

Keeping the Internet Neutral?: Tim Wu and Christopher Yoo Debate

Tim Wu is Professor of Law at the Columbia Law School. He is the author of *Network Neutrality, Broadband Discrimination* (2003) and coauthor, with Jack Goldsmith, of *Who Controls the Internet?* (Oxford University Press 2006). **Christopher S. Yoo** is Professor of Law and Director of the Technology and Entertainment Law Program at the Vanderbilt University Law School. He is the author of *Beyond Network Neutrality* (2005) and *Network Neutrality and the Economics of Congestion* (2006) and the coauthor, with Daniel F. Spulber, of the forthcoming *Networks in Telecommunications: Economics and Law* (Cambridge University Press).

Yoo:

During the past year, network neutrality emerged as one of the most controversial issues in Internet policy. Although the details of specific proposals differ, as a general matter, a network neutrality mandate would prohibit network owners from discriminating against particular applications and content providers. Network neutrality played a key role in the debates over communications reform legislation that was pending before the Senate and the House of Representatives, as well as in the Federal Communications Commission's ("FCC") clearance of the SBC-AT&T, Verizon-MCI, and AT&T-BellSouth mergers.¹

I am not convinced that deviations from network neutrality will necessarily harm consumers and innovation. On the contrary, competition and innovation might be better served if policymakers embraced a

1. On the role that network neutrality played in congressional debates and the SBC-AT&T and Verizon-MCI mergers, see Christopher S. Yoo, *Network Neutrality and the Economics of Congestion*, 94 GEO. L.J. 1847, 1859–60 (2006) [hereinafter *Economics of Congestion*]. On the AT&T-BellSouth merger, see *AT&T Inc. and BellSouth Corporation Application for Transfer of Control*, News Release, WC Docket No. 06-74 (Dec. 29, 2006) (merger conditions available at http://hraunfoss.fcc.gov/edocs_public/attachmatch/DOC-269275A1.pdf).

“network diversity” principle that would allow different network owners to pursue different approaches to routing traffic.

Simply put, deviations from network neutrality may represent nothing more than network owners’ attempts to satisfy the increasingly intense and heterogeneous demands imposed by end-users.² The early Internet was dominated by applications such as email and Web browsing, in which delays of half a second were virtually unnoticeable. These are being replaced by newer applications, such as Internet telephony and streaming video, in which such delays can be catastrophic. One obvious solution would be to give a higher priority to traffic associated with time-sensitive applications. Unfortunately, this is precisely the type of discrimination between applications that network neutrality would condemn.³

Another interesting innovation is the emergence of content-delivery networks like Akamai, which reportedly serves 15% of the world’s Web traffic. Suppose that an end-user in Los Angeles attempted to download a Web page from CNN.com. If CNN.com hosted the content itself, this request would have to travel thousands of miles to the server in CNN’s headquarters in Atlanta and back, passing any number of points of congestion along the way. The speed with which the request is filled also depends on the number of other queries being directed at CNN’s server. Akamai minimizes delay by caching content at thousands of locations throughout the Internet and routing requests to the server that is the closest and/or the least congested. The catch from the standpoint of network neutrality is that Akamai is a commercial enterprise, which means that those who are willing to pay more get faster service.⁴

Employing different protocols might also provide more competition among network platforms by permitting multiple networks to survive by targeting subsegments of the overall market, in much the same way that specialty stores survive in a world dominated by low-cost, mass-market retailers (or, more properly, given the scale necessary for a telecommunications network to be viable, in the same way that department stores compete by developing strengths in certain types of merchandise and becoming the exclusive distribution outlet for particular product lines). For example, deviating from network neutrality might make it possible for three last-mile networks to coexist: one optimized for traditional Internet applications, such as email and Web site access; a second incorporating

2. See Christopher S. Yoo, *Would Mandating Network Neutrality Help or Hurt Broadband Competition?: A Comment on the End-to-End Debate*, 3 J. ON TELECOMM. & HIGH TECH. L. 23, 34–37 (2004).

3. Christopher S. Yoo, *Beyond Network Neutrality*, 19 HARV. J.L. & TECH. 1, 20–25 (2005) [hereinafter *Beyond Network Neutrality*].

4. See *Economics of Congestion*, *supra* note 1, at 1881–82.

security features to facilitate e-commerce; and a third that facilitates time-sensitive applications such as streaming media and Internet telephony. Network neutrality, in contrast, threatens to foreclose this outcome and instead forces networks to compete solely on price and network size—considerations that favor the largest players.⁵

At this point, it is impossible to foresee which architecture will ultimately represent the best approach. When it is impossible to tell whether a practice would promote or hinder competition, the accepted policy response is to permit the practice to go forward until actual harm to consumers can be proven. This restraint provides the room for experimentation upon which normal competitive processes depend. It also shows appropriate humility about our ability to predict the technological future.⁶

Wu:

Network neutrality is a useful way of talking about discrimination policies, on networks or otherwise. Whether it comes to employment, networks, or just about anything else, no one really believes in systems that ban discrimination completely. In employment, for example, you want to be able to fire people who are lousy—to discriminate on the basis of ability. When government chooses who gets to vote, we accept that it can say “no” to twelve-year-olds.

Yet I don’t think that the fact that an absolute ban on discrimination would be ridiculous undermines the case for discrimination laws. It’s like what nutritionists say about fat: there are good and bad types. And what I think is going on in the network neutrality debate—the useful part of it—is getting a better grip on what amounts to good and bad forms of discrimination on information networks.

Christopher, you’ve done a good job of suggesting some of the reasons that types of discrimination can be useful on a network, like dealing with congestion problems and offering different types of networks altogether. These are valid points. But sometimes you seem to be arguing that based on a few good examples of discrimination, that there’s no such thing as bad discrimination—particularly where a network gatekeeper has market power. That is where we part company.

I’ll start with the clearest network example: blocking. So yes, in general, a Bell or cable company has some interest in giving you as broadly useful a network as possible, because then the product is more valuable, and the company can charge more for it. But that interest in neutrality holds

5. See *Beyond Network Neutrality*, *supra* note 3, at 27–37.

6. See *id.* at 6–7, 75.

true only to a point. If a product being offered over the network—say, Internet voice (“VoIP”) for \$5 a month—competes with an established revenue source (telephone service, offered at \$30 a month), the temptation to block it is strong. It is true that, in theory, the provider might start charging the customer \$25 a month extra because the network is now more valuable. But that means taking on the costs of changing business models and establishing new consumer pricing patterns, which companies are loath to do.

I am not sure if you would go so far to suggest that blocking is fine because either companies won’t do it or will have good reasons when they do. As to whether they will, we don’t have to make guesses, because incumbent providers in the United States and in many countries around the world, including Mexico, have blocked or wanted to block competition from VoIP. The United States Trade Representative’s office has an ongoing practice, in fact, of trying to talk to countries and their incumbents about such blocking. They don’t call it network neutrality or anything of the sort, but it is the export of network neutrality policies.

What’s bad about blocking, then? At an extreme, blocking can keep a better or cheaper product (VoIP) from coming to market at all, and often it can prevent such products from being offered in an effective form. That’s a problem, in turn, because if you believe that market entry and innovation are linked to economic growth, we’re ultimately talking about such policies hindering the growth rate of the country.

Now I admit blocking is the clearest case where discrimination is bad, and it provides the strongest justification for network neutrality rules. That’s what Michael Powell thought too, and that’s why he announced such blocking would be illegal.⁷ But I also think there’s another type of bad discrimination—picking favorites, or choosing one company out of many to favor. I’ll explain why in the next post, but I better let you back on to see what you have to say.

Yoo:

To date, the debate has focused primarily on a type of discrimination known as “access tiering,” in which network owners charge Web sites and application providers more for premium (i.e., higher speed) service. Access tiering could provide benefits similar to those provided by the emergence of premium mail services like FedEx. Instead of taking three to four days to send a letter from coast to coast, FedEx made it possible to send the same letter overnight. FedEx customers were more than happy to pay more for

7. Ben Charny, *Mexico Telephone Operator Under VoIP Fire*, CNETNEWS.COM, Apr. 25, 2005 (describing USTR comments), available at http://news.com.com/Mexico+telephon e+operator+under+VoIP+fire/2100-7352_3-5681542.html.

faster service, since it opened up new ways of doing business that were impossible when everyone paid the same amount for a single class of service.

The same logic applies to the Internet. The Internet is currently dominated by a suite of protocols known as TCP/IP (Transmission Control Protocol/Internet Protocol). TCP/IP has two notable features: first, it routes traffic on a “first come, first served” basis, which provides no guarantees as to how quickly a packet will arrive; second, it also routes traffic on a “best efforts” basis, which provides no guarantees that a packet will ever be delivered. Companies developing applications that depend on guaranteed throughput rates (e.g., 100 Mbps) have indicated that they would willingly pay more to ensure better quality service. This has led leading technologists to point out that TCP/IP is a thirty-year-old technology and that network owners should be permitted to experiment with new capabilities.⁸

So what is the proper policy response if access tiering would sometimes be beneficial and sometimes not? Fortunately, the Supreme Court’s antitrust jurisprudence offers useful guidance. These precedents establish a presumption in favor of the rule of reason, which evaluates competitive harms on a case-by-case basis.⁹ Practices that evince such a “pernicious effect on competition and lack of any redeeming virtue” that they can be “conclusively presumed to be unreasonable and therefore illegal without elaborate inquiry as to the precise harm they have caused or the business excuse for their use” are declared to be illegal per se and are categorically prohibited.¹⁰ Conversely, there is a strong argument in favor of treating practices that are almost never harmful as legal per se.¹¹ In the absence of a “demonstrable economic effect,” practices should not be categorically prohibited.¹² Practices that are sometimes harmful and sometimes beneficial are subject to the rule of reason, which permits them to go forward until those challenging them can demonstrate a concrete harm to competition.¹³ Supreme Court precedent would thus contradict regulations that would make ambiguous practices like access tiering

8. See Andrew Orlovski, *Father of Internet Warns Against Net Neutrality*, THE REGISTER, Jan. 18, 2007, http://www.theregister.co.uk/2007/01/18/kahn_net_neutrality_warning/ (quoting speech by co-developer of TCP/IP Robert Kahn and noting that with the exception of Vint Cerf, who now serves as a policy advocate for Google, “most of the senior engineers responsible for developing the packet switched internetworking of today oppose ‘Neutrality’ legislation.”).

9. See *Bus. Elecs. Corp. v. Sharp Elecs. Corp.*, 485 U.S. 717, 726 (1988).

10. See, e.g., *N. Pac. Ry. Co. v. United States*, 356 U.S. 1, 5 (1957).

11. See Richard A. Posner, *The Next Step in the Antitrust Treatment of Restricted Distribution: Per Se Legality*, 48 U. CHI. L. REV. 6, 23–26 (1981).

12. *Bus. Elecs.*, 485 U.S. at 726.

13. *Id.*

categorically illegal. Instead, it would seem to favor taking a middle course—like my “network diversity” proposal—that would allow networks to experiment with different approaches unless and until they are shown to harm competition.¹⁴

Even Web site or port blocking may not be as problematic as may appear at first glance. One of the central insights of competition policy is that network owners have powerful incentives to maximize the value of applications and content delivered through their networks.¹⁵ As suggested in my earlier post, exclusivity can provide a form of differentiation that can increase the number of providers who can survive. For example, DirecTV’s exclusive access to the “NFL Sunday Ticket” package has enhanced its ability to compete with cable,¹⁶ and DirecTV recently struck a similar deal for Major League Baseball’s “Extra Innings” package. The partnership between Yahoo! and SBC’s (now AT&T’s) DSL service and Disney’s and ESPN’s recent efforts to offer mobile phones that give preferential access to certain types of content may represent attempts to pursue a similar strategy.¹⁷ And if a wireless broadband or broadband over powerline (“BPL”) provider were to emerge so that consumers have at least three last-mile broadband options (including cable modem and DSL), there would be little danger in allowing one of those networks to experiment with exclusivity arrangements. The experimenting network might find a new business model that would deliver greater value to consumers. If not, then we would expect competitors to steal business from the experimenting network until it reversed course.

In any event, the possibility of anticompetitive blocking would not

14. See *Beyond Network Neutrality*, *supra* note 3, at 75. Interestingly, the speech in which Michael Powell announced his four Internet freedoms is often misconstrued as an endorsement of network neutrality regulation. See Michael K. Powell, *Preserving Internet Freedom: Guiding Principles for the Industry*, 3 J. ON TELECOMM. & HIGH TECH. L. 5, 11–12 (2004). Powell made clear at the time that he thought that the evidence did not justify mandating network neutrality and that his words were offered simply as a statement of a set of best practices to which he thought the industry should adhere. *Id.* at 10. Powell has subsequently reemphasized the same point. See *Economics of Congestion*, *supra* note 1, at 1857.

15. See Christopher S. Yoo, *Vertical Integration and Media Regulation in the New Economy*, 19 YALE J. ON REG. 171, 187–202, 253–67 (2002) [hereinafter *Vertical Integration*]; accord Joseph Farrell & Philip J. Weiser, *Modularity, Vertical Integration, and Open Access Policies: Towards a Convergence of Antitrust and Regulation in the Internet Age*, 17 HARV. J.L. & TECH. 85, 104 (2003) (noting that “the platform monopolist has an incentive to be a good steward of the applications sector for its platform”); James B. Speta, *Handicapping the Race for the Last Mile?: A Critique of Open Access Rules for Broadband Platforms*, 17 YALE J. ON REG. 39, 76 (2000) (noting that network owners have strong incentives to maximize the value of complementary services).

16. See *Beyond Network Neutrality*, *supra* note 3, at 32.

17. See *Economics of Congestion*, *supra* note 1, at 1895.

support the type of general nondiscrimination mandate favored by network neutrality proponents. The only time that network owners have a plausible incentive to block a Web site is when they sponsor Web sites that compete directly with the blocked site. Conversely, network owners that do not operate auction sites have no incentive to block eBay, since doing so would simply lower the value of their network (and thus lower the amount that they can charge for it) without providing any compensating benefits. Similarly, while DSL providers may have some incentive to block VoIP, they have no plausible incentive to block services like streaming video that they do not currently offer. At most, concerns about blocking would thus support limited regulatory intervention that would only prohibit vertically integrated network owners from blocking content and applications that competed directly with their own offerings. It would not justify broad restrictions on discrimination of the kind being proposed (and currently being rejected) in Congress.¹⁸

Wu:

A lot of the difference between Christopher's view and my own stems from how we think the process of innovation occurs. Christopher, rather like Joseph Schumpeter in his later years, believes that large firms—in this case, network operators—drive telecommunications innovation. As Schumpeter then put it, the “large-scale establishment” is “the most powerful engine of progress and in particular of the long-run expansion of total output.”¹⁹

Christopher thinks incumbents like AT&T will rarely or perhaps never threaten innovation. Instead he views them as the driving force of the technologies of tomorrow.

I am skeptical. I think this view of incumbent behavior has been discredited, and that in general, incumbents, particularly in a monopoly position, have a strong incentive to block market entry and innovative technologies that threaten their existing business model.

My faith is that economic growth is driven by market entry, and I believe that when it's careful, government can play an important role in controlling barriers to market entry that incumbents might impose. That's not to say it is easy—the challenge is to bar the worst abuses without destroying an incentive to become an incumbent in the first place. Government often gets it wrong. But Christopher's views tend toward assuming the problem away, through what I view as unrealistic assumptions about incumbent behavior.

18. *See id.* at 1899–900.

19. *See* JOSEPH SCHUMPETER, CAPITALISM, SOCIALISM & DEMOCRACY 106 (1957).

The growth of the many industries on top of the Internet is a powerful testament to the vision I've described. For the Internet's design itself, and then successive FCC rules (like the famous Computer Inquiries rules) managed to prevent infrastructure incumbents from having any influence on market entry. My stake, stated otherwise, is with the younger Schumpeter, who studied entrepreneurs, unusual individuals with "the dream or will to found a private kingdom," "the will to conquer: the impulse to fight, to prove oneself superior to others," and finally the "joy of creating."²⁰

But let's turn away from theory to the practical matter Christopher brought up: what he calls access tiering—or giving preferential treatment over the last mile.

In my view, there are several problematic sides to access tiering. You have, say, AT&T with a monopoly over broadband in a given area. AT&T makes an exclusive deal with Yahoo! to provide preferred searches on AT&T's network. As a consequence, the Yahoo! engine loads faster than any of its competitors. I've said elsewhere it might be as if your electric company was to make a deal with Samsung so that your refrigerators from General Electric would no longer work quite so well. That's the problem I'm discussing.

There's a word for this: it's a form of discrimination called Most Favored Nation ("MFN") discrimination—different treatment of like, competing products. And the problem, of course, is a distortion of competition. In our search example, the best product doesn't win, but rather the product with the best connection to AT&T, and the one that poses no threat to any of AT&T's business models.

Second, access tiering is another word for charging companies a termination fee—a fee to reach customers of the service provider in question. While Christopher and others suggest that access tiering will lead to more innovation in the last mile, the opposite can be true. If you can generate revenue by charging content provider to *reach* customers, as opposed to charging for bandwidth, something happens. The incentives become mixed, as the provider gains an incentive to maintain a level of scarcity, and thereby maximize gatekeeper revenue. So I don't agree with Christopher that access fees will necessarily spark more last-mile innovation.

All this returns me to the earlier discussion of innovation. The risk, as I've said elsewhere, is a market where several large companies set the pace of innovation, not the challenges of competitors. But historically—and by current economic theory—the many beat out the few. I'll take the track

20. JOSEPH A. SCHUMPETER, A THEORY OF ECONOMIC DEVELOPMENT 93 (Harvard Univ. 1961).

record of decentralized innovation.

Yoo:

The Schumpeterian thesis (that large firms are more innovative) has spawned a huge empirical literature that is largely inconclusive.²¹ AT&T provides an excellent example. On the one hand, the Bell System created a telephone network that was the envy of the world and pioneered Nobel Prize-winning breakthroughs such as the transistor. On the other hand, it was extremely slow to deploy innovative technologies like DSL.

Furthermore, Schumpeterian competition is founded on the idea that horizontal competition *within* a market among similarly situated players offering similar products to the same customers would be replaced by competition between a succession of monopolists *for* the market. Interestingly, network diversity would provide a way for multiple players to survive and prevent the market from collapsing into Schumpeterian competition in the first place.²²

But the Schumpeterian thesis is not central to the debate over network neutrality. As Tim has recognized in his earlier work, network neutrality is really about vertical integration between content and conduit.²³ Over the past few decades, vertical integration theory has undergone a sea change.²⁴ Until the 1970s, economic theory and the Supreme Court's antitrust jurisprudence were quite hostile toward vertical integration. Instead, they fostered a world in which manufacturers were free to mix and match with different retailers and distributors as they saw fit.

Over time, both academia and the courts began to realize that vertical integration simply represents a different way to organize an industry that can often yield substantial benefits. To cite one concrete example, the central goal of the breakup of AT&T was to enable consumers to choose their long-distance provider.²⁵ In today's world, wireless customers cannot choose their long-distance provider, and yet that fact has not prevented the wireless market from being extremely competitive. The key difference is that during the breakup of AT&T, there was only one local service option. In today's world, there are more, and the competition among them keeps everyone honest.

Competition policy thus teaches us that any vertical chain of

21. See *Vertical Integration*, *supra* note 15, at 276–77.

22. See *Beyond Network Neutrality*, *supra* note 3, at 58–60.

23. See Tim Wu, *The Broadband Debate, A User's Guide*, 3 J. ON TELECOMM. & HIGH TECH. L. 69, 84–85 (2004).

24. See *Economics of Congestion*, *supra* note 1, at 1885–87; *Vertical Integration*, *supra* note 155, at 186–202.

25. See *Beyond Network Neutrality*, *supra* note 3, at 17–18.

production will only be as efficient as its least competitive link. The proper focus of broadband policy is to identify the level of production that is the most concentrated and the most protected by entry barriers and to try to make it more competitive. This suggests that the current debate is focusing on the wrong policy problem. Network neutrality proposals are aimed at preserving competition in applications and content, which are those portions of the industry that are already the most competitive and the least protected by entry barriers (and thus the most likely to remain that way). Instead, the real focus should be on the impact network neutrality regulation would have on the competitiveness of the last-mile.²⁶

The last twelve months demonstrate how imposing network neutrality threatens to reduce investment in new last-mile technologies. After the Supreme Court's June 2005 *Brand X* decision made clear that content and applications providers could no longer count on regulation to guarantee access to cable modem and DSL systems,²⁷ companies such as Google, Microsoft, Earthlink, and Intel began pouring money into wireless broadband and broadband over powerline ("BPL"), demonstrated most dramatically by Google's agreement to build a wireless broadband network in San Francisco for free.²⁸ These were not acts of corporate charity. The threat of being cut off from the existing networks was what spurred these companies into investing in new ones.

I also do not think that Most Favored Nation nondiscrimination will be as easy to implement as Tim suggests. The Supreme Court's *Trinko* decision recognized that the complexity of the interface between telecommunications providers creates myriad nonprice-related dimensions along which the quality of interconnection can vary.²⁹ Mandating nondiscrimination would thus require policing a large swath of the business relationship between a party seeking access and a network that would not be doing business with it absent regulation. Furthermore, large, established players have more resources and experience with which to influence the regulatory process.³⁰

Competition in the last mile can achieve the same benefits while avoiding the problems associated with regulation. Once a sufficient number of last-mile options exists, it would matter little if one network chose to make Yahoo! its preferred search engine. As I noted earlier, exclusivity can

26. See *Beyond Network Neutrality*, *supra* note 3, at 15–18.

27. Nat'l Cable & Telecomm. Ass'n v. Brand X Internet Servs., 545 U.S. 967 (2005).

28. See *Economics of Congestion*, *supra* note 1, 1894–95.

29. Verizon Commc'ns Inc. v. Law Offices of Curtis V. Trinko, LLP, 540 U.S. 398, 414–15 (2004).

30. See *Beyond Network Neutrality*, *supra* note 3, at 37–45, 67–68; *Economics of Congestion*, *supra* note 1, at 1896–97.

promote competition by allowing networks to compete on dimensions aside from price and network size (considerations that inherently favor the largest players). If such exclusivity proves to be uneconomic, the network will lose customers until it returns to nonexclusivity.

So I agree with Tim that we should place our faith in market entry. Where we differ is that I would focus on entry into the last mile, not entry into content and applications. And economic theory and Supreme Court precedent have both recognized that mandating access would increase last-mile concentration by reducing incentives to invest in new transmission technologies.³¹

Wu:

Christopher brings up the economics of the last mile, which are worth talking about, and to my mind, unendingly interesting. They are a shortcut for talking about the economics of infrastructure, which is really the center of this debate.

So the classic challenge with infrastructure projects like the last mile is this: there are high upfront costs to build the infrastructure, and low “marginal” or incremental costs of running the infrastructure. If we’re talking about roads, for example, it costs a lot to build a road, but the cost of handling each additional car on the road is low (nearly nothing).

Those economics have a tendency to make market entry challenging. That’s why some (though this is disputed) suggest that infrastructure like plumbing, electricity, or telecom service is by its nature a “natural monopoly.”

Whether that is true is a big debate that I don’t want to get into. It is worth saying that the label “natural monopoly” has sometimes been used to justify too much regulation. But let’s look at the telecom situation.

In telecom, the high upfront costs have sometimes but not always scared off private investments. They haven’t scared off investment when the market entrant is offering a new and compelling service, like cable television in the 1970s, or at one point, telephone service between the 1890s and the 1920s. But when there’s an incumbent in place, either its presence, or misguided regulation like franchising requirements, seems to have deterred market entry.

Internet access is a good example. There is vigorous market entry, as Christopher noted, at virtually every part of the Internet-affiliated economy—including, at the infrastructure layer, the national backbone. But the exception to this rule is the last mile. Today, despite much hope and

31. See *Trinko*, 540 U.S. at 407–08, 414; *Beyond Network Neutrality*, *supra* note 3, at 48–53.

talk over the last decade, there hasn't been a successful widespread deployment of a third pipe to the home (including wireless). Sprint, for a while, offered a fixed wireless service. Some areas, usually rural, use satellite services. Broadband over powerlines is still talked about now and then, but truly mass deployments, according to the FCC's numbers, do not exist.³²

The basic story, for most of the country's businesses, is a monopoly, and for homes, a duopoly of cable and Bell.

So if we want to encourage the deployment of last-mile infrastructure, what to do? There are a number of classic solutions to the infrastructure problem, and I'll discuss three.

1. One is for government to spend money and build the infrastructure itself. That's what the United States does for roads, and what many Asian countries have been doing with the Internet and broadband. Their theory is that the purpose of government is to invest in national infrastructure, and they see investing in Internet infrastructure as a part of that.

In fact, I remember meeting with a Chinese Internet policy advisor to President Hu Jintao, and he asked me how much the U.S. federal government spends on building networks. I said, other than some funding for schools, and investments in research, very little. Astounded, he asked, "But what about the Internet?" That was research, I said.

Today's municipal broadband networks are an example of a local version of the same policy. They are efforts by the government to build infrastructure it doesn't think will be built by the private sector.

I don't want to say there aren't problems with these kinds of approaches. Pork projects are a predictable consequence—railways to nowhere, and so on. There are also good odds that the wrong thing will be built—roads when we need railways, or vice versa. But anyhow, it's one approach, and one this country and others have used frequently over history.

2. A similar solution is to subsidize buildouts, one way or another. We can find this in another major part of U.S. infrastructure policy: the mortgage deduction. The result of the mortgage deduction is that developers build far more homes and buildings than they would otherwise. It is a straightforward incentive to build. Such incentives might be considered for broadband.

In telecom policy, telephone companies already take major depreciation deductions, but it might be possible for the tax code to do more to encourage deployments of information networks. There are, of

32. FCC, WIRELINE COMPETITION BUREAU, HIGH-SPEED SERVICES FOR INTERNET ACCESS: STATUS AS OF JUNE 30, 2006, at 5, tbl. 1 (2007).

course, problems with this approach too, like getting the tax deduction wrong in one of a million ways.

3. Do nothing. Doing nothing isn't a bad approach, necessarily. It presumes that in some way or another, either the market or new technologies will overcome the infrastructure economics problem. It is true, for example, that the lure of offering TV service and capturing some of cable's market share seems to be what is pulling Verizon and AT&T into deploying fiber optic cable in some areas. Doing nothing is also a bet that new technologies might arrive (or have arrived) that overcome the problems of last-mile economics—such as the hope that eventually wireless technologies of some kind will solve the last-mile solution. If you don't think broadband infrastructure is not worth subsidizing, and if what you fear most is the risk of government wasting too much money on infrastructure, doing nothing is has its merits.

The downside with doing nothing is the possibility that nothing will happen. It is possible that, under a do-nothing approach, today's duopoly will simply persist, and build out higher speed networks with all deliberate speed, which is to say, slowly. Stated differently, Christopher may be wrong about how much technological developments have really changed the economics of the last mile. From my time in industry, I'm frankly a little skeptical of the view that today's last-mile is truly a contestable market, but I'd love to be proved wrong.

All of these options have their attractions and problems. But to my mind, given the fundamental nature of the problem, the issue of network neutrality is really quite beside the point. The problems of infrastructure economics are real and cannot be ignored. But the connection between these points and allowing last-mile providers to run discriminatory networks seems to me tangential at best.

Arguably, as a "solution" to the last-mile problem, allowing discrimination is both costly and ineffective. Its costs are large potential costs to the application market. And the idea that it will somehow solve the economic problems of the last mile strikes me as unlikely at best. So you risk the health of the applications market, and really, all for what?

Yoo:

I agree that the high fixed costs have long represented one of the defining features of the telecommunications industry and the touchstone of all telecommunications policy. For decades, the conventional wisdom accepted that local telecommunications networks were natural monopolies and that competition among multiple last-mile networks was infeasible. Thus, even though concentration in the last mile represented the central issue in telecommunications policy, it was presumed that any attempt to

increase the competitiveness of the last mile would ultimately prove futile. As a result, policymakers focused on the second-best goal of promoting competition in complementary services.³³ It was during this period that the FCC instituted the prior access regulations that Tim usually invokes as precedents for network neutrality.³⁴

The economics of the last mile have changed radically in recent years. The fixed costs of establishing last-mile networks have dropped through the floor. Switching equipment that used to take up an entire building can now be housed in a box roughly the size of a personal computer. Copper wires have been replaced by a series of innovations, including terrestrial microwave, satellites, and fiber optics, which have greatly reduced the costs of transmission.

The emergence of spectrum-based transmission is important for another reason. It renders telecommunications markets “contestable.” Contestability theory has pointed out that high fixed costs need not represent an entry barrier if new entrants can recoup most of those costs by reselling them to someone else should they have to exit. Although the resale market for the wires of a failed telecommunications network has historically been rather limited, the same is not true for spectrum. The greater number of ways that spectrum can be used renders the market for redeploying spectrum considerably more vibrant.³⁵

Demand-side forces are also rendering competition in the last mile increasingly feasible. Many markets involve fixed costs; it is only when the fixed costs are large relative to the market as a whole that they become problematic. The pressure toward natural monopoly can thus also be alleviated by increases in demand as well as by reductions in fixed cost. Put a different way, if a network generates more value per customer, the size of the customer base that a network owner needs to survive shrinks, and the number of networks that can exist in equilibrium increases.

The development of the Internet has greatly increased the value of the services that can be provided by last-mile networks. The rollout of convergent technologies, such as Internet telephony and packet video, will break down the barriers that previously limited the revenues generated by any particular transmission technology. Cable is already able to provide voice through its coaxial network, and it is just a matter of time before telephone companies are able to provide video. Application-based distinctions between transmission media will completely collapse once all applications become packetized. At that point, all applications will simply be packets riding on a data pipe, and the functional distinctions between

33. See *Economics of Congestion*, *supra* note 1, at 1878–79, 1894–95.

34. See, e.g., Wu, *supra* note 23, at 88–89.

35. See *Beyond Network Neutrality*, *supra* note 3, at 27, n.92.

transmission media that have long lain at the heart of telecommunications policy will become irrelevant.³⁶

Now that competition in the last mile is feasible, the focus should shift away from the second-best policy goal of promoting competition in complementary services and return to the first-best policy goal of promoting competition in the last mile. As I have noted before, this shift in focus arguably favors abandoning access regulations like network neutrality. Not only are access regulations extremely difficult to implement, they can deter investment in new last-mile networks, since content and applications providers who are guaranteed access to the existing network have no incentive to invest in new ones.³⁷ In other words, access regulation threatens to deprive would-be builders of alternative network capacity of their natural strategic partners. In the process, access regulation could well have the perverse effect of cementing the existing last-mile oligopoly into place.

Although government construction of last-mile networks is a plausible alternative, global history counsels against such a course. The U.S. is singular in its embrace of private ownership of the core telecommunications network. In the vast majority of other countries, telecommunications networks were government-created and -owned. The poor service quality, long waiting lists for installation, and slow deployment of new technologies in Britain and other government-owned telecommunications systems are legendary. The most eloquent proof is that essentially all of those countries are either in the process of privatizing their telecommunications networks or have already done so. Waiting for these new last-mile networks to emerge can be frustrating, and the lack of last-mile options may cause content and applications providers difficulty in the meantime. Before jumping in and regulating, policymakers should remind themselves of the inherent tendency to overvalue immediate harms and to undervalue future benefits, because the former seem so concrete and the latter so contingent. The problem is that in many (if not most) cases, compounding causes the long-term benefits to dominate the short-term losses. Placing too great an emphasis on the pressing needs of the here and now could foreclose these larger, longer-term benefits from ever being realized.³⁸

At the end of the day, a large part of the network neutrality debate can be viewed as nothing more than an intramural fight between the large content providers (like Google) and the large network providers (like Verizon and Comcast). The market power that last-mile providers possess

36. See *Vertical Integration*, *supra* note 15, at 285–90.

37. See *supra* notes 27–33 and accompanying text.

38. See *Beyond Network Neutrality*, *supra* note 3, at 67–68.

vis-à-vis consumers exists because most Americans currently only have two choices in last-mile broadband providers. Mandating network neutrality would not alter that fact one iota. As a result, it would not reduce the prices that cable modem and DSL charge consumers. That said, network neutrality would affect the way that the resulting profits would be divided between the Googles and the Verizons of the world. Although the division of profits between network providers is crucial to those companies and their shareholders, it is not ultimately a policy issue.

Wu:

Christopher's last post does a good job of crystallizing the differences between us on the last mile. In closing, let's look at where we differ.

Christopher believes that, at least when it comes to information networks, technology is changing the conditions for market entry in physical networking. He points to fiber optics and the potential use of wireless spectrum as examples. He believes that over the next decade we're likely to see vigorous competition among new entrants and old, like in any other "regular" market.

At the risk of sounding like a dinosaur, I am skeptical. Despite the mists and magic of the Internet, I don't think the basic economics of transportation infrastructure, and particularly telecom's last mile, have changed all that much. The time I actually spent in the industry made me very skeptical of the kinds of claims about the technology Christopher has made. And if I were investing in the market, I'd be willing to bet Christopher that over the next decade the infrastructure market will continue to heavily favor the main incumbents.

Instead of just speaking in the abstract, let's look at a real example: Verizon's FiOS buildout. According to various figures, the costs are about \$1500 per home to lay fiber and then hook up a connection.³⁹ That's a lot to have a chance of acquiring a customer who then may pay \$50–\$100 per month in services. Those are also the costs of an incumbent carrier who already has much of the infrastructure in place, not a true entrant. So if you're a competitive carrier, and say you have plans to reach 10 million homes, we're talking about a \$10.5 billion capital investment—in other words, serious money.

These facts are why, despite nearly a decade of talk, there are today very few (in most markets, no) "facilities-based" competitors in the residential market (other than the basic cable-Bell combination). Those that haven't gone out of business, companies like Yipes, target businesses

39. See, e.g., Stephanie N. Mehta, *Verizon's Big Bet on Fiber Optics*, *Fortune*, Feb. 22, 2007, available at http://money.cnn.com/magazines/fortune/fortune_archive/2007/03/05/8401289/index.htm.

exclusively. The advantages of incumbency are great indeed.

In Verizon's area, FiOS looks to be a great service at a great price point, and I wouldn't be surprised if it serves as a model for successful Bell deployments. Meanwhile, cable has few tricks left for getting more bandwidth out of its coaxial deployments, through adjusting how it uses the bandwidth it already has.

What I am painting is essentially a rosy picture for the incumbents—and why not? Comcast and other cable companies have grown strongly through the 2000s, prompting Comcast's CEO to say "2006 was simply our best year ever... we could not be more enthusiastic about the future."⁴⁰ AT&T, despite weaker facilities, remains healthy and profitable, even before merging with Bell South.⁴¹ I don't for a second begrudge the Bells and cable companies their revenue and profits—I think they demonstrate that the Internet economy has lifted all boats. I am in favor of doing everything possible to make it easy for the Bells to offer TV service, and for the cable companies to offer voice. Giving the Bells and cable more ways to compete using private networks encourages the network buildouts we're reading about.

If I am right about where things are going, I think it leaves two last policy questions. First, we ought to ask whether the buildouts we'll see will be fast or extensive enough. At some point, this is an issue of national economic policy—what kind of broadband infrastructure does this country really want?

Nothing in the current deployment plans are likely to make "ultra" wideband reach marginal customers or nonwealthy areas. So as in other areas of infrastructure policy, at some point we're going to have to decide whether we care if the nation's ultra-broadband networks don't reach the whole population.

Second, and finally, we should consider what this means for network neutrality. I think Christopher is right that in the big picture of last-mile economics, net neutrality is chump change. But as I've said, net neutrality's prohibitions on discrimination are most important for favoring the lowest-end market entrants—application companies. That's why it's been a wise network design and why it makes for wise national policy.

In the end, network neutrality rules are not the only way government can try to lower the costs of market entry in the national economy. However, it is one of the simplest, and it has proven very effective over the last decade. That's why I favor whatever it takes—whether it's just a code

40. Press Release, Comcast, Comcast Reports 2006 Results and Outlook for 2007 (Feb. 1, 2007), *available at* http://biz.yahoo.com/prnews/070201/phth005.html?_v=82.

41. AT&T, 2006 ANNUAL REPORT ONLINE (2007), http://www.att.com/Investor/ATT_Annual/Letter/index.html.

of honor or an actual law—that keeps the network as neutral as possible as between market competitors, and tries to keep the price of market entry as low as possible.