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The Future of the Internet

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Executive Summary

In its short history, the Internet has grown at an astounding pace. Legislators have the ability to dramatically affect the future of Internet growth and innovation. I argue that legislators should carefully weigh the benefits and costs of regulatory policies. I use the examples of network neutrality and network management to suggest how this might be done.

I argue that the economic issues raised in the network neutrality and network management debates can be effectively addressed by using antitrust authority where appropriate, allowing Internet pricing flexibility, and fostering more efficient use of spectrum to facilitate entry into the broadband market. My basic message is that government should allow firms to experiment with different business models for Internet services. Allowing such market flexibility is likely to be the best way to ensure efficient innovation on the information superhighway.

The Future of the Internet

Robert W. Hahn

1. Introduction

I am pleased to appear before this Senate committee to present my views on the future of the Internet. I have studied and written about regulation for more than two decades. I also have done a great deal of work on telecommunications and Internet regulation.[1]

About a decade ago, I helped organize a cooperative effort between the American Enterprise Institute and the Brookings Institution to study regulation. The result was the AEI-Brookings Joint Center for Regulatory Studies, which I directed. I now direct the AEI Center for Regulatory and Market Studies, which is the successor to the Joint Center.[2]

A primary objective of the center is to hold lawmakers and regulators more accountable by providing thoughtful, objective analysis of existing regulatory programs and new regulatory proposals. The Reg-Markets Center and the Joint Center have been at the forefront of outlining principles for improving regulation and enhancing economic welfare.[3]

In its short history, the Internet has grown at an astounding pace. This growth is seen in the bandwidth consumed by the video sharing site YouTube. By some estimates, YouTube consumed as much bandwidth in 2007 as the entire Internet combined in 2000![4]

That growth is expected to continue. Traffic on the Internet is expected to nearly double every two years.[5] Much of this growth will be driven by peer-to-peer network

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1. *See* William J. Baumol et al., *Economists' Statement on Net Neutrality* (AEI-Brookings Joint Center for Regulatory Studies, Related Publication No. 07-08, 2007) [hereinafter Baumol et al.]; Elizabeth E. Bailey et al., *Economists' Statement on U.S. Broadband Policy* (AEI-Brookings Joint Center for Regulatory Studies, Related Publication No. 06-06, 2006) [hereinafter Bailey et al.]; Robert Hahn & Scott Wallsten, *The Economics of Network Neutrality*, 3 THE ECONOMISTS' VOICE, n. 6, article 8 (2006); Robert Hahn & Robert Litan, *The Myth of Network Neutrality And The Threat to Internet Innovation*, MILKEN INST. REV. 28, First Quarter (2007); Robert Hahn et al., *The Economics of Wireless Net Neutrality*, 3 J. COMPETITION L. & ECON. 399, n. 3 (2007); Robert Hahn & Anne Layne-Farrar, *Is More Government Regulation Needed to Promote E-commerce?*, 35 CONN. L. REV., n. 1 (2002); Robert Hahn & Anne Layne-Farrar, *The Law and Economics of Software Security*, 30 HARV. J. L. & PUB. POL'Y 284, n. 1 (Fall 2006); Robert Hahn et al., *Bandwidth for the People*, 127 POL'Y REV. 67, (October/November 2004).

2. All Reg-Markets Center and Joint Center publications can be found at http://www.reg-markets.org.

3. *See* Arrow et al., *Is There a Role for Benefit-Cost Analysis in Environmental, Health, and Safety Regulation?*, 272 SCIENCE 1569, n. 5268 (1996).

4. Steve Lohr, *Video Road Hogs Stir Fear of Internet Traffic Jam*, N.Y. TIMES, Mar. 13, 2008, at 1.

5. Cisco Systems White Paper, *Global IP Traffic Forecast and Methodology, 2006-2011*, Jan. 14, 2008, at 1, available at http://www.cisco.com/en/US/solutions/collateral/ns341/ns525/ns537/net_implementation_white_paper0900aecd806a81aa.pdf ("After a brief mid-decade slowdown, IP traffic will nearly double every two years through 2011. Total IP traffic will nearly quadruple in the four-year period

traffic, which is expected to quadruple by 2011.[6] Internet traffic will also continue to grow as high-definition video and other traditional commercial video services are delivered via IP within a single network.[7] Consumer video services are expected to grow from 18 percent of consumer Internet traffic to 43 percent.[8]

Since I only have 5 minutes, let me cut to the chase. As America's lawmakers, you have the ability to dramatically affect the future of Internet growth and innovation.

That's both good news and bad news. The good news is that if you choose policies wisely, and regulate with a very light hand, we will continue to enjoy the immense benefits that this medium has offered all of us. If, on the other, you choose policies that dramatically interfere with the workings of the marketplace, you could significantly reduce the pace of Internet innovation, leading to losses for consumers that could be in the billions of dollars. Applications ranging from telemedicine to online games could be jeopardized by regulation that seeks to bar contracting for prioritized delivery—a critical ingredient for these applications to run effectively. Without the ability to set prices freely, these applications, along with their associated benefits for the economy, may never be introduced. But, fortunately, you have the opportunity to make wise choices.

So how to choose policies wisely, some of you may ask? That is a good question, and one that I would like to focus on today. I am an economist, so my basic answer is that you need to look carefully at the benefits and costs of various policy interventions, and choose those for which you believe the benefits are likely to exceed the costs.

In the interest of time, I would like to focus my remarks on the issue of net neutrality. I will conclude with a couple of observations about the current controversy over network management, which is related to the net neutrality issue.

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from 2007 to 2011." at 1. "Consumer IP traffic generated by the transport of cable and IPTV video-on-demand (VoD) content will grow faster than consumer Internet traffic.").

6. *Id*. at 2 ("Peer-to-peer traffic still dominates Internet traffic and growth is not slowing. traffic is not expected to decrease over the forecast period. Instead, it will nearly quadruple from 1,330 petabytes per month in 2006 to 5,270 petabytes per month in 2011, driven by the global increase in high-speed broadband penetration, the increasing use of peer-to-peer for standard-definition video file exchange, and the advent of high-definition video file exchange and television content via peer-to-peer.").

7. *Id*. at 1 ("Consumer IP traffic generated by the transport of cable and IPTV video-on-demand (VoD) content will grow faster than consumer Internet traffic. Consumer IPTV and IP VoD traffic will grow at a CAGR of 81 percent, while consumer Internet will grow at a rate of 42 percent.").

8. *Id*. ("In 2011, only 57 percent of consumer IP traffic will be Internet traffic, while 43 percent will be traffic generated by the delivery of traditional commercial video services over IP within a single operator's network. This is a dramatic shift from the composition of 2006 consumer IP traffic, over 82 percent of which is Internet traffic.").

2. Network Neutrality[9]

Network neutrality is a policy proposal that would, among other things, regulate how network providers manage and price the use of their networks.

Net neutrality proponents assert that if Internet service providers are allowed to charge content providers for enhanced service offerings, those content providers that cannot afford the "toll" will be forced to exit—thus impairing innovation at the "edges" of the Internet. In contrast, net neutrality opponents suggest that allowing experimentation with new business models is the key to (1) Internet innovation at both the "core" and the "edge" of the network, and (2) the deployment of more intelligent networks needed to handle rapidly growing Internet traffic.

Congress has introduced several bills on network neutrality over the last few years.[10] Proposed legislation generally would mandate that Internet service providers exercise no control over the content that flows over their lines, and would bar service providers from charging content providers for certain enhancements such as prioritized delivery. For example, senators Byron Dorgan and Olympia Snowe introduced network neutrality legislation in 2006 and again in 2007, which, had it passed, would have prevented *any* contracting between access providers and content providers.[11] Several scholars have uncovered the unintended consequences of such a prohibition, including higher prices of Internet service for end users and decreased innovation in application markets.[12]

These proposals must be considered carefully in light of the underlying economics. My basic concern is that most proposals aimed at implementing net neutrality are likely to do more harm than good.

Analysis

Regulation of prices and services has often resulted in costs that exceed benefits, especially in competitive markets. Highly dynamic markets, such as those for high-speed Internet services, pose particular problems because they change so quickly. In such dynamic markets, it is difficult for regulators to determine appropriate prices because

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9. This section draws heavily on the AEI-Brookings net neutrality statement. *See* Baumol et al., *supra* note 1.
10. H.R. 5273, 109th Cong. § 2(10) (2006). S. Res. 2360, 109th Cong. § 4(a)(6) (2006).
11. *Dorgan, Snowe Take Another Stab at Net Neutrality Legislation*, TR DAILY, Jan. 9, 2007.
12. *See, e.g.*, Robert Litan & Hal J. Singer, *The Unintended Consequences of Net Neutrality*, 5 JOURNAL ON TELECOMMUNICATIONS AND HIGH TECH LAW 533 (2007).

technology and consumer demands are difficult to forecast; and introducing price regulation risks discouraging the healthy process of risk-taking innovation—which is especially important in telecommunications.

The market for high-speed Internet services, or broadband, is the key concern. Before jumping to conclusions about market power, one should look carefully at the data. And the data suggest that there is robust and growing competition in the market for high-speed Internet services in both the wireline and wireless space. Prices for digital subscriber line service dropped by roughly one-third between 2001 and 2006. In the case of cable modem service, the quality-adjusted price declined significantly, as cable connection speeds increased significantly while prices held steady. In March of this year, the FCC reported that high-speed lines increased by 22% during the first half of 2007, from 82.8 million to 100.9 million lines in service, following a 27% increase, from 65.3 million to 82.8 million lines, during the second half of 2006.[13] Virtually the entire U.S. population lives in a zip code where a high-speed service provider operates, and numerous service providers compete in the major population centers. And this is to say nothing of the boom in handheld devices, like blackberries, that provide wireless access to the net.

In most, but not all, cases, I believe these markets are workably competitive. Moreover, even if some service providers could exercise some market power, the multi-sided nature of the market and the geographic scope of most Internet content means that they still have powerful incentives not to block content. In particular, providers need content in order to attract subscribers. If a provider restricted access, its product would be less valuable and attract fewer subscribers. The point is that even firms with market power in one part of the market will not necessarily be able to control content.

Recommendations

I offer two recommendations related to pricing flexibility and facilitating more competition.

Recommendation 1: Firms should be allowed to experiment with different pricing schemes for providing Internet access.

13. FCC, High-Speed Services for Internet Access as of June 30, 2007, released March 2008.

One advantage of giving Internet service providers pricing flexibility is that it will give them incentives to make new investments in network intelligence, which will support a range of real-time applications from telemedicine to online games. Without such innovations, these real-time applications may never see the light of day.

Another advantage of pricing freedom is that it can lead to lower subscription prices for end users. Most economic models of "two-sided platforms" show that platform owners have strong incentives to subsidize the most price-sensitive customers, which in this case would be end users.

There is not one right way to charge different customers in these high-speed markets. That is precisely why broadband providers should be allowed to charge market prices on *both* sides of the market, unless there is a clear showing that the optimal pricing policy from the perspective of platform owners is not consistent with the socially optimal pricing policy. Not only do we lack empirical proof of this proposition, there does not appear to be any theoretical basis.

Recommendation 2: Congress and federal regulators should promote policies that increase the opportunities for competition and foster Internet innovation. One such policy would be spectrum liberalization.

High-speed Internet connections may be provided using wireless networks. Much valuable spectrum, however, is not available for its most productive uses. The Federal Communications Commission should make additional licensed spectrum available for flexible use as soon as possible and allow it to be traded so that spectrum can be allocated to its highest-valued applications.[14]

Both Congress and the FCC should refrain from imposing special conditions on spectrum licenses, such as the recent openness requirement that was introduced in the last FCC spectrum auction for certain licenses. This requirement would allow third-parties with wireless applications to piggyback on the licensee's network at no charge. While openness may sound good, the cost of mandatory openness is significant, and to this day, has never been compared against the benefits.

One measure of the size of the costs imposed by an open-platform requirement is provided by the recent FCC spectrum auction itself. Bidders offered less for the C-block

14. *See* Bailey et al., *supra* note 1.

than for other, roughly comparable spectrum. Indeed, one other block went for almost triple the price per potential customer.[15] Multiplying these price differences by the population in the United States (286 million) and the size of the C block (22 megahertz), we can infer that bidders estimated that the openness requirement would reduce the value of the C block by between $2.5 billion and $12 billion. That lower value translates into lower auction revenue, which from a pure budgetary perspective, is not good news for taxpayers.

3. Network Management

The issue of managing high-speed Internet networks has been in the news lately. Congressman Ed Markey introduced the "Internet Freedom Preservation Act of 2008."[16] At about the same time, the Federal Communications Commission held hearings at Harvard to consider whether network management practices of Internet providers should be regulated in some way. The Commission released a policy statement promoting open access to the Internet. The policy makes an exception for "reasonable" network management, but does not define what is meant by reasonable.

A key catalyst for the interest in this seemingly arcane subject is the recent controversy stemming from Comcast's decision to limit its customers' use of BitTorrent, a file-sharing application. Most scholars agree that a firm like Comcast should not be allowed to simply disconnect a user from the network, or slow the delivery of content, unless the firm and user agreed to those contract terms upfront.

But a funny thing happened recently in this controversy that should give lawmakers and regulators reason for optimism in the marketplace. That funny thing was that Comcast and BitTorrent came to an agreement. Comcast also reached an agreement with Pando Networks, the leading managed peer-to-peer content delivery service, which will lead to the creation of a peer-to-peer "Bill of Rights and Responsibilities" for peer-to-peer users and Internet service providers. Such agreements provide a path for resolving thorny network management issues in a voluntary and collaborative market-driven process.

15. Spectrum in the A block sold for about $0.40 per "megahertz-pop" (a measure of spectrum quantity adjusted for the potential population it can serve) than spectrum in the C block. Similarly, B-block spectrum sold for an average of $1.91 more.

16. See Robert Hahn, *The Internet Freedom Act* (Reg-Markets Center, Policy Matters No. 08-03, 2008) for an analysis of this proposal.

Conclusion

The issues raised in the net neutrality and network management debates can be effectively addressed by using antitrust authority where appropriate, allowing Internet pricing flexibility, and fostering more efficient use of spectrum to facilitate entry into the broadband market.

My basic message is that government should allow firms to experiment with different business models for Internet services. Allowing such market flexibility is likely to be the best way to ensure efficient innovation on the information superhighway.