



Network neutrality on the Internet: A two-sided market analysis

Nicholas Economides^{a,1}, Joacim Tåg^{b,*}

^a Stern School of Business, New York University, 44 West Fourth Street, NY 10012-1126, New York, USA

^b Research Institute of Industrial Economics (IFN), P.O. Box 55665, SE-102 15 Stockholm, Sweden

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ABSTRACT

We discuss network neutrality regulation of the Internet in the context of a two-sided market model. Platforms sell broadband Internet access services to residential consumers and may set fees to content and application providers on the Internet. When access is monopolized, cross-group externalities (network effects) can give a rationale for network neutrality regulation (requiring zero fees to content providers): there exist parameter ranges for which network neutrality regulation increases the total surplus compared to the fully private optimum at which the monopoly platform imposes positive fees on content providers. However, for other parameter values, network neutrality regulation can decrease total surplus. Extending the model to a duopoly of residential broadband ISPs, we again find parameter values such that network neutrality regulation increases total surplus suggesting that network neutrality regulation could be warranted even when some competition is present.

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1. Introduction

The Internet is the primary global network for digital communications. A number of different services are provided on the Internet, including e-mail, browsing, peer-to-peer services, Internet telephony (Voice over Internet Protocol “VOIP”), and many others. A number of different

functions/applications run on top of the Internet browser, including information services, display of images, transmission of video and other features.

Since the inception of the Internet, information packets are transported on the Internet under “network neutrality.” This is a regime that does not distinguish in terms of price between bits or packets depending on the services for which these bits and packets are used or on the identities of the uploader and downloader. The typical contract of an Internet service provider (ISP) with a customer gives the customer access to the whole Internet through a physical or virtual pipe of a certain bandwidth. Similarly, an ISP

* Corresponding author. Tel.: +46 (0)8 665 4524.

E-mail addresses: economides@stern.nyu.edu (N. Economides), joacim.tag@ifn.se (J. Tåg).

¹ Tel.: +1 212 998 0864.

buys from an Internet backbone network access to the whole Internet through a physical or virtual pipe of a certain bandwidth in a service called “transit.” “Transit” delivers access to the buyer to the whole Internet and therefore the buyer/ISP does not need to have any contractual relationship with any other ISP except its backbone provider.²

The price a customer pays to an ISP for Internet access depends crucially on the availability of competing ISPs for this customer. Customers that are not locationally constrained and can connect to the Internet at many locations can negotiate very small connection charges. Content/applications providers are typically not locationally constrained and have negotiated very small Internet access charges. In contrast, residential customers typically face a local monopoly or duopoly and have much higher charges.

As search services, video services and digital distribution of content over the Internet are growing, Internet broadband access providers AT& T, Verizon and a number of cable TV companies have recently demanded additional compensation for carrying valuable digital services. Ed Whitacre, AT& T's then CEO, was quoted in *BusinessWeek* referring to AT& T's Internet infrastructure: “Now what they would like to do is use my pipes free, but I ain't going to let them do that because we have spent this capital and we have to have a return on it.”³ However, no one is using the Internet for free. In a transmission of an information packet the ISPs on both sides pay the Internet backbone and each ISP is paid by its customer.⁴ AT& T, together with Verizon and cable TV companies, are asking for the abolition of “network neutrality.”

In terms of pricing, this would imply that content and application providers (such as Google, Yahoo, MSN, or Disney) would be forced to pay the a residential consumers' Internet service provider to ensure that the consumer can access their services. The Internet service providers have also expressed a desire to be able to apply different prices to different content providers, even for the same type of information transmitted to consumers. This would imply that a residential ISP could potentially charge Google more for making the Google search service available to consumers than what it charges Microsoft for making its search service available.

In abolishing network neutrality, telephone and cable companies are departing from the “end-to-end principle”

that has governed the Internet since its inception.⁵ Under the end-to-end principle, computers attached to the Internet that are sending and receiving information packets did not need to know the structure of the network and could just interact end-to-end. Thus, there could be innovation “at the edge” of the network without interference from network operators.⁶ The way the Internet has operated so far is a radical departure from the operating principles of the traditional digital electronic networks predating it, such as Comuserve, Prodigy, AOL, AT& T Mail, MCI Mail and others. These older electronic networks were centralized with very little functionality allowed at the edge of the network.

From an economics point of view, the departure from network neutrality regulation will have two primary consequences.

- It will introduce the potential of two-sided pricing on the Internet where a transmission company controlling some part of the Internet (here last mile access) will charge a fee to content or application firms “on the other side” of the network which typically did not have a contractual relationship with it. This payment by a content or applications provider would be over and above the traditional one-sided payment to its ISP for providing access and transmission of information packets.
- It will introduce the possibility for prioritization, which may enhance the arrival time of information packets originating from paying content and application firms “on the other side,” and may degrade the arrival time of information packets that originate from non-paying firms. This has the possibility of increasing efficiency of packet transfers over the Internet, such that more time-sensitive packets are given prioritized access. But it can also effectively exclude access to non-paying firms' content and applications.

In this paper, we deal with the issue of introducing two-sided market pricing by formally building a model of a two-sided market. We thus only concentrate on the issue of one-sided versus two-sided pricing (which we think should play a larger role in the debate) and ignore other (admittedly important) issues such as exclusion of content providers, dynamic investment incentives and price discrimination. In particular, we abstract entirely from prioritization issues in order to focus on two-sided pricing.

We explicitly model the Internet broadband market as a two-sided network consisting of broadband users on one side and content and applications providers on the other. Prices imposed on both sides have direct implications on the number of broadband consumers as well as on the number of active providers of content and applications. In our framework, network neutrality is defined as the restriction that Internet Service providers cannot directly charge content providers for access to consumers, i.e., the price on one side of the market is constrained to zero. We only consider direct charges to content providers over

² ISPs can also accept payment in kind, that is, barter, called ‘peering.’ Peering is a restricted service whereby two interconnecting networks agree not pay each other for carrying the traffic exchanged between them as long as the traffic originates and terminates in the two networks. For a more detailed description, see Economides (2005, 2007).

³ Interview with Ed Whitacre, *BusinessWeek* November 7, 2005. Q: How concerned are you about Internet upstarts like Google (GOOG), MSN, Vonage, and others? A: How do you think they're going to get to customers? Through a broadband pipe. Cable companies have them. We have them. Now what they would like to do is use my pipes free, but I ain't going to let them do that because we have spent this capital and we have to have a return on it. So there's going to have to be some mechanism for these people who use these pipes to pay for the portion they're using. Why should they be allowed to use my pipes? The Internet can't be free in that sense, because we and the cable companies have made an investment and for a Google or Yahoo! (YHOO) or Vonage or anybody to expect to use these pipes [for] free is nuts!

⁴ See Economides (2005, 2007).

⁵ For more on the end-to-end argument, see e.g. Saltzer et al. (1984).

⁶ See Cerf (2006a,b) for a detailed explanation of this argument.

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