Internet era. The Danish case provides inspiration of multi-party cooperation and vision for a digital society. The wisdom of this approach has been confirmed in the rankings of Denmark as a leading digital nation. The goal of moving communications regulation to a competition framework has a number of benefits for resolving the distortions and asymmetries created by one-sided Open Internet policies.

Following is author's assessment of the standards of good policy when applied to net neutrality regulation and competition law.[852]

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[849] Brent Skorup and Joseph Kane, "The FCC and Quasi-Common Carriage," Mercatus Center, September 20, 2016, https://www.mercatus.org/publications/fcc-and-quasi-common-carriage-case-study-agency-survival.

[850] "Empowering the 21st Century Consumer," Federal Communications Commission, October 19, 2016, https://www.fcc.gov/document/empowering-21st-century-consumer.

[851] "Rulemaking at the FCC," Federal Communications Commission, May 1, 2011, https://www.fcc.gov/general/rulemaking-fcc.

[852] Framework developed with the assistance of Niels Rytter, former head of section Danish Competition Authority "Konkurrencerådgivning," accessed November 11, 2016, http://www.konkurrenceraadgivning.dk/.

Figure 86: Standards of good policy applied to net neutrality regulation and competition law

Standard	**Net neutrality regulation**	**Competition law**
Aligned with national laws and institutional goals	Depends on country	Yes
Based on rational, comprehensive data and evidence—both quantitative and qualitative	No	Yes
Clearly states the reasons why it's needed and the proposed outcome	No	Yes
Provides a framework for achieving the outcome	No	Yes
Neccesity	No	Yes
Comprehensitivity	No	Yes
Accurate in its objective	No	Yes
Concise, clearly communicated and widely understood	No	Yes
Predictable and not to be changed prematurely	No	Yes
Designed to be followed	No	Yes
Internationally harmonized	No	Yes
Creates value and benefits with measurable outcomes	No	Yes
Monitored, evaluated and reviewed regularly	No	Yes

One final interpretation is a heterodox view of regulation, that creating net neutrality rules only broadband providers is a way for a regulator to pay tribute to another constituency, that of "edge providers." This is George Stigler's regulatory capture observation: regulation is acquired by industry and operated for its benefit.[853] For example the FCC said in no uncertain terms that it had no intention to police edge providers

[853] George Stigler, "The Theory of Economic Regulation," Bell Journal of Economics 2, no. 1 (1971): 3–21.

even if they break the law. "The Commission has been unequivocal in declaring that it has no intent to regulate edge providers,"[854] wrote a FCC official to a the consumer organization Watchdog in response to a request that the FCC police the privacy violations of Internet companies.

Watching the explosion of rulemaking around the world which proceeds with so little evidence gathering and measurement makes one skeptical of the premise of regulatory expertise and independence. It could be that regulators are merely "satisficing,"[855] that is, creating open internet rules because they think they should and feel a pressure to "keep up on the regulatory trends of other countries", lest they look like they are doing nothing.

The incidence of net neutrality violation is quite small in relation to the explosion of rules. Indeed blocking by broadband providers is rare whereas it is commonplace when practice by governments. As such the growth of net neutrality rulemaking does not appear to be driven by bad behavior from ISPs but rather transnational activism which is incentivized to deliver hard rules as a means to certify success to their funders. Ironically internet activism, even if it overloads the IT systems with millions of emails, may well be embraced by regulators because it provides a reason for being.

Macy and Miller observe, "An agency that has been rendered obsolete by exogenous changes in the form of technological development or new marketplace developments will find that it must provide favors to discrete constituencies in order to preserve some measure of support for its continued existence."[856] For example French regulator

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[854] Matthew DelNero, "Before the Federal Communications Commission Washington, D.C. 20554," FCC, (November 6, 2015), https://apps.fcc.gov/edocs_public/attachmatch/DA-15-1266A1_Rcd.pdf.

[855] Simon Herbert, "Rational Choice and the Structure of the Environment," Psychologial Review, March 1956, http://digitalcollections.library.cmu.edu/awweb/awarchive?type=file&item=33544.

[856] Jonathan Macey and Geoffrey Miller, "Reflections on Professional Responsibility in a Regulatory State," Faculty Scholarship Series, January 1, 1995, http://digitalcommons.law.yale.edu/fss_papers/1442.

Sebastian Soriano noted during the BEREC consultation, "I must confess that some of these tweets and messages that I received made me emotional... people asking me to "Save the Internet" and "Stop corporate capture..." I really wanted to respond to them."[857] Hence regulators have found its new constituency.

If it fact it is the case that net neutrality is urgent and necessary, it bears mention why more empirical studies have not been performed. For indeed if the policy works so well, as purported, then evidence should be forthcoming.

There is no doubt that net neutrality may have a value, but for nations to engage in policymaking without methods and standards to assess their impact, this undermines credibility for policymakers and policies. As such this project represents one possible, and preliminary, way to measure the impact of rules.

[857] "The Internet is… saved??!!" Avaaz.org September 2016. https://secure.avaaz.org/en/we_saved_the_internet/?slideshow Accessed November 11, 2016

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