INTERNET THINK

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There are many lawyers and policymakers now engaged in debating laws concerning high speed broadband connections to the Internet. What do they mean by "the Internet"? Does it matter what they mean?

This essay suggests that how "the Internet" is understood has substantial legal, social, and cultural consequences. In particular, what is meant by "the Internet" determines which actors' voices will be listened to, what arguments will be respected, and which goals will be considered legitimate. If "the Internet" means "a logical architecture" (as the original engineers would say it does), protections for speech may not be relevant, and that architecture could change at any time. If "the Internet" means "privately-owned pipes" (as the incumbent telephone companies would say it does), fundamental principles developed over centuries to avoid monopolies over communication may be lost. If "the Internet" means standards and relationships that give rise to persistent social worlds (as Internet futurists would say it does), economic arguments made by the owners of the transport pipes may be undermined. Both the FCC and Congress have been confronted with all three of these definitions at one time or another. Which one will be chosen to frame our domestic approach to "the Internet"? What effects will choosing one or another have on policy?

This essay represents a brief exploration of this issue from my intuitive perspective that public policy should "protect the Internet." I acknowledge this starting point, but I want to be open-minded about where this intuition leads and what stumbling blocks it will (and should) encounter. To the extent policymakers have an opportunity to choose one or another of these three definitions, I would like to understand what these choices mean in some detail. Then, instead of committing myself in advance to abstract economic talk or theories of democracy, I would like to understand the social and cultural implications of choosing one definition over another.[1] If the shared goal of pro-"network neutrality" advo-

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1. I gratefully acknowledge Julie Cohen's suggestion that this "social and cultural" question is the right one to ask. Prof. Cohen made this suggestion in response to a different draft paper of mine. *See* Julie E. Cohen, Commentary, *Network Stories*, 70 LAW & CONTEMP. PROBS. (forthcoming 2007); *see also* Susan P. Crawford, *Network Rules*, LAW & CONTEMP.

cates is to "protect the Internet," what exactly will we be protecting, and to what social and cultural end?

In Part I of this essay, I will very briefly describe representative proponents of each of these views, and the historical contexts in which their particular definitions have been put forward. In Part II, I will describe some of the changes in the Internet that have taken place since the FCC's and Congress's initial involvement, and the ways in which these changes relate (if at all) to the three "definitions" I have suggested. And in Part III, I will outline what these changes suggest for our future if one or another of them is chosen for protection.

I. THE INTERNET DEFINED

A. The Engineers

At this year's Silicon Flatirons Conference, Robert Kahn defined the Internet as follows:

> One of the things about the Internet that escapes a lot of people but was mentioned today, is that it really is composed of things like routers and lines and computers and the like, but those do not define the Internet. They're just the things of which it's built. The Internet really was a logical architecture that allowed you to connect virtually any type of networking machine together. So when people ask me what's the Internet, I say it's this logical construct, independent of the particular elements that go into it. So if this network went away and got replaced by a new technology in the future, it's still the Internet.[2]

Kahn's views on "what is the Internet" are taken seriously because he was one of the co-inventors of the TCP/IP protocol. His views are also representative of a class of computer engineers who "invented the Internet" thirty years ago (the "Engineers").

From the Engineers' perspective, the Internet began with the ARPANet and the idea of packet switching, both of which had their intellectual origins in the work of J.C.R. Licklider of MIT.[3] In September

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PROBS. (forthcoming 2007), *available at* http://www.scrawford.net/display/061406%20network%20rules.doc. This essay is a first step towards taking on the task of establishing a "social theory of regulation by protocol" that Prof. Cohen suggested, by beginning in the context of a particular definitional swamp: "What is the Internet?"

2. Video: Robert Kahn, Keynote Address at the The Digital Broadband Migration (Silicon Flatirons Telecommunications Program 2006), *available at* http://telecom.colorado.edu/index.php?load=content&page_id=126.

3. ARPANet was a precursor to the Internet. M. MITCHELL WALDROP, THE DREAM MACHINE: J.C.R. LICKLIDER AND THE REVOLUTION THAT MADE COMPUTING PERSONAL 178 (reprint 2002) (2001).

1969, Bolt Beranek and Newman, Inc. (BBN) installed the first packet-switching device (an Interface Message Processor, or IMP) at UCLA; three more nodes were soon added (at the Stanford Research Institute, UC Santa Barbara, and the University of Utah); and by the end of 1969 four host computers were connected together into the initial ARPANet. An initial packet-switching protocol, called the Network Control Protocol (NCP), was used through the early 1970s.[4] NCP did not have the ability to allow one network to address another, because it was designed to work within the single ARPANet network.

In 1972, Bob Kahn (then at BBN) began work on a meta-level internetworking architecture that would allow addressing of machines and networks other than ARPANet. Vint Cerf became involved in 1973, and together Kahn and Cerf developed the Transmission Control Protocol/Internet Protocol, or TCP/IP. The overall plan was to make it possible for any machine attached to any network to connect to any other. The TCP portion of the protocol was designed to check (through acknowledgments) whether packets had made it to their destination; the IP portion was designed to allow communications to be chunked into packet-sized informational units, addressed, and forwarded to hosts identified through numerical "octets."

From Kahn's perspective, TCP/IP is the Internet. It is a logical architecture designed to be a general infrastructure on top of which new applications could be introduced. Protocols constrain, but this one constrained only in that (1) it provided only for "best efforts" quality control (if packets didn't make it to their destinations, the source would try again), (2) it suggested that the gateways between the connected networks would not retain information about the packets flowing through them, and (3) it did not suggest that there would be any global control of these operations.[5]

ARPANet and the two other early national US packet-switched networks (packet-switched radio and packet-switched satellite) had few hosts, and the identity of these hosts could be kept track of easily.[6] With the rise of Local Area Networks and Ethernet technology, the number of hosts (each with a unique IP address) proliferated quickly. Because IP addresses were difficult for humans to remember, Paul Mockapetris of USC/Information Sciences Institute invented the domain name system (DNS), which is a distributed mechanism for translating textual host names into IP addresses.[7]

4. BARRY LEINER ET AL., ISOC, ALL ABOUT THE INTERNET: HISTORIES OF THE INTERNET (2003), http://www.isoc.org/internet/history/brief.shtml.

5. *Id.*

6. *Id.*

7. *Id.*

The idea behind this TCP/IP logical architecture was that networks could do their own form of routing and forwarding as long as they used a common gateway method of routing.[8] TCP/IP was incorporated into the Unix operating system, and that operating system was adopted by many computer science researchers. According to the Internet Society, the adoption of Unix (and the responsiveness of researchers to updates to that operating system) was key to the widespread use of these protocols.[9] Beginning in 1985, the U.S. NSFNet program required that "the connection must be made available to ALL qualified users on [academic] campuses,"[10] and mandated use of TCP/IP.[11]

The NSF national backbone could only be used for educational purposes until 1995, when NSF defunded the backbone and redistributed the resulting funds to regional networks to buy connectivity from private long-haul networks.[12] By 1995, the Internet was connecting 50,000 networks around the globe, and TCP/IP was in wide use worldwide. The task that Kahn and Cerf took on was to interconnect independent networks. They did that, and the resulting logical architecture, to them, is "the Internet."

For the Engineers, then, the definition of the "Internet" that makes sense is the one adopted by the Federal Networking Council in 1995:

> RESOLUTION: The Federal Networking Council (FNC) agrees that the following language reflects our definition of the term "Internet". "Internet" refers to the global information system that – (i) is logically linked together by a globally unique address space based on the Internet Protocol (IP) or its subsequent extensions/follow-ons, (ii) is able to support communications using the Transmission Control Protocol/Internet Protocol (TCP/IP) suite or its subsequent extensions/follow-ons, and/or other IP-compatible protocols, and (iii) provides, uses, or makes accessible, either publicly or privately, high level services layered on the communications and related infrastructure described herein.[13]

Two points about this definition characterize the Engineers' approach. First, this definition of the "Internet" emphasizes globally unique addressing (supporting interconnectivity) and the use of TCP/IP, but makes clear that these elements can change. IP can have "exten-

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8. *Id*.
9. *Id*.
10. LEINER, *supra* note 4. Government involvement in the early Internet was crucial. Federal agencies helped pay for common infrastructure, coordinated with other networking organizations, and encouraged networks to find commercial customers for local services.
11. *Id*.
12. *Id*.
13. *Id*.

sions/follow-ons," TCP/IP can be subsumed by "other IP-compatible protocols," and services using communications infrastructure could be made available privately or publicly, depending on what made sense. Any logical architecture that provides for interconnection between networks and a set of agreed-on protocols (with some connection to the historical TCP/IP suite) will be "the Internet" to the Engineers. Second, the FNC/Engineer definition does not recognize the role of the transport pipes, because the Engineers are indifferent to them.

B. The Telcos

Another Silicon Flatirons speaker, Level 3 CEO James Crowe, gave his own definition of "the Internet":

> First there's the local connection, generally a fairly big connection, from the content provider to the backbone. Generally this is quite a large fiber optic connection. Then, there's the Internet backbone itself, which is again a very large optical IP connection. Then there is the piece that connects the end-user to the backbone—local Internet access. The first two sections of the Internet, that is the piece from the content provider to the backbone, and the backbone itself, are hotly competitive. We have lots of choices of providers. It's the piece that we all buy, connecting our homes to the Internet, that's the real issue. I think the content providers and the Internet community are generally correct that the telco providers and cable companies have a duopoly [for this section of the Internet].[14]

This speaker is steeped in the history of telephony. He thinks of "the Internet" as three categories of pipes that connect "consumers" to "content" and vice versa. For him, the definition of "the Internet" is not driven by the logical architecture employed over transport pipes, although he is certainly aware of the Internet Protocol.[15] In his mind, the pipes themselves are the Internet. Although this is probably unfair to Crowe himself, I will label his Internet definition the "Telco" position.[16]

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14. James Crowe, *Regulation and Free Markets Redux: Additional Insights on Regulating the Telecommunications Industry in the New Economy*, 5 J. ON TELECOMM. & HIGH TECH. L. 487, 498 (2007).

15. Indeed, Crowe is famous for understanding the benefits of packet-switched networks in competing with traditional circuit-switched telephony networks, and the name "Level 3" comes from IP routing soft-switches above transport networks. *See* James Crow, *Regulation and Free Markets: How to Regulate the Telecommunication Industry in the New Economy*, 2 J. ON TELECOMM. & HIGH TECH. L. 429, 436 (2003). Level 3 owns fiber infrastructure across the U.S. and provides long-haul IP-based communications services to other carriers and businesses.

16. "Telco" is a common shorthand designation for "telephone company," and connotes the incumbent providers of telephone services that were spun off of AT&T by court order in 1984 but have since recombined through merger into four large companies: AT&T, BellSouth,

If "the Internet" is the three sections of connection pipes described by Crowe, then whether or not a protocol related to TCP/IP is used by or over those pipes is irrelevant. Global interconnection through unique addressing, the central assumption underlying the Engineers' definition, is also moved to the side. Networks may or may not connect to one another, depending on the commercial realities of their relationships. (Indeed, the 2005 flap over Level 3's refusal to peer with Cogent, and subsequent backing-down, is emblematic of the Telco approach to the Internet.)[17] The pipes that make up "the Internet," from the Telco point of view, are privately owned and can be privately deployed.

The historical context for the Telco definition of "the Internet" is straightforward. From the Telco point of view, "the Internet" is what happened when telephone companies all around the world allowed computers to connect (through modems) to previously-existing telephone networks. Thus, the combination of these underlying networks is the totality of "the Internet" to them.

In general, Telcos in the U.S. have always worried that allowing equipment not sold by them to be connected to their networks would risk the integrity of these pre-existing networks, and it took regulatory intervention to require that non-Telco equipment (including modems) be allowed to be connected.[18] The Telco attitude toward Internet communications in particular (communications that originate in computers that are not "part" of the Telco networks from the Telco point of view) has traditionally been grudging acceptance – although telephone companies made money when people bought second lines to allow dial-up connections, they were slow to embrace the idea that access to the Internet was essential to American households. Now that the disruptive effects of Internet communications on traditional Telco business models have been thoroughly digested by the Telcos, they are re-focusing on the importance of their particular network connections and reminding us that their private networks are collectively "the Internet."

This common sense understanding of "the Internet" has penetrated the minds of many. For example, Senator Ted Stevens (R-Alaska) recently said that the Internet was a "series of tubes."[19] And people on the

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Qwest Communications International and Verizon Communications. The large providers of cable services in the U.S., Comcast, Time Warner Cable and Cablevision, are sometimes aligned with the Telcos, and in my view have the same understanding of "the Internet."

17. Hiawatha Bray, *Dispute Threatens to Snarl Internet*, BOSTON GLOBE, Oct. 7, 2005, at C1.

18. Connection of Terminal Equipment to the Telephone Network, 47 C.F.R. § 68.106 (2006).

19. *Communications Reform Bill: Full Committee Markup Before The S. Comm. on Commerce, Science & Transportation*, 109th Cong. (2006) (statement of Sen. Ted Stevens), *available at* http://www.publicknowledge.org/node/497 (last visited Sept. 29, 2006).

street will say that "the Internet" is the same as "the telephone network." The Telco definition of "the Internet" is often the default, standard definition.

C. The Nethead

In often glowing and hyperbolic terms, Internet futurists define the Internet in terms of the social worlds and creative conversations that exist online. Here is David Weinberger, well-known co-author of The Cluetrain Manifesto and blogger:

> The Internet is a medium only at the bit level. At the human level, it is a conversation that, because of the persistence and linkedness of pages, has elements of a world. It could only be a medium if we absolutely didn't care.[20]

This "human level" view of the Internet – as a "conversation" that is a "world" – can be characterized as the "Nethead" definition.[21] This definition has a distinguished history, reaching back to Vannevar Bush, Doug Engelbart, Norbert Wiener, and J.C.R. Licklider.

In 1945, Vannevar Bush's essay "As We May Think" (published in the *Atlantic Monthly* and in *Life*), proposed the creation of a "memex," an enormous, indexed database of knowledge that would allow scholars and others to create links through information.[22] In Bush's words:

> The human mind . . . operates by association. With one item in its grasp, it snaps instantly to the next that is suggested by the association of thoughts, in accordance with some intricate web of trails carried by the cells of the brain. . . . Selection by association, rather than indexing, may yet be mechanized. . . . Consider a future device for individual use, which is a sort of mechanized private file and library. It needs a name, and, to coin one at random, 'memex' will do. A memex is a device in which an individual stores all his books, records, and communications, and which is mechanized so that it may be consulted with exceeding speed and flexibility. It is an enlarged intimate supplement to his memory.[23]

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20. Joho the Blog!, http://www.hyperorg.com/blogger/index.html (Mar. 27, 2004, 07:32 EDT).

21. PCMag.com defines "Nethead" as "[a] person who has a passion for the Internet." PCMag.com, Nethead, http://www.pcmag.com/encyclopedia_term/0,2542,t=Nethead&i=47793,00.asp (last visited Sept. 26, 2006).

22. Vannevar Bush, *As We May Think*, ATLANTIC MONTHLY 101, 106-08 (1945), *available at* http://www.theatlantic.com/doc/print/194507/bush.

23. *Id.* at 106.

Bush posited that the memex could be used for associative indexing, so that anyone could join items together in a "trail" that could be followed and added to by others.[24]

Bush's vision of scientific applications that would allow people "truly to encompass the great record" of human achievement was eagerly adopted by Doug Engelbart, who had read around the same time an essay by William James entitled "What Makes a Life Significant."[25] The James essay urged readers wishing to live a significant life to join "inner joy, courage, and endurance" with an ideal.[26] Engelbart's ideal became to make it possible for people to follow the associative trails dreamed of by Bush – to augment human intellect.

Doug Engelbart decided to boost mankind's ability to deal with complex, urgent problems by creating a "general information environment" that would use screens to allow people to "work in a collaboration mode that would be much closer and more effective than we had ever been able to accomplish."[27] This original vision of Engelbart's became his obsession and his lifelong project. He went on to invent the mouse, the window, and the word processor. Engelbart's demonstration of computer-supported cooperative work using videoconferencing and mixed text/graphic displays ("dealing lightning with both hands," in the words of one of the young computer designers who saw a video of the demonstration),[28] the mouse, and linked media made an enormous impact on those who saw it or heard about it. On a rainy Monday morning in December 1968, Engelbart "showed the nation's best computer scientists and hardware engineers how people would in the future work together and share complex digital information instantaneously, even though they might be a world apart."[29] Engelbart sat before the audience in front of an enormous screen on which images of participants from miles away were projected, while they collaborated on text. It seems simple now, but it was one of the most remarkable demonstrations of technology of all time. Instead of man acting at the behest of a computer (a mainframe hidden behind glass), man would wield the computer (and the personal computer) for his own purposes.

In a sense, Engelbart was introducing his viewers to "cyberspace,"

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24. *Id.*

25. JOHN MARKOFF, WHAT THE DORMOUSE SAID: HOW THE SIXTIES COUNTERCULTURE SHAPED THE PERSONAL COMPUTER INDUSTRY 7 (2005).

26. WILLIAM JAMES, WHAT MAKES A LIFE SIGNIFICANT 16 (1898), *available at* http://philosophy.lander.edu/intro/articles/jameslife-a.pdf.

27. D.C. ENGELBART, STAN. RES. INST., AUGMENTING HUMAN INTELLECT: A CONCEPTUAL FRAMEWORK 188-89 (1962), *available at* http://www.bootstrap.org/augdocs/friedewald030402/augmentinghumanintellect/AHI62.pdf.

28. MARKOFF, *supra* note 25, at 148.

29. *Id.* at 149.

that idea of decentralized feedback that had galvanized Norbert Wiener more than twenty years before. Wiener, often described as the "father of the information age,"[30] had a conception of information that re-characterized it as communication. For Wiener, "information was not just a string of bits to be transmitted or a succession of signals with or without meaning, but *a measure of the degree of organization in a system.*"[31] He developed a new science of communication and control, focusing on "the interplay of complex communication processes that connect human beings to the living world around them,"[32] and called it "cybernetics" (from the Greek word for steersman, 'kubernetes'). This steersman was like the governor for a thermostat: automatic, and controlled by feedback generated by the autonomous actions of all the communicants. "Communication and control" can also be understood as "interactivity," the central breakthrough that makes the Internet the "conversation" celebrated by Weinberger. Thus, while "cyberspace" is sometimes derided as an old-fashioned term, its currency remains: cyberspace is that place/mode/medium[33] where humans can interact electronically and collectively create feedback ("steer" automatically) that generates nonlinear (but still essentially human) outcomes. In other words, the online interactivity celebrated and demonstrated by Engelbart was the implementation of Wiener's cybernetic discussions.

Another key Engelbart and Internet antecedent was, of course, J.C.R. Licklider, who led the Advanced Research Projects Agency (ARPA, now DARPA, the Defense Advanced Research Projects Agency) and vigorously encouraged the networking that led to the Internet.[34] Licklider shared with Wiener a strong vision of human-computer coexistence, saying that it would be essential "to enable men and computers to cooperate in making decisions and controlling complex situations without inflexible dependence on predetermined programs."[35] Licklider understood that communication was not a one-way street running between a sender and a passive "receiver," and claimed that "[i]n a

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30. FLO CONWAY & JIM SIEGELMAN, DARK HERO OF THE INFORMATION AGE: IN SEARCH OF NORBERT WIENER 1 (2004).

31. *Id.* at 190.

32. *Id.* at 173. Wiener's CYBERNETICS: OR CONTROL AND COMMUNICATION IN THE ANIMAL AND THE MACHINE (1948) has been ranked as among the most "memorable and influential" works of 20th century science.

33. *See generally*, Julie Cohen, *Cyberspace as/and Space*, 107 COLUM. L. REV. 210 (2007); Dan Hunter, *Cyberspace as a Place, and the Tragedy of the Anticommons*, 91 CAL. L. REV. 439 (2003) (referring to the implications of using "place" as a metaphor to describe cyberspace).

34. *See generally* WALDROP, *supra* note 3, at 204-58.

35. J.C.R. Licklider, *Man-Computer Symbiosis*, HFE-1 IRE TRANSACTIONS ON HUM. FACTORS IN ELECTRONICS 4 (1960), *available at* ftp://gatekeeper.research.compaq.com/pub/DEC/SRC/research-reports/SRC-061.pdf.

few years, men will be able to communicate more effectively through a machine than face to face."[36] Early on, Licklider was among the first to believe in Engelbart's vision of interactivity, and Engelbart thought of him as a big brother.[37]

This history of Nethead-understanding is both distinguished and dreamlike. For more than forty years now, people like Bush, Wiener, Licklider, and Engelbart have mused about the possibilities of human interaction online. Many of their dreams seem to have come true – but not all. The development of the World Wide Web by Tim Berners-Lee has made possible the "pool of human knowledge" envisioned by Bush, because it allows the linking of documents and navigation among them.[38] As Weinberger and many others have pointed out, the Internet makes everyone a publisher. Over 48 million American Internet users have posted something of their own online, such as a photo, a piece of art, a video, a piece of writing, or some other form of a digital file.[39] They have grown up being able to interact with media, and they are very used to an Internet-centric life. Overall, almost 50 million Americans have left part of their creative life online – by having their own blog, having their own web page, working on a blog or webpage for work or a group, or sharing self-created content such as a story, artwork, or video.[40] But the "associational trails" envisioned by Bush are not yet easily perceptible by us online, and it seems likely that we are still in an early, primitive era of the Internet's development.

Nonetheless, for definitional purposes, the Nethead view is that the *standards* that make the Internet (and the web) work – TCP/IP, HTML, HTTP – are an essential part of "the Internet" but do not capture the entire idea of the Internet. Importantly, these standards make *relationships* possible and persistent. These relationships can be among texts (the hypertext links of the web) as well as machines, and among humans and groups as well. On this view, the Internet is made up of standards and relationships, both the logical architecture beloved by the Engineers and the cultural and intellectual life essential to humans.

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36. J.C.R. Licklider & Robert W. Taylor, *The Computer as a Communication Device*, SCI. & TECH., Apr. 1968, at 40, *available at* http://gatekeeper.dec.com/pub/DEC/SRC/publications/taylor/licklider-taylor.pdf.

37. MARKOFF, *supra* note 25, at 52.

38. *See generally* TIM BERNERS-LEE & MARK FISCHETTI, WEAVING THE WEB: THE ORIGINAL DESIGN AND ULTIMATE DESTINY OF THE WORLD WIDE WEB BY ITS INVENTOR (1999).

39. JOHN B. HORRIGAN, PEW INTERNET & AM. LIFE PROJECT, HOME BROADBAND ADOPTION (2006), http://www.pewinternet.org/pdfs/PIP_Broadband_trends2006.pdf.

40. *Id*.

II. THE EVOLUTION OF THE INTERNET

All three of these "Internet" definitions emerged some time ago. The Engineers and the early Netheads were there at the start, developing logical architecture and human-computer interactions. The Telcos were also there at the start (even if they did not really understand what they were dealing with), providing the pipes (or "tubes" in Sen. Stevens's lexicon) necessary for transport of packets. During the early days of the Internet, Congressional and FCC involvement in Internet "regulation" was minimal.[41] But the facts on the ground have changed dramatically since then. This Part briefly discusses how the evolution of the Internet relates to the three broad "definitions" I have suggested in Part I. Although many dimensions of Internet use have changed since the early 1990s, I have chosen four in particular to discuss: number of hosts, bandwidth speed and penetration of access, development of new applications, and the social impact of Internet availability.

A. Number of Hosts

The number of hosts[42] is usually considered to be the most accurate available measure of the size of the Internet.[43] In 1994, when Tim Berners-Lee published his first articles about his development of the World Wide Web, there were approximately 2.2 million hosts.[44] As of January 2006, there were approximately 394 million hosts.[45] A less accurate measure of the size of the Internet attempts to assess the number of world Internet users. The estimate being used these days is a billion Internet

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41. *See* Susan P. Crawford, *Shortness of Vision: Regulatory Ambition in the Digital Age*, 74 FORDHAM L. REV. 695, 697-98 (2005).

42. "A computer system that is accessed by a user working at a remote location. Typically, the term is used when there are two computer systems connected by modems and telephone lines. The system that contains the data is called the host, while the computer at which the user sits is called the remote terminal[.]" Webopedia Computer Dictionary, Host, http://www.webopedia.com/TERM/h/host.html (last visited Sept. 29, 2006); *but see* Internet System Consortium, http://www.isc.org/index.pl?/ops/ds/ (follow "Frequently Asked Questions" hyperlink) (last visited Sept. 29, 2006) (stating that a host used to be a single machine on the Internet; however, the definition of a host has changed in recent years due to virtual hosting, where a single machine acts like multiple systems and has multiple domain names and IP addresses).

43. *See Internet Hosts Reach 100 Million Worldwide*, INFO. SUPERHIGHWAYS NEWSL. (IGI Group Inc., Brighton, Mass.), June 2001, *available at* http://www.findarticles.com/p/articles/mi_m0IGM/is_6_8/ai_76701365.

44. *See* Internet Systems Consortium, Internet Domain Survey, http://www.isc.org/index.pl?/ops/ds/ (last visited Sept. 29, 2006). In 1969, of course, there were only four hosts: SRI, UCLA, UCSB, and Utah. *See* Computer History Museum, Exhibits, Internet History, http://www.computerhistory.org/exhibits/internet_history/ (last visited Sept. 29, 2006).

45. *Id.*

users, representing 15 percent of the world's population.[46] On any measure, of course, the Internet is a much larger place than it was thirteen years ago.

It is also far less homogeneous. In both 1999 and 2002, fully half of the public sites on the Internet were asserted to be in America.[47] Although America remains the country with the most Internet users, only 18 percent of all Internet users worldwide are American.[48] Eleven percent of Internet users are now found in China,[49] and observers believe that Chinese Internet use has already exceeded that of the U.S.[50]

From the Engineers' perspective, the logical architecture that is "the Internet" may no longer be adequately serving the world. Although the idea of interconnection of autonomous networks is still important, and interconnection is still functioning well, the architecture they designed for the use of a relatively homogenous group of engineers may not be appropriate for such a large and diverse world. For example, MIT's Dave Clark and Internet pioneer Bob Kahn have separately called for a re-engineering of the Internet to deal with security issues, spam, intellectual property problems, and other current Internet issues.[51] And ICANN has been discussing for years whether and how to create multilingual top-level domains in the DNS to serve non-English speaking populations. For an Engineer, the free flow of information may not be the top priority; the architecture that is "the Internet" was always supposed to be able to evolve.

From the Telcos' perspective, the use of their pipes for Internet communications is increasing, but they are being treated as the provider

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46. *See* Internet World Stats, World Internet Usage and Population Stats, http://www.internetworldstats.com/stats.htm (last visited Sept. 29, 2006). This represents a 200.9 percent growth since 2000. *Id.* This figure is up from only 45 million in 1995 and 420 million in 2000. Press Release, Computer Indus. Almanac, Worldwide Internet Users Top 1 Billion in 2005 (Jan. 4, 2006), *available at* http://www.c-i-a.com/pr0106.htm.

47. *See* Online Computer Library Center, Country and Language Statistics, http://www.oclc.org/research/projects/archive/wcp/stats/intnl.htm (last visited Sept. 29, 2006).

48. *See* Press Release, Computer Indus. Almanac, *supra* note 46.

49. *Id*.

50. Natalie Pace, Opinion, *China Surpasses U.S. in Internet Use,* FORBES.COM, Apr. 3, 2006 ("Chinese Internet users spend nearly two billion hours online each week, while the U.S. audience logs on for 129 million hours per week"), *available at* http://www.forbes.com/2006/03/31/china-internet-usage-cx_nwp_0403china.html.

51. David Talbot, *The Internet is Broken,* 108 TECH. REV., Dec. 2005 / Jan. 2006, at 63 ("The Net's fundamental flaws cost companies billions, impede innovation, and threaten national security. It's time for a clean-slate approach."). Kahn frequently speaks about the necessity of treating online information as "digital objects" that can be managed authoritatively. *See, e.g.*, Robert Kahn & Patrice Lyons, *Representing Value as Digital Objects: A Discussion of Transferability and Anonymity*, 5 J. ON TELECOMM. & HIGH TECH. L. 189 (2006). Kahn also recently argued against net neutrality. *See generally*, Andrew Orlowski, *Father of Internet Warns Against Net Neutrality*, THE REGISTER, Jan. 18, 2007, http://www.theregister.co.uk/2007/01/18/kahn_net_neutrality_warning/.

of transport—a commodity service. They are frustrated with their inability to internalize the benefits of increasing network connectivity experienced by the communicating world.

From the Netheads' perspective, the critical online mass needed to make human-computer symbiosis and meaningful online "conversation" real is rapidly emerging. The world is online, and being so may make the world a better place. They are anxious to retain global interconnectivity and the free flow of information online, confident that the decentralized "steersman" will cause positive world outcomes to come into being.

B. Bandwidth speed and penetration

When Doug Engelbart did his 1969 demonstration, only one-direction modems carrying data at 1200 baud were available to him.[52] By 1994, the highest-speed dial-up connection commercially available was 9600bps (or 9.6Kbps), and text transfers continued to be the only feasible use for these connections (unless the user was extraordinarily patient).[53] Connections were unreliable. Dial-up speeds widely available eventually reached 56Kbps in the late 1990s,[54] but still precluded use of the Internet for downloading or uploading visual files.

By the 2000s, Digital Subscriber Line ("DSL") access over traditional copper telephone wires (providing digital data transmission) became commercially available, as did cable modem access. The traditional local exchange carriers were not initially enthusiastic about DSL, because they were happy with the profit margins generated by consumers installing second phone lines.[55] But pressure from the cable installations forced them to install DSL widely, cannibalizing their second-line business. In any event, speeds currently available from DSL and cable modem installations in the U.S. range from 256K to 24Mbps, with most

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52. MARKOFF, *supra* note 25, at 151. "At slow speeds, only one bit of information (signaling element) is encoded in each electrical change. The baud, therefore, indicates the number of bits per second that are transmitted. For example, 300 baud means that 300 bits are transmitted each second (abbreviated 300 bps)." Webopedia Computer Dictionary, Baud, http://www.webopedia.com/TERM/b/baud.html (last visited Sept. 29, 2006). *See also* Bandwidth Speed Test, Results Explanation ("At one time [the baud rate at higher speeds] was equal to the bits per second, but modern technology allows us to send more than one bit per electric signal"), http://www.bandwidthplace.com/speedtest/about/tech.php?a=results (last visited Sept. 29, 2006).

53. TRACY L. LAGUEY, THE INTERNET COMPANION: A BEGINNER'S GUIDE TO GLOBAL NETWORKING ch. 7 (2d ed. 1994), *available at* http://archives.obs-us.com/obs/english/books/editinc/andr-7.htm.

54. Wikipedia, Modem, http://en.wikipedia.org/wiki/Modem (last visited Nov. 1, 2006).

55. Wikipedia, Digital Subscriber Line, http://en.wikipedia.org/wiki/Digital_Subscriber_Line (last visited Nov. 1, 2006).

commercial connections having speeds of 1.5 to 2Mbps in the U.S.[56] Meanwhile, however, in South Korea and Japan speeds of 100Mbps are common.[57]

Thus, broadband data speeds now are millions of times faster than they were at the birth of the Internet. And penetration of these broadband connections is high: as of May 2006, more than 40 percent of all American adults (estimates range between 84 million and 95.5 million people) had a high-speed Internet connection at home – a 40 percent increase over the number in 2005.[58] The U.S. remains behind at least eleven other OECD (Organisation for Economic Co-Operation and Development) countries in broadband penetration (in Iceland, for example, there are 27 broadband subscribers for every 100 people, but in the U.S. there are only 17 per 100),[59] but penetration is continuing to increase. Meanwhile, cable and telephone companies in the U.S. are busily upgrading their networks so as to be able to provide video, voice, and data services over proprietary high-speed connections. As fast as they are, standard, current-generation DSL and cable modem connections cannot deliver high-quality video-on-demand services.[60]

From the Engineers' perspective, increasing access speeds are almost irrelevant to their understanding of "the Internet." The logical architecture may need to change, but any successor will still be the interconnection protocol that makes the Internet what it is. To avoid the spam and other troubles available on the commercial Internet, they are happy to use the affordances of Internet2.[61]

From the Telcos' perspective, all of this speed requires enormous investment. They want assurance that they will be able to monetize "their" networks through price differentiation in order to recoup their outlays. Because "the Internet" is a collection of private network connections, to their mind monetization is no more than garden-variety exploitation of a private resource. They have successfully convinced the FCC to cease treating them as a common carrier with respect to these re-

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56. GLOBAL BROADBAND BATTLES: WHY THE U.S. AND EUROPE LAG WHILE ASIA LEADS 148 (Martin Fransman ed., 2006).

57. *Id*.

58. PEW INTERNET & AM. LIFE PROJECT, HOME BROADBAND ADOPTION 2006 1 (2006), http://www.pewinternet.org/pdfs/PIP_Broadband_trends2006.pdf; Press Release, Neilsen//Netratings, Two-Thirds of Active U.S. Web Population Using Broadband, Up 28 Percent Year-Over-Year to an All-Time High (Mar. 14, 2006), *available at* http://www.nielsen-netratings.com/pr/pr_060314.pdf.

59. Organisation for Economic Co-operation & Development, OECD Broadband Statistics to June 2006 (2006), http://www.oecd.org/sti/ict/broadband.

60. *See* COMM. ON BROADBAND LAST MILE TECH. ET AL., BROADBAND: BRINGING HOME THE BITS ch. 3 (2002), *available at* http://newton.nap.edu/html/broadband/ch3.html.

61. *See generally* Internet 2, http://www.internet2.edu/ (last visited Feb. 4, 2006).

sources, and are planning to do the same in statutory language.[62]

From the Netheads' perspective, high-speed access makes possible a myriad of yet-to-be-invented applications that will make collaboration and user participation online even easier. They are worried that the Telcos' monetization of their pipes will stymie these positive developments.

C. New Applications

What are all these people using these high-speed connections for? In the U.S., they look for news,[63] banking services,[64] health information,[65] information relevant to major life decisions,[66] and, increasingly, use these high-speed connections to post material of their own (pictures, text, video) online.[67] Voice-over-Internet Protocol ("VoIP") services have not taken off in the U.S. with the same ferocity that they have overseas,[68] but U.S. users are likely to discover these services in large numbers in the next few years. U.S. consumers spent $1.4 billion on online gaming in 2005, and more than a million people in the U.S. subscribed to online gaming services like World of Warcraft.[69] According to the NPD Group, "With the increase in high speed Internet access, not only are users purchasing their games online, they are also willingly paying additional recurring fees over and above the price of the game to subscribe to services that let them play with others online."[70] And some U.S. broadband Internet users use their connections to facilitate sharing files of all

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62. *See* Nat'l Cable & Telecomms. Ass'n v. Brand X Internet Servs., 545 U.S. 967 (2005) (holding that, neither cable modem service nor DSL broadband provision is subject to the common carrier requirements (interconnection, nondiscrimination, and access) of Title II of the Communications Act); *see also* Appropriate Framework for Broadband Access to the Internet Over Wireline Facilities, *Report & Order & Notice of Proposed Rulemaking*, 20 FCC Rcd. 14,853 (2005).

63. JOHN B. HORRIGAN, PEW INTERNET & AM. LIFE PROJECT, FOR MANY HOME BROADBAND USERS, THE INTERNET IS A PRIMARY NEWS SOURCE (2006), http://www.pewinternet.org/pdfs/PIP_News.and.Broadband.pdf.

64. SUSANNAH FOX & JEAN BEIER, PEW INTERNET & AM. LIFE PROJECT, ONLINE BANKING 2006: SURFING TO THE BANK (2006), http://www.pewinternet.org/pdfs/PIP_Online_Banking_2006.pdf.

65. MARRY MADDEN & SUSANNAH FOX, PEW INTERNET & AM. LIFE, FINDING ANSWERS ONLINE IN SICKNESS AND IN HEALTH (2006), http://www.pewinternet.org/pdfs/PIP_Health_Decisions_2006.pdf.

66. JOHN HORRIGAN & LEE RAINIE, PEW INTERNET & AM. LIFE, THE INTERNET'S GROWING ROLE IN LIFE'S MAJOR MOMENTS (2006), http://www.pewinternet.org/pdfs/PIP_Major%20Moments_2006.pdf.

67. HORRIGAN, *supra* note 39.

68. *Id.*

69. Press Release, The NPD Group, The NPD Group Reports Total U.S. Consumer Spending on PC Games Reached $1.4 Billion in 2005 (May 25, 2006), *available at* http://www.npd.com/press/releases/press_060525.html.

70. *Id*.

kinds with others.[71] Many Americans want to send photos and other large files to their families and friends (and not to strangers), and broadband connections make these activities possible.[72]

Americans, like other broadband users worldwide, will likely find uses for broadband that are collaborative, user-generated, immersive, and persistent – involving always-on presence, voice/video conferencing, video creation and distribution, elaborate virtual-world interactions, and social interactions generally.[73]

From the Engineers' perspective, these new applications made possible by broadband availability are no more than additional layers made possible by the original logical architecture that is the Internet. They are, again, concerned about the security and other risks posed by an "open" Internet in which the original protocols have not evolved beyond their 1970s state.

From the Telcos' perspective, it is enormously frustrating not to be participating in some way as a provider of applications as well as transport. They would like to be selling their own video-on-demand services to willing consumers as another way to recoup their enormous investment in infrastructure. They assert that these services are sensitive to latency and jitter issues for which the Internet provides no quality assurance, and claim that they require quality assurance control over their own pipes in order to provide them. The cable companies, for their part, would like to be providing online voice services without worrying about competition from services they do not control.

From the Netheads' perspective, these new applications have the potential to change the world dramatically, bringing us closer to the dreams of "associational trails" described so eloquently by Vannevar Bush. They have some concerns about the synchronous nature (e.g., real-time video conferencing) of these applications, but they are excited by the future to come. They assert that adequate bandwidth availability

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71. In early 2005, Wired reported that "[a]nalysts at CacheLogic, an Internet-traffic analysis firm in Cambridge, England, report that BitTorrent traffic accounts for more than one-third of all data sent across the Internet." Clive Thompson, *The BitTorrent Effect*, WIRED, Jan. 2005, at 1, *available at* http://www.wired.com/wired/archive/13.01/bittorrent.html. The creator of the BitTorrent protocol has since then announced that he will partner with content distributors interested in creating efficient download systems. *See NTL, BitTorrent, CacheLogic Team Up on Legit Video Download Service*, ONLINE REPORTER, Feb. 18, 2006, http://www.onlinereporter.com/article.php?article_id=6101.

72. Om Malik, *File-sharing Is the New Email*, BUS. 2.0 MAG., May 1, 2006 (describing three start-ups aiming to serve Americans wanting easy-to-use BitTorrent functionality for point-to-point sending of large files), *available at* http://money.cnn.com/2006/05/01/technology/business2_launchpad0501/index.htm.

73. *See, e.g.*, Ben Anderson & Yoel Raban, *The Social Impact Of Broadband Household Internet Access* (Chimera Inst. for Soc. & Technical Res. Working Paper No. 2005-06), *available at* http://www.essex.ac.uk/chimera/content/pubs/wps/CWP-2005-06-Social-Impact-BB.pdf.

would solve all the latency and jitter issues raised by the Telcos. These new applications, on the Nethead view, are creating new relationships among people using the standards agreed to for the public Internet. The economic arguments made by the Telcos strike Netheads as being orthogonal to the human-development opportunities the future Internet will make possible.

D. Social impact

The social impact of broadband access is unclear. We do know that Americans are spending a great deal of time communicating and using media devices—more time than they spend doing anything else during the day—and that they are often mobile when they are communicating.[74] People with broadband connections tend to spend more time online more often, interacting with multimedia, bringing offline activities online, and generally feeling positively about the Internet's "role in their lives."[75] They expect to find communities they want to join online.[76] They look to "amateur experts" online for advice and rely on it.

We do not know what the future will bring. If "fiber to the family" connections become available, with 1 Gbit/sec of data, that family will be able to "hold more than 8,000 simultaneous telephone conversations. . . listen to 3500 CD-quality music tracks at the same time . . . download the entire Encyclopedia Britannica [in] just over 30 seconds . . . [and] watch 200 DVD-quality or 66 HDTV channels."[77] At the moment, Americans are primarily doing what they used to do with their dial-up connections, but doing it more quickly. The transformative social and cultural effects of true high-speed access will be a fruitful area for future study.

III. CHOOSING A LENS

With the prospect of several years of discussion about revising U.S. communications law before us, we will need to have some understanding about what is meant by the words "the Internet" and how any legislative change will affect "the Internet" (once we understand it). From the Engineers' point of view, the logical architecture that is "the Internet" can

74. Lee Rainie, Director, Pew Internet & Am. Life Project, How the Internet is Changing Consumer Behavior and Expectations (June 7, 2006), *available at* http://www.pewinternet.org/ppt/2006 - 6.7.06 ThinkTank Seton Hall.pdf.

75. *See* DEBORAH FALLOWS, PEW INTERNET & AM. LIFE PROJECT, THE INTERNET AND DAILY LIFE (2004), http://www.pewinternet.org/pdfs/PIP_Internet_and_Daily_Life.pdf.

76. Rainie, *supra* note 74, at 12.

77. Lightwave Online Article, *South Korea Loses Broadband Penetration crown, Gains FTTx Subscribers*, LIGHTWAVE, July 5, 2006, http://lw.pennnet.com/Articles/Article_Display.cfm?ARTICLE_ID=259277&p=1.

change at any time, and legislators should have little to say about that logical architecture. This perspective may assist the Telcos, who would like to change the current "open" architecture of consumers' broadband connections to the Telcos' pipes (the Telcos' "Internet") in order to be able to discriminate in favor of particular packets, and are anxious to have statutory language in place that will enable them to do this. But the Netheads want the original logical architecture to remain constant, unchanged, to facilitate the establishment of relationships that is "the Internet" to them.

What is a policymaker to do? If we choose the Engineers' lens, which so easily combines with that of the Telcos', then the Telcos' arguments about their need for certainty and ownership will unquestionably prevail, and "Internet" fast lanes will be created using changed logical architectures that favor the Telcos' content. This may be very good news for the Telcos, but not such good news for the future of online communications. If we choose the Netheads' lens, and mandate in statutory language that the standards of the Internet remain unchanged (thus facilitating the interesting relationships that the Netheads hold dear), it is unclear who will pay to maintain and upgrade the broadband networks that the Netheads say they want.

Each of these three viewpoints, standing by itself, is too narrow to be used meaningfully by policymakers. Neither the Engineer nor the Nethead perspective is of any help when lawmakers are worried about the economics of installing and upgrading physical pipes. The Telco perspective seems short-sighted, because it assumes that people prefer to passively receive communications rather than participate in creating their own – which does not necessarily fit with the findings of recent studies of broadband use.[78] The Nethead perspective, on the other hand, seems to lead inevitably to the creation of heavy-handed regulatory control over expensive privately-held assets. The Engineers would rather not deal with regulators at all, and point to their own standard-setting activities as being perfectly capable of encouraging the continued evolution of the Internet. All three of these groups have legitimate concerns and a good deal of logic on their side. None of these three definitions, however, adequately assists policymakers in planning for the future.

What is missing from the Engineer and Telco definitions is a sense of social or cultural context. They are unconcerned with how the Internet has changed the world (if it has) and how it may force social and cultural changes in the years ahead. Indeed, their definitions bear no relationship to human uses of the Internet, and are focused instead on how computers communicate (the Engineers) and how machines are con-

78. HORRIGAN, *supra* note 39.

nected (the Telcos). On the other hand, the Netheads are focused almost exclusively on cultural context and cannot adequately explain how the real costs involved in setting up the kinds of broadband access regimes established in South Korea and Japan will be covered.

This is a difficult set of issues that is likely to engage Congress and the courts for years to come. My own contribution to this debate is modest: I would like policymakers to understand what people from different professional backgrounds mean when they talk about "the Internet." It also seems to me that it would be wise to take a larger, social/cultural view of the future, rather than focusing only on either freezing the current logical architecture in its place or protecting the Telcos' investments at all costs. The Netheads' view needs to be taken into consideration more seriously than it has been in the past. After all, dreams of Netheads like Vannevar Bush, Norbert Wiener, and Doug Engelbart played a significant role in the creation of the Internet, and it cannot be denied that this network of networks (however defined) has had an enormous impact on global economic and cultural life.

My normative view, based on this brief exploration, is that some combination of these three lenses should be adopted by lawmakers. The Engineers are right to emphasize global interconnectivity of networks, and the Telcos' resistance to that understanding is troubling. On the other hand, the Telcos are right to emphasize the private nature of their pipes. They may need to be compensated for their investments if those pipes are transformed into a utility. Finally, the Netheads are right to be concerned about human collaboration online and the effects of private Telco control on the global flow of information. If we adopt only the Telco point of view, we run the risk of encouraging a not-very-interesting online future, in which only those application providers affiliated with the Telcos are able to reach subscribers and users have little ability to participate in content-creation themselves. If we adopt only the Nethead point of view, we may end up with highly-collaborative use of very slow, government-controlled network connections. If we adopt only the Engineer point of view, and fail to enact any legislation whatsoever, we run the risk of having Internet standard-setting activities around the world co-opted by the Telcos—who have the funding to attend and make great progress towards their goals.

A fruitful combination of all three perspectives on "the Internet" might involve emphasizing the importance of global interconnectivity (the Engineer priority) while recognizing both the potential for human development inherent in globally interactive communications (the Nethead priority) and the need for adequate investment in infrastructure (the Telco priority). Many policy outcomes are made possible by such a combined approach.

CONCLUSION

Beginning in the 1940s, Netheads adopted an understanding of man-computer symbiosis that continues to be attractive to Internet futurists. Later on, in the 1970s, Engineers addressed the architectural needs of the future in a concrete way, seeking to interconnect diverse networks. In recent years, the Telcos have increasingly taken the position that "the Internet" is no more than the sum of their privately-owned pipes and wires. These three different approaches to "the Internet" are now informing a complex and important public policy debate about "network neutrality." Policymakers need to recognize that each of these definitions has something to contribute to the debate. The wisest approach may be to craft legislative approaches to "the Internet" that take into account all three viewpoints. In particular, Nethead concern for the social and cultural potential of the Internet needs to be considered seriously.