A DEFERENCE TO PROTOCOL: FASHIONING A THREE-DIMENSIONAL PUBLIC POLICY FRAMEWORK FOR THE INTERNET AGE[♦]

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Abstract

This Article discusses how public policy grounded in the Internet's architecture can best ensure that the Net fully enables tangible benefits such as innovation, economic growth, free expression, and user empowerment. In particular, recognizing that the Internet is rapidly becoming society's chief operating system, this Article shows how an overarching public policy framework should be faithful to the multifaceted nature of the online world. As part of such a framework, this Article will explore one key aspect of the Internet: the "logical" Middle Layers functions, its inner workings derived from open software protocols and inclusive, decentralized processes. Adhering to the deferential principle of "respect the functional integrity of the Internet," in combination with the appropriate institutional and organizational implements, can help ensure that any potential regulation of Internet-based activities enables, rather than hinders, tangible and intangible benefits for end users. In brief, optimal public policy solutions can come from fitting the correct Code (Net target) to the most effective Rules (institutions) and Players (organizations).

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Truth happens to an idea.[1]

— William James

I. INTRODUCTION

A. *No Nerds Allowed*

In late 2011, the United States Congress was heavily involved in debating legislation aimed at stopping foreign websites from hosting content that violates U.S. copyright laws. The House bill, called the Stop Online Piracy Act ("SOPA"), and the Senate bill, known as the Protect Intellectual Property Act ("PIPA"), shared a common element: they sought to impose certain technical requirements on website owners, search engines, Internet Service Providers ("ISPs"), and other entities, in order to block the dissemination of unlawful content on the Internet.[2]

On November 16, 2011, the House Judiciary Committee held a public hearing on SOPA.[3] Representatives from the affected content industries were on hand to testify in favor of the legislation. A lone voice in opposition was Google's copyright counsel, Katie Oyama.[4]

[1] WILLIAM JAMES, THE MEANING OF TRUTH x (Prometheus Books 1997) (1911).
[2] *See generally* Stop Online Piracy Act, H.R. 3261, 112th Cong. (2011) (SOPA); Preventing Real Online Threats to Economic Creativity and Theft of Intellectual Property Act, S. 968, 112th Cong. (2011) (PROTECT IP Act, also known as "PIPA").
[3] *Stop Online Piracy Act: Hearing on H.R. 3261 Before the H. Comm. On the Judiciary*, 112th Cong. (2011).
[4] David S. Levine, *Bring in the Nerds: Secrecy, National Security, and the Creation of International Intellectual Property Law*, 30 CARDOZO ARTS & ENT. L.J. 105, 139 (2012) ("While there was one Congressional hearing on SOPA that was dominated by entities that were pro-SOPA, the dire need for expert 'nerd' input was expressed by members of Congress. Indeed, during the hearing, members of Congress stated that they were not 'nerds,' highlighting their lack of expertise to assess SOPA's DNS provisions. From the perspective of the concerns raised by this Article, and in comparison to the closed processes involving ACTA and TPP . . . the opportunity to bring in the nerds to offer useful public input was absent.").

Notably there were no witnesses called to provide expert testimony about how the legislation would actually affect the Internet—including technical experts on the inner workings of the Net.[5] No software engineers, no hardware engineers, no technologists, no scientists, no economists, no historians.[6]

This apparent oversight was particularly surprising in light of the fact that many prominent Internet engineers were actively speaking out against the legislation. For example, in May 2011, various network-engineering experts produced a straightforward technical assessment of the many infirmities of the legislation.[7] The engineers took no issue with the goal of lawfully removing infringing content from Internet hosts with suitable due process.[8] Instead, they pointed out how the proposed means of filtering the Internet's Domain Name System ("DNS") would be easily circumvented.[9] They also argued that collateral damage to innocent online activities would result from such circumvention techniques and from the mere act of DNS filtering itself.[10] These experts readily identified both the under- and over-inclusionary risks from the pending legislation.[11]

After the November hearing some eighty-three engineering experts, including Steve Crocker, Paul Vixie, Esther Dyson, and Dave Farber, expressed similar concerns in their own letter to Congress.[12] The engineers agreed that the bill's proposed targeting of basic networking functions on DNS, and other functional elements of the Internet, would interfere with the Net's naming and routing systems in a way that would be both ineffective (because many technical workarounds are possible) and over-inclusive (because many legitimate uses and users would be adversely affected).[13] In other words, Congress was considering legislation that, while laudable in its overall objective, was aimed at the wrong functional target.

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[5] *See id.*

[6] *Id.*

[7] *See* STEVE CROCKER ET AL., SECURITY AND OTHER TECHNICAL CONCERNS RAISED BY THE DNS FILTERING REQUIREMENTS IN THE PROTECT IP BILL (2011) [hereinafter *Security and Other Technical Concerns*], *available at* http://domainincite.com/docs/PROTECT-IP-Technical-Whitepaper-Final.pdf.

[8] *Id.* at 3.

[9] *Id.* at 7–10.

[10] *Id.* at 10–13.

[11] *See id.*; *see also* Allan A. Friedman, *Cybersecurity in the Balance: Weighing the Risks of the PROTECT IP Act and the Stop Online Piracy Act*, BROOKINGS INSTITUTION (Nov. 15, 2011), http://www.brookings.edu/research/papers/2011/11/15-cybersecurity-friedman (Legislation's attempt to "execute policy through the Internet architecture" creates real threats to cybersecurity by both harming legitimate security measures (over-inclusive) and missing many potential workarounds (under-inclusive)).

[12] Parker Higgins & Peter Eckersley, *An Open Letter from Internet Engineers to the U.S. Congress*, ELECTRONIC FRONTIER FOUND. (Dec. 15, 2011), https://www.eff.org/deeplinks/2011/12/internet-inventors-warn-against-sopa-and-pipa [hereinafter *An Open Letter*].

[13] *Id.*

In their arguments, the engineers relied on the design principles embedded in the Internet's architecture. "When we designed the Internet the first time," they explained, "our priorities were reliability, robustness and minimizing central points of failure or control. We are alarmed that Congress is so close to mandating censorship—compliance as a design requirement for new Internet innovations."[14]

Little evidence of these views actually made its way into the November 16th hearing, and no expert testimony about the inner workings of the Internet was heard. At a subsequent markup of the House bill, members debated whether such knowledge was even necessary.[15] For example, the ranking member of the subcommittee that governs Internet policy exclaimed, "I don't know about the technical stuff, but I don't believe the experts."[16] He then added, "I'm not a nerd."[17] Another member complained that those who sought to bring up questions about the bill's impact on the Internet were "wasting time."[18] A few voices were raised on the other side. Congressman Jason Chaffetz (R-UT) said, "We are doing surgery on the Internet without understanding what we are doing . . . . If you don't know what DNSSEC is, we don't know what we're doing." As he put it, "Maybe we ought to ask some nerds what this thing really does."[19]

Nonetheless the political skids appeared greased. After a markup on December 15th, it seemed increasingly likely that this legislation would pass, and be signed into law, albeit reluctantly, by President Obama.[20] But that did not happen. On January 18, 2012, a host of Internet companies participated in what became known as the "Internet Blackout Day," seeking to enlist their users to protest the bills.[21] Over

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14 *Id.* at 1.

15 Victoria Bekiempis, *The People Trying To Ruin The Internet: Mel Watt*, THE VILLAGE VOICE BLOGS (May 22, 2012, 9:08 AM), http://blogs.villagevoice.com/runninscared/2012/05/mel_watt_wants_to_ruin_the_internet.php.

16 *Id.*

17 *Id.*

18 Joshua Kopstein, *Dear Congress, It's No Longer OK To Not Know How The Internet Works*, MOTHERBOARD, http://motherboard.vice.com/blog/dear-congress-it-s-no-longer-ok-to-not-know-how-the-internet-works.

19 Seth A. Riddley, *Bring in the Nerds*, THE HARVARD CRIMSON (Mar. 7, 2012), http://www.thecrimson.com/article/2012/3/7/nerds-computers-president/.

20 On January 17th, the White House issued a statement that the President would not "support legislation that reduces freedom of expression, increases cyber security risk, or undermines the dynamic, innovative, global Internet." Press Briefing, White House Press Sec'y Jay Carney (Jan. 17, 2012, 12:53 PM), *available at* http://www.whitehouse.gov/the-press-office/2012/01/17/press-briefing-press-secretary-jay-carney-11712. It is not clear whether this was a legitimate veto threat, or something short of one.

21 Annemarie Bridy, *Copyright Policymaking As Procedural Democratic Process: A Discourse-Theoretic Perspective on ACTA, SOPA, and PIPA*, 30 CARDOZO ARTS & ENT. L.J. 153, 159 (2012) ("[T]he operators of Wikipedia made the unprecedented decision to 'go dark'. . . [on] January 18, 2012. In addition to Wikipedia, more than 100,000 Internet companies, including Google, Mozilla, Reddit, and I Can Has Cheezburger (of LOLcats fame), joined the one-day protest. Their forms of protest varied, but their message to their users and fans was unitary:

100,000 websites participated in the Web's version of a collective work stoppage, with some, like Wikipedia, closing access to their content while others, like Google, posting messages exhorting users to voice their concerns to Congress.[22] Lawmakers received emails from some fourteen million people.[23] The response was swift, and predictable: the legislation would not be brought to a floor vote in either chamber.[24]

The interesting question is where things go from here. Despite the political success of Internet Blackout Day, after which politicians scrambled to dissociate themselves from bills previously endorsed,[25] too many members of Congress still lack an informed appreciation for the structural and functional integrity of the Internet. As one commenter puts it, policymakers displayed "a troubling nonchalance. . . when it comes to understanding the objects of their regulation."[26] As a result the debate over SOPA and PIPA appears to have turned into a classic political battle, won in the end by unconventional but straightforward lobbying pressure tactics, rather than the power of legitimate ideas.

B. *Accepting Kingdon's Challenge*

Political scientist John Kingdon famously asserted that, in the political sphere, it is often ideas, and not political pressure, that matters most at the end of the day.[27] These ideas in turn have the potential to become policy proposals that can compete to solve problems in the "garbage can" of the political process.[28] While power, influence, and strategy are important, "the content of the ideas themselves, far from being mere smokescreens, or rationalizations, are integral parts of decision making in and around government."[29] John Maynard Keynes agreed that in politics "the power of vested interests is vastly exaggerated compared with the gradual encroachment of ideas."[30]

And yet, the still-fresh SOPA-PIPA legislative battle sorely tests that optimistic thesis, and crystallizes the challenge. After all, the

'Petition your elected representatives to oppose these bills.' And petition their representatives people did--in droves. Google reported that 4.5 million people in one day signed its petition opposing SOPA and PIPA.").

22 *Id.*

23 Jonathan Weisman, *After an Online Firestorm, Congress Shelves Antipiracy Bills*, THE NEW YORK TIMES (Jan. 20, 2012), http://www.nytimes.com/2012/01/21/technology/senate-postpones-piracy-vote.html?_r=1&.

24 *Id.*

25 As Congresswoman Zoe Lofgren put it, congressional passage of the legislation was inevitable, "until one morning it became unthinkable." Congresswoman Zoe Lofgren (D-CA), Verbal Remarks at CCIA 40th Anniversary Dinner (Mar. 19, 2013).

26 Bridy, *supra* note 21, at,156.

27 JOHN W. KINGDON, AGENDAS, ALTERNATIVES, AND PUBLIC POLICIES 131 (1st ed. 1995).

28 *Id.* at 91.

29 *Id.* at 131.

30 John MAYNARD KEYNES, THE GENERAL THEORY OF EMPLOYMENT, INTEREST, AND MONEY 383 (1936).

various concerted educational efforts did not appear to succeed; instead, politics as usual (with a unique Internet-fueled twist) won the moment, with the Internet Blackout Day forcing a hasty retreat even by staunch bill sponsors. Although the resulting abandonment of support for SOPA and PIPA was widely celebrated by its opponents, the fact that many in Congress seemed to be driven by confusion and fear, rather than a genuine understanding of the legislation's policy implications, is hugely problematic. Such shows of political force are difficult to replicate, complicated to harness, and can quickly lose their novelty and impact. Moreover, while most impressive and effective, at least for the moment, the show of force convinced politically, without necessarily convincing intellectually.[31]

Modern political theories, as applied to Internet policymaking, suffer from many of the same drawbacks as neoclassical economic theories: they are rooted in basic misconceptions about micro and macro human behavior. Fundamental misunderstandings persist in the annals of theory about how ordinary people think and operate in the real world, particularly in pervasive networked environments like the Internet.[32] In previous papers, I respectfully suggested new ways of framing the relevant policy issues related to online markets[33] and communications infrastructure,[34] so they capture a more accurate reflection of human interactions via technology platforms.

This Article represents another attempt to frame public policy using the lens of technology. Here, I argue that lawmakers should understand and, where appropriate, defer to the substance and processes imbued in the Internet's functional design. This translates into focusing on the optimal fit between the means and ends of proposed regulation of the Internet's inner workings—what I call its "Middle Layers"—so as to best preserve the integrity of its overall design. Fortunately, there are a number of ways that public policy can be applied to the Internet without contravening its working internal structure. The key is to match the

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31 Ultimately it is impossible to conclude whether the "uninvited 'nerd' testimony" was a decisive factor in the defeat of SOPA/PIPA, but it is certain that the combination of voices on behalf of the Net, and from the Net, turned the policymaking tide. Bridy, *supra* note 21, at 163.

32 See *id.*; Richard S. Whitt & Stephen Schultze, *The New "Emergence Economics" of Innovation and Growth, and What It Means for Communications Policy*, 7 J. TELECOMM. & HIGH TECH. L. 217 (2009) [hereinafter *Emergence Economics*]; Richard S. Whitt, *Adaptive Policymaking: Evolving and Applying Emergent Solutions for U.S. Communications Policy*, 61 FED. COMM. L.J. 483 (2009) [hereinafter *Adaptive Policymaking*]. *See also* Richard S. Whitt, *Evolving Broadband Policy: Taking Adaptive Stances to Foster Optimal Internet Platforms*, 17 COMMLAW CONSPECTUS 417 (2009) (applying the market and technology framings to broadband transmission networks, offering concrete examples of novel policy options.) [hereinafter *Broadband Policy*]. Each of these papers share a certain perspective about the desirability of creating an overarching conceptual framework for the Internet that helps us explore and craft policy solutions that work with, and not against, its generative nature.

33 *See Emergence Economics*, *supra* note 32.

34 *See Adaptive Policymaking*, *supra* note 32; *Broadband Policy*, *supra* note 32.

right policy instruments to the right functional solution. As Lawrence Solum points out, Internet policy choices should not be grounded in "vague theoretical abstractions," but rather "in the ways that communications networks actually are designed, constructed, and operated."[35]

For all practical purposes, the Net is becoming the chief operating system for society. And yet, confusion and misapprehension about how the Net functions—its basic design attributes and architecture—remains frighteningly high, even in policymaking circles. Ironically, the collective ignorance of our body politic is slowly strangling that which we should want most to preserve. Perhaps the Net community in part has itself to blame for this predicament. For too long we urged policymakers simply to look the other way whenever talk about possible Internet regulation surfaced. After all, many of us simply laughed when a U.S. Senator railed about the Net as a "series of tubes," or a U.S. President referred to "the internets." We were convinced that misunderstandings about the Internet—just a big mysterious, amorphous cloud, right?—would lead our politicians to shy away from imposing laws and rules.

One can make a case that the lack of understanding was willful, that the fault lies not with the Net's partisans but with the politicals who chose to overlook the actual impact of their proposed actions, and not grapple with the complexities of Internet regulation. And clearly serious efforts had been undertaken to educate policymakers about the potential errors of their ways.[36] On the other hand, for some entities the ability to shield commercial dealings behind the rhetorical cloak of Internet "unregulation" can help ward off unwanted government scrutiny. Deliberate obfuscation can protect pecuniary interests. Regardless of motivations on both sides, however, the larger point is what is crucial: the days of easy sloganeering are over. It is time for the Internet community to come out from behind the curtain and explain itself. This Article is intended as a modest contribution to that end.

To be clear at the outset, this piece is not going to argue for a form of what some have termed "Internet exceptionalism."[37] The rallying cry of "Don't regulate the Internet" no longer makes much sense, at least as

[35] Richard S. Whitt, *A Horizontal Leap Forward: Formulating a New Communications Public Policy Framework Based on the Network Layers Model*, 56 FED. COMM. L.J. 587, 595 (2004) [hereinafter *Horizontal Leap*] (discussing Lawrence B. Solum & Minn Chung, *The Layers Principle: Internet Architecture and the Law*, 79 NOTRE DAME L. REV. 815 (2004)).

[36] While there have been such educational efforts in the past, too often these voices have failed to reach the ears of policymakers. *See, e.g.*, Doc Searls & David Weinberger, *World of Ends, What the Internet Is, and How to Stop Mistaking It for Something Else*, WORLD OF ENDS (Mar. 10, 2003), http://worldofends.com.

[37] *E.g.*, Tim Wu, *Is Internet Exceptonalism Dead? in* The Next Digital Decade– Essays On The Future Of the Internet 179, TECH FREEDOM (Berin Szoka & Adam Marcus ed. 2010).

commonly understood. Most of the myriad activities facilitated by online platforms will be regulated, to some degree, by someone.[38] The chief question is, how? This Article will attempt to explain that what we really need is a new form of "Internet contextualism," where the basic workings of the Net are understood and fully accounted for as we wrestle with difficult questions about societal concerns. Under this banner, government involvement—directly or indirectly, through a variety of institutional and organizational vehicles—would happen only for the right reasons, and aimed in the right way at pertinent uses and abuses of the network.

Philosophical pragmatists will observe that it is not enough for an idea to be true; for purposes of public acceptance, it must be seen to be true.[39] Assuring politicians that it is acceptable not to regulate what they don't comprehend—content to settle for living in what amounts to "an epistemic vacuum"[40]—simply won't fly anymore. In Kingdonian terms, we need to couple the three policy streams of recognizing problems, formulating proposals, and connecting to politics.[41] We cannot afford to ignore or downplay any of those three elements in a policy framework that actually works—correct ideas must find a compelling voice, and platforms for political access. Nor should we invest in slogans whose time came quickly and is long gone. But as we shall see, a new slogan now may be appropriate. A more modest and grounded exhortation, to "respect the functional integrity of the Internet": an idea whose veracity and validity in the minds of too many policymakers is still very much in doubt.[42]

II. The Internet's Fundamental Design Features

A. *The Net's Framing Years*

A technology is not easily severable from the culture in which it is

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[38] As Bertrand de La Chapelle puts it, "The Internet is far from being unregulated: numerous national laws directly or indirectly impact human activities on the Internet, whether we like it or not." Bertrand de La Chapelle, *Multistakeholder Governance, Principles and Challenges of an Innovative Political Paradigm*, *in* MULTISTAKEHOLDER INTERNET DIALOG, CO:LLABORATORY DISCUSSION PAPER SERIES NO. 1, INTERNET POLICY MAKING 16 (2011), *available at* http://dl.collaboratory.de/mind/mind_02_neu.pdf. *See also* Wolfgang Kleinwachter, *Internet Co-Governance, Towards a Multilayer Multiplayer Mechanism of Consultation, Coordination, and Cooperation (M3C3)*, 3 E-LEARNING 473, 473 (2006) ("The myth of a 'free and unregulated Internet' in its radical understanding was never true.").

[39] "The truth of an idea is not a stagnant property inherent in it. Truth *happens* to an idea. It *becomes* true, is *made* true by events. Its verity *is* in fact an event, a process, the process namely of its verifying itself, its veri-*fication*. Its validity is the process of its valid-*ation*." WILLIAM JAMES, THE MEANING OF TRUTH x (Prometheus Books 1997) (1911). *See also Adaptive Policymaking*, *supra* note 32, at 547.

[40] Bridy, *supra* note 21, at 162.

[41] *See* KINGDON, *supra* note 27.

[42] *See supra* notes 14–18 and accompanying text.

embedded.[43] It is a truism that the Internet was born and raised not from the market, but from an unlikely confluence of government and academic forces. Many hundreds of people contributed to what eventually became the "Internet project" over several decades of development, from designers and implementers to writers and critics. The participants came from universities, research laboratories, government agencies, and corporations.[44] What many of them worked on were the technical standards that would provide the essential building blocks for the various online technologies to follow.[45]

There is little doubt that the Internet "represents one of the most successful examples of sustained investment and commitment to research and development in information infrastructure."[46] A brief overview of the Net's roots, processes, and people will shed some light on how it actually operates.

1. From Top-Down Government Management to Bottom-Up Guidance

The Internet was actually born from several different projects in the late 1960s and 1970s, all of which were funded and controlled in some manner by national government agencies. However, the early homogeneity of design and top-down control slowly gave way over time to a heterogeneity of design and bottom-up governance. In some sense, the nature of process followed the nature of function.

In 1968 the U.S. Department of Defense's Advanced Research Projects Agency ("DARPA") awarded to contractor BBN the first government grant to construct and develop ARPANET.[47] This single network was intended to allow dissimilar computers operating at different sites to share online resources.[48] ARPANET eventually became DARPA's host-to-host communications system. One key feature was the Interface Message Processors ("IMPs")—the packet-switching nodes and network protocols that connected together different networks.[49] DARPA provided direct management and control over this project, alongside introduction of the Network Working Group ("NWG") in 1969 and the DARPA Internet Experiment group in

[43] *Emergence Economics*, *supra* note 32, at 251.
[44] David D. Clark, *The Design Philosophy of the DARPA Internet Protocols*, 18 ACM SIGCOMM COMPUTER COMM. REV., no. 4, Aug. 1998, at 106, 114, *available at* http://ccr.sigcomm.org/archive/1995/jan95/ccr-9501-clark.pdf.
[45] *The Importance of Voluntary Technical Standards for the Internet and Its Users*, CENTER FOR DEMOCRACY & TECH. 3 (Aug. 29, 2012), https://www.cdt.org/files/pdfs/Importance%20of%20Voluntary%20Technical%20Standards.pdf.
[46] Barry M. Leiner et al., *The Past and Future History of the Internet*, COMM. ACM, Feb. 1997, at 102, *available at* http://ccrg.soe.ucsc.edu/CMPE252A/FALL2012/PAPERS/history1.pdf.
[47] *The Arpanet: Forerunner of Today's Internet*, RAYTHEON BBN TECHNOLOGIES, http://www.bbn.com/about/timeline/arpanet.
[48] *Id.*
[49] Leiner, *supra* note 46, at 103.

1973.[50]

Beginning in 1968, Vint Cerf and Bob Kahn would do much of their work on the Transmission Control Protocol-Internet Protocol (better known as "TCP/IP") software suite under the auspices and funding of DARPA. As opposed to addressing how to communicate within the same network, Cerf and Kahn tackled a far more challenging problem: linking together disparate packet-switching networks with a common set of protocols. The landmark Cerf-Kahn paper of 1974 developed TCP as the means of sharing resources that exist in different data networks (the paper focused on TCP, but IP was later separated out to logically distinguish router addressing from host packet sending).[51] TCP/IP was adopted as a Defense Department standard in 1980, and incorporated within ARPANET in 1983.[52] This work helped serve as a crucial bridge to the next phase in the development of what now is known as the Internet.

Moving beyond ARPANET, the top-level goal for the new Internet project was to develop "an effective technique for multiplexed utilization of existing interconnected networks."[53] The National Science Foundation ("NSF") and others recognized TCP/IP as the primary means of solving that difficult task, and the protocol suite was incorporated into its NSFNET research network in 1985. NSF and other government agencies were in control of this particular networking project, and access remained strictly limited to academic institutions and the U.S. military. Nonetheless, starting in the late 1970s other bodies began to appear to help steer the course of this growing new "network of networks," including the Internet Configuration Control Board ("ICCB") founded by Vint Cerf in 1979, the International Control Board, and the Internet Activities Board.[54] The Internet Engineering Task Force ("IETF") was launched in 1986.

Commercial services were authorized on "the Internet" beginning in 1989, and with it came a plethora of new bodies involved in some element of Internet governance or standards. The Internet Society ("ISOC") arrived in 1992, along with the Internet Architecture Board ("IAB"), which replaced ICCB. The World Wide Web Consortium ("W3C") followed two years later, and the Internet Corporation for

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50 *Id.*

51 Vinton G. Cerf & Robert E. Kahn, *A Protocol for Packet Network Intercommunication*, 22 IEEE TRANSACTIONS ON COMM. 637 (1974). In essence, TCP creates and organizes data packets, while IP wraps a header with routing instructions around each packet. UDP was another host-to-host protocol developed in this same timeframe.

52 Ronda Hauben, *From the ARPANET to the Internet*, COLUMBIA UNIVERSITY, http://www.columbia.edu/~rh120/other/tcpdigest_paper.txt.

53 Clark, *supra* note 44, at 106.

54 Birth of the Internet, ARPANET: General Overview, SMITHSONIAN.YAHOO.COM, http://smithsonian.yahoo.com/arpanet2.html.

Assigned Names and Numbers ("ICANN") made its appearance in 1998. As government control and funding declined, commercial and non-commercial entities alike stepped into the breach to guide the Internet's continuing evolution.

2. From Government Roots to Market Reality

Amazingly, some would contest this long-settled version of the Net's history. Gordon Crovitz, former publisher of *The Wall Street Journal*, proclaimed in a recent opinion piece that "[i]t's an urban legend that the government launched the Internet."[55] The reaction to this piece was swift, and appropriately merciless.[56] It is troubling that a major publication would publish such nonsense. As much as there is ignorance about the basic workings of the Internet, the article demonstrated an apparently willful effort to confuse the public about its origins as well.[57] The reality is that the Net's design derives directly from its birth as an unusual confluence of government, academic, and libertarian culture, which only gradually gave way to commercialization.

Indeed, it is a fascinating question whether the Internet would have developed on its own as a purely commercial creature of the marketplace. Networking pioneer and entrepreneur Charles Ferguson, for one, says no. He argues that many new technologies like the Internet typically come not from the free market or the venture capital industry. Rather, "[v]irtually all the critical technologies in the Internet and Web revolution were developed between 1967 and 1993 by government research agencies and/or in universities."[58]

Steve Crocker, an original technical pioneer of the Internet, shares that view. He points out that the Internet never could have been created

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55 Gordon Crovitz, *Who Really Invented the Internet?*, WALL ST. J. (July 22, 2012, 6:21 PM), http://online.wsj.com/article/SB10000872396390444464304577539063008406518.html. Instead, he claims, Xerox should get "full credit" for such an invention. His motivation for holding and explicating such a view, apparently, is that the Net's history is "too often wrongly cited to justify big government." *Id.*

56 *See, e.g.*, Farhad Manjoo, *Obama Was Right: The Government Invented the Internet*, SLATE (July 24, 2012, 6:03 PM), http://www.slate.com/articles/technology/technology/2012/07/who_invented_the_internet_the_outrageous_conservative_claim_that_every_tech_innovation_came_from_private_enterprise_.html ("Crovitz's entire yarn is almost hysterically false. . . . [A] ridiculously partisan theory."); Harry McCracken, *How Government Did (and Didn't) Invent the Internet*, TIME (July 25, 2012), http://techland.time.com/2012/07/25/how-government-did-and-didnt-invent-the-internet (Crovitz's argument "is bizarrely, definitively false."). Vint Cerf also provided a pointed response. *See* Charles Cooper, *No Credit for Uncle Sam in Creating Net? Vint Cerf Disagrees*, CNET (July 25, 2012, 10:58 AM), http://news.cnet.com/8301-1023_3-57479781-93/no-credit-for-uncle-sam-in-creating-net-vint-cerf-disagrees ("I would happily fertilize my tomatoes with Crovitz' assertion.").

57 Moreover, election-year posturing should not be allowed to obscure the simple fact that the Internet is a different animal because of its origins.

58 CHARLES H. FERGUSON, HIGH STAKES, NO PRISONERS: A WINNER'S TALE OF GREED AND GLORY IN THE INTERNET WARS 13 (Times Books ed. 1999).

without government's assistance as funder and convener.[59] In particular, the Internet's open architecture was a fundamental principle that was a hallmark of the government research effort, one that would not have come about if the Net had been created instead by private industry.[60] Indeed, "without the existence of a ready alternative like the Internet, [the relatively] 'closed' [online] networks may well have become the prevailing marketplace norm."[61]

Regardless, given its distinctive origins at the "unlikely intersection of big science, military research, and libertarian culture,"[62] it is not surprising that the players, processes, and guiding philosophies pertinent to how the Net was designed and operated are rather unique. This may well mean that we need some unconventional tools to fully assess the Net as a technological and social phenomenon not springing ready-made from the market.

3. Rough Consensus and Running Code

With the Net's roots stretching at least as far back as 1962, "[t]he initial impulse and funding for the Internet came from the government military sector," with "members of the academic community enjoy[ing] great freedom" as they helped create the network of networks.[63] According to Justyna Hofmokl, that freedom "remained as a major source of path dependency," as shown in the early shaping principles and operating rules of the Net: the lack of a central command unit (with consensus-driven, democratic processes to define operations), the principle of network neutrality (a simple network with intelligence residing at the end points), and an open access principle (local networks joining the emerging global Internet structure).[64]

During its first decade, the Net's design criteria were conceptualized in powerfully path-dependent ways that have been foundational for the treatment of legal and policy issues then and now—what Sandra Braman calls "the framing years."[65] Key to the design criteria is technical standards, the language that computers, phones, software, and network equipment use to talk to each other.[66] Protocols

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59 Steve Crocker, *Where Did the Internet Really Come From?*, TECHPRESIDENT (Aug. 3, 2012), http://techpresident.com/news/22670/where-did-internet-really-come.
60 *Id.*
61 *See Emergence Economics*, *supra* note 32, at 254.
62 MANUEL CASTELLS, THE INTERNET GALAXY 17 (2001).
63 Justyna Hofmokl, *The Internet Commons: Towards an Eclectic Theoretical Framework*, 4 INT'L J. COMMONS 226, 230 (2010).
64 *Id.*
65 Sandra Braman, Presentation at the Telecommunications Policy Research Conference: The Framing Years: Policy Fundamentals in the Internet Design Process, 1969–1979, at 3 (Oct. 2010), *available at* http://ssrn.com/abstract=1989650.
66 *The Importance of Voluntary Technical Standards for the Internet and Its Users*, *supra* note 45, at 1.

became widely recognized technical agreements among computers and other devices about how data moves between physical networks.[67] Internet pioneer Steve Crocker states that a "culture of open processes" led to the development of standards and protocols that became building blocks for the Net.[68] Informal rules became the pillars of Internet culture, including a loose set of values and norms shared by group members.[69] The resulting broader global vision of both process and rules "overshadowed the orientation that initially had been pursued by the government agencies focused on building specific military applications."[70]

Unconventional entities accompany these informal rules. Today there is no single governing body or process that directs the development of the Internet's protocols.[71] Instead, we have multiple bodies and processes of consensus. Much of the "governance" of the Internet is carried out by so-called multistakeholder organizations (MSOs) such as ISOC, W3C, and ICANN. Over the last two decades, although these entities have largely established the relevant norms and standards for the global Internet, "they are little known to the general public and even to most regulators and legislators."[72]

ISOC is one of the most important and influential MSOs, with a stated mission "to assure the open development, evolution, and use of the Internet for the benefit of all people throughout the world."[73] Since 1992 engineers, users, and the companies that assemble and run the Internet debate at ISOC about what particular course the Net should take.[74]

The Internet Engineering Task Force ("IETF") now operates under the auspices of ISOC, and its stated goal is "to make the Internet work better."[75] It grew out of the Internet Activities Board, and previously

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67 DOC SEARLS, INTENTION ECONOMY 96–97 (2012). In 1969 the Network Working Group adopted the word "protocol" (then in widespread use in the medical and political fields to mean "agreed procedures") to denote the set of rules created to enable communications via ARPANET. Interestingly, the Greek root "protokollon" refers to a bit of papyrus affixed to the beginning of a scroll to describe its contents—much like the header of a data packet. *See Horizontal Leap*, *supra* note 35, at 601–02.

68 *Broadband Policy*, *supra* note 32, at 507 n.533.

69 Hofmokl, *supra* note 63, at 230.

70 *Id.* at 231.

71 Gerald Bernbom, *Analyzing the Internet as a Common Pool Resource: The Problem of Network Congestion* 13 (Int'l Ass'n for the Study of Common Property, Pre-Conference Draft, 2000), *available at* http://citeseerx.ist.psu.edu/viewdoc/summary?doi=10.1.1.119.9942.

72 Joe Waz & Phil Weiser, *Internet Governance: The Role of Multistakeholder Organizations*, 10 J. TELECOMM. & HIGH TECH. L. 331, 322 (2012).

73 *FAQ*, INTERNET SOCIETY, http://www.isoc.org/dotorg/faq.shtml (last visited Feb. 13, 2013).

74 *Internet Society (ISOC)*, AMERICAN REGISTRY FOR INTERNET NUMBERS, https://www.arin.net/participate/governance/isoc.html.

75 H. Alvestrand, *A Mission Statement for the IETF* 1 (Network Working Group, Request for Comments No. 3935) (Oct. 2004), *available at* http://www.ietf.org/rfc/rfc3935.txt [hereinafter RFC 3935].

the Internet Configuration Control Board. The IETF is the institution that has developed the core networking protocols for the Internet, including IPv4, IPv6, TCP, UDP, and countless others.[76] The body is open to any interested individual, meets three times a year, and conducts activities through working groups in various technical areas. Its standards-setting process includes electronic publishing and broad distribution of proposed standards.

The IETF has articulated its own cardinal principles for operation. The body employs an open process (where any interested person can participate, know what is being decided, and be heard), relies on technical competence (where input and output is limited to areas of "engineering quality"), has a volunteer core of leaders and participants, utilizes "rough consensus and running code" (standards are derived from a combination of engineering judgment and real-world experience), and accepts responsibility for all aspects of any protocol for which it takes ownership.[77] An early document states that IETF should act as a trustee for the public good, with a requirement that all groups be treated equitably, and an express recognition of the role for stakeholders.[78] Some have argued that this statement alone created "the underpinning of the multistakeholder governance system that is the foundation of Internet governance."[79]

The Request for Comments ("RFC") process was first established by Steve Crocker of UCLA in April 1969.[80] These memos were intended as an informal means of distributing shared ideas among network researchers on the ARPANET project.[81] "The effect of the RFCs was to create a positive feedback loop, so ideas or proposals presented in one RFC would trigger other RFCs."[82] A specification document would be created once consensus came together within the governing organization (eventually IETF), and used as the basis for implementation by various research teams. RFCs are now viewed as the "documents of record" in the Net standards community,[83] with over six thousand documents in existence.

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[76] Laura DeNardis, *The Emerging Field of Internet Governance* 7 (Yale Info. Soc. Working Paper Series, 2010), *available at* http://papers.ssrn.com/sol3/papers.cfm?abstract_id=1678343.

[77] Alvestrand, *supra* note 75, at 1–2.

[78] J. Postel, *Domain Name System Structure and Delegation* 4–5 (Network Working Group, Request for Comments No. 1591) (Mar. 1994), *available at* http://www.ietf.org/rfc/rfc1591.txt [hereinafter RFC 1591].

[79] Avri Doria, *Study Report: Policy Implications of Future Network Architectures and Technology* 19 (Berlin Symposium on Internet and Society, Pre-Conference Draft, 2011), *available at* http://berlinsymposium.org/sites/berlinsymposium.org/files/paper_future_internet-new_covertext_1.pdf.

[80] Leiner et al., *supra* note 46, at 106.

[81] *Id.*

[82] *Id.*

[83] *Id.*

An RFC does not automatically carry the full status of a standard. Three types of RFCs can be promulgated: the proposed standard (containing specifications and some demonstrated utility), the draft standard (referencing implementations and at least some limited operational capability), and the standard itself (showing demonstrated operational capacity).[84] A proposed or draft standard can only become an actual standard once it has been readily accepted and used in the market. In fact, "[s]tandards ultimately succeed or fail based on the response of the marketplace."[85]

Other organizations involved in governing the Internet include W3C and ICANN. W3C was formed in 1994 to evolve the various protocols and standards associated with the World Wide Web. The body produces widely available specifications, called Recommendations, which describe the building blocks of the Web. ICANN was formed in 1998, in what Milton Mueller calls "cyberspace's constitutional moment."[86] Its relatively narrow role is to manage the unique system of identifiers of the Internet, including domain names, Internet addresses, and parameters of the Internet Protocol suite.[87]

As we shall see, the Internet's "running code" is a reflection of its unique heritage: open standards and public commons (as opposed to proprietary standards and private property). While much of its underlying physical networks, applications, and content come from the commercial, privately-owned and -operated world, its logical architectural platform typically does not.

B. *The Internet's Designed Architecture*

Complex systems like the Internet can only be understood in their entirety by "abstraction and reasoned about by reference to principles."[88] "Architecture" is a high-level descriptor of a complex system's organization of basic building blocks, its fundamental structures.[89] How the Internet runs is completely dependent on the implementing software code, its fundamental nature created and shaped by engineers.[90] Indeed, "the Internet's value is founded in its technical

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84 *What RFCs Are*, IT AND COMMUNICATION (Jan. 27, 2004), http://www.cs.tut.fi/~jkorpela/rfcs.html.

85 Kevin Werbach, *Higher Standards Regulation in the Network Age*, 23 HARV. J.L. & TECH. 179, 199 (2009).

86 MILTON L. MUELLER, RULING THE ROOT 5 (2002). He believes there is no suitable legal or organizational framework in place to govern the Net. *Id.* at 4.

87 *Welcome to ICANN!*, INTERNET CORPORATION FOR ASSIGNED NAMES AND NUMBERS, http://www.icann.org/en/about/welcome.

88 MATTHIAS BARWOLFF, END-TO-END ARGUMENTS IN THE INTERNET: PRINCIPLES, PRACTICES, AND THEORY 133 (2010).

89 BARBARA VAN SCHEWICK, INTERNET ARCHITECTURE AND INNOVATION 20 (2010).

90 Solum & Chung, *supra* note 35, at 12.

architecture."[91]

Technology mediates and gives texture to certain kinds of private relationships, weighing in on the side of one vested interest over others.[92] "Design choices frequently have political consequences—they shape the relative power of different groups in society."[93] Or, put differently, "technology has politics."[94] Law and technology both have the power to organize and impose order on society.[95] Importantly, "technology design may be the instrument of law, or it may provide a means of superseding the law altogether."[96] Langdon Winner may have put it best (in a pre-Internet formulation): "The issues that divide or unite people in society are settled not only in the institutions and practices of politics proper, but also, and less obviously, in tangible arrangements of steel and concrete, wires and semiconductors, nuts and bolts."[97] Indeed, "like laws or social norms, architecture shapes human behavior by imposing constraints on those who interact with it."[98]

David Clark and others remind us that

> [T]here is no such thing as value-neutral design. What choices designers include or exclude, what interfaces are defined or not, what protocols are open or proprietary, can have a profound influence on the shape of the Internet, the motivations of the players, and the potential for distortion of the architecture.[99]

Those responsible for the technical design of the early days of the Internet may not always have been aware that their preliminary, and often tentative and experimental, decisions were simultaneously creating enduring frames not only for the Internet, but also for their treatment of social policy issues.[100] As time went on, however, those decisions came more into focus. The IETF proclaims that "[t]he Internet isn't value-neutral, and neither is the IETF. . . . We embrace technical concepts such as decentralized control, edge-user empowerment, and sharing of resources, because those concepts

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91 Searls & Weinberger, *supra* note 36.
92 Helen Nissenbaum, *From Preemption to Circumvention: If Technology Regulates, Why Do We Need Regulation (and Vice Versa)?*, 26 BERKELEY TECH. L.J. 1367, 1375 (2011).
93 Ian Brown, David D. Clark, & Dirk Trossen, *Should Specific Values Be Embedded in the Internet Architecture?*, ReArch Technical Program 2010, http://conferences.sigcomm.org/co-next/2010/Workshops/REARCH/ReArch_papers/10-Brown.pdf.
94 Nissenbaum, *supra* note 92, at 1377.
95 *Id.* at 1373.
96 Sandra Braman, *Defining Information Policy*, 1 J. INFO. POL'Y 1, 4 (2011).
97 Langdon Winner, *Do Artifacts Have Politics?*, *in* THE WHALE AND THE REACTOR: IN SEARCH FOR LIMITS IN AN AGE OF HIGH TECHNOLOGY 19, 29 (1986).
98 VAN SCHEWICK, *supra* note 89, at 28.
99 David D. Clark, et al., *Tussle in Cyberspace: Defining Tomorrow's Internet,* SIGCOMM '02, at 347, 350 (2002), *available at* https://www.cs.duke.edu/courses/compsci514/cps214/spring09/papers/p347-clark.pdf.
100 Braman, *supra* note 65, at 29.

resonate with the core values of the IETF community."[101] And as we shall see, the implications are profound for the world of policymaking. Per Kleinwachter, "[l]ike the natural laws of physics, the architecture of the Internet determines the spaces in which public policy can be developed and executed."[102]

It may well be true that "[e]ngineering feed-back from real implementations is more important than any architectural principles."[103] And yet, the fundamental design attributes of the Net have stood the challenge of time. Through several decades of design and implementation, and several more decades of actual use and endless tinkering, these are the elements that simply work.

C. *The Internet Design Model: Four Functional Attributes*

The Internet is a network of networks, an organic arrangement of disparate underlying communications platforms melded together through common protocols. The Net's architecture constitutes a "non-material" infrastructure of virtual resources not linked to any location or nationality.[104] Understanding the what, where, why, and how of this architecture goes a long way towards understanding the role the Net serves in modern society, and the many benefits (and some challenges) it provides.

It would be quite useful to come up with "a set of principles and concerns that suffice to inform the problem of the proper placement . . . of functions in a distributed network such as the Internet."[105] Data networks like the Internet actually operate at several different levels. Avri Doria helpfully divides the world of Internet protocols and standards into three buckets.[106] First we have the general communications engineering principles, consisting of generic elements like simplicity, flexibility, and adaptability.[107] Next we have the specific design attributes of the Internet, such as no-top-down design, packet-switching, end-to-end transmission, layering, and the Internet Protocol hourglass.[108] Finally we have the actual operational resources, those naming and numbering features dedicated to carrying out the design principles; these include the Domain Name System ("DNS"), IP addressing, and Autonomous System Numbers.[109] This Article will

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101 RFC 3935, supra note 75, at 4.
102 Kleinwachter, *supra* note 38, at 474.
103 B. Carpenter, *Architectural Principles of the Internet* 4 (Network Working Group, Request for Comments No. 1958) (June 1996), *available at* http://www.ietf.org/rfc/rfc1958.txt [hereinafter RFC 1958].
104 Kleinwachter, *supra* note 38, at 475.
105 BARWOLFF, *supra* note 88, at 135.
106 *See* Doria, *supra* note 79.
107 *Id.* at 7–18.
108 *Id.*
109 *Id. See* DeNardis, *supra* note 76, at 4. She calls these "critical Internet resources."

focus on Doria's second bucket of the Net's fundamental design attributes, the home of many of the Net's defining software protocols.

DeNardis points out the key role played by protocol standards in the logical layers:

> The Internet "works" because it is universally based upon a common protocological language. Protocols are sometimes considered difficult to grasp because they are intangible and often invisible to Internet users. They are not software and they are not material hardware. They are closer to text. Protocols are literally the blueprints, or standards, that technology developers use to manufacture products that will inherently be compatible with other products based on the same standards. Routine Internet use involves the direct engagement of hundreds of standards . . . .[110]

Scholars differ on how to define and number the Net's design attributes. As mentioned, Doria identifies the lack of top-down design, packet-switching, end-to-end transmission, layering, and the Internet Protocol hourglass.[111] Barwolff sees five fundamental design principles of the Internet: end-to-end, modularity, best efforts, cascadability, and complexity avoidance.[112] Bernbom comes up with his own five principles of distributed systems, network of networks, peer-to-peer, open standards, and best efforts.[113] Barbara van Schewick weighs in with another short list of design principles: layering, modularity, and two forms (the narrow version and the strong version) of the end-to-end principle.[114]

RFC 1958 probably best summed it up back in 1996: "[I]n very general terms, the community believes that the goal is connectivity, the tool is the Internet Protocol, and the intelligence is end to end rather than hidden in the network."[115] And, one can add with confidence, modularity or layering is the logical scaffolding that makes it all work together. So, consistent with RFC 1958 and other sources, I come up with a list of four major design attributes: (1) the structure of layering (the what); (2) the goal of connectivity (the why); (3) the tool of the Internet Protocol (the how); and (4) the ends-based location of function (the where).[116]

As with Doria's exercise, it is important at this point to separate

110 *Id.* at 6 (citation omitted).
111 Doria, *supra* note 79, at 8–12.
112 BARWOLFF, *supra* note 88.
113 Bernbom, *supra* note 71, at 3–5.
114 VAN SCHEWICK, *supra* note 89, at 5. Van Schewick sees layering as a special kind of modularity. I agree, which is why I refrain from assigning modularity as a wholly separate design attribute. Modularity is more of a general systems element applicable in most data networks. For this Article, I use the two terms interchangeably.
115 RFC 1958, *supra* note 103, at 2.
116 *See also Emergence Economics*, *supra* note 32.

out the actual network function from both the impetus and the effect, even though those aspects are critical to understanding a particular function's role. Design attributes also are not the same as the actual network instantiations, like DNS and packet-switching. My list may not be definitive, but it does seek to capture in a single design model much of the logical essence of the Net.

1. The Law of Code: Modularity

The modular nature of the Internet describes the "what," or its overall structural architecture. "The use of layering means that functional tasks are divided up and assigned to different software-based protocol layers."[117] For example, the "physical" layers of the network govern how electrical signals are carried over physical wiring; independently, the "transport" layers deal with how data packets are routed to their correct destinations, and what they look like, while the "application" layers control how those packets are used by an email program, web browser, or other user application or service.

This simple and flexible system creates a network of modular "building blocks," where applications or protocols at higher layers can be developed or modified with no impact on lower layers, while lower layers can adopt new transmission and switching technologies without requiring changes to upper layers. Reliance on a modular system of layers greatly facilitates the unimpeded delivery of packets from one point to another. Importantly, the creation of interdependent layers also creates interfaces between them. These stable interfaces are the key features that allow each layer to be implemented in different ways.

RFC 1958 reports that "[m]odularity is good. If you can keep things separate, do so."[118] In particular, layers create a degree of "modularity," which allows for ease of maintenance within the network. "Layering thus organizes [separate] modules into a partially ordered hierarchy."[119] This independence, and interdependence, of each layer creates a useful level of abstraction as one moves through the layered stack. Stable interfaces between the layers fully enable this utility. In particular, the user's ability to alter functionality at a certain layer without affecting the rest of the network can yield "tremendous efficiencies when one seeks to upgrade an existing application (higher layer) that makes extensive use of underlying physical infrastructure

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117 *Id.* at 256.

118 RFC 1958, *supra* note 103, at 4. On the other hand, some forms of layering (or vertical integration) can be harmful if the complete separation of functions makes the network operate less efficiently. *See* R. Bush & D. Meyer, *Some Internet Architectural Guidelines and Philosophy* 7–8 (Network Working Group, Request for Comment No. 3439) (Dec. 2002), *available at* http://www.ietf.org/rfc/rfc3439.txt [hereinafter RFC 3439].

119 VAN SCHEWICK, *supra* note 89, at 46.

(lower layer)."[120] So, applications or protocols at higher layers can be developed or modified with little or no impact on lower layers.[121]

In all engineering-based models of the Internet, the fundamental point is that the horizontal layers, defined by code or software, serve as functional components of an end-to-end communications system. Each layer operates on its own terms, with unique rules and constraints, and interfaces with other layers in carefully defined ways.[122]

2. Smart Edges: End-to-End

The end-to-end ("e2e") design principle describes the "where," or the place for network functions to reside in the layered protocol stack. The general proposition is that the core of the Internet (the network itself) tends to support the edge of the Internet (the end user applications, content, and other activities).[123] RFC 1958 states that "the intelligence is end to end rather than hidden in the network," with most work "done at the fringes."[124] Some have rendered this broadly to mean that dumb networks support smart applications.[125] A more precise technical translation is that a class of functions generally can be more completely and correctly implemented by the applications at each end of a network communication. By removing interpretation of applications from the network, one also vastly simplifies the network's job: just deliver IP packets, and the rest will be handled at a higher layer. In other words, the network should support generality, as well as functional simplicity.[126]

The e2e norm/principle arose in the academic communities of the 1960s and 1970s, and only managed to take hold when the U.S. Government compelled adoption of the TCP/IP protocols, mandated a regulated separation of conduit and content, and granted

120 *Horizontal Leap*, *supra* note 35, at 604.

121 *Emergence Economics*, *supra* note 32, at 257. *See also* Chistopher S. Yoo, *Modularity and Internet Policy* 12 (2010) (Telecomms. Pol'y Res. Conf. Submission), *available at* http://papers.ssrn.com/sol3/papers.cfm?abstract_id=2032221 (the benefits of modularity include making complexity more manageable, accelerating innovation, facilitating the division of labor, and promoting flexibility).

122 *Horizontal Leap*, *supra* note 32, at 602. "In the 'pure' version of layering, a layer is allowed to use only the layer immediately below it. . . . In the 'relaxed' version of the layering principle, a layer is permitted to utilize any layer that lies below it." VAN SCHEWICK, *supra* note 89, at 45. The Internet uses a version of relaxed layering, with IP acting as the "portability" layer for all layers above it. *Id.*

123 *Emergence Economics*, *supra* note 32, at 257–58.

124 RFC 1958, *supra* note 103, at 2, 4.

125 David S. Isenberg, *The Dawn of the Stupid Network*, NETWORKER (June 6, 1998), *available at* http://www.isen.com/papers/Dawnstupid.html.

126 As van Schewick puts it, e2e requires not "stupidity" or simplicity in the network core, but that network functions need only be general in order to support a wide range of functions in the higher layers. VAN SCHEWICK, *supra* note 89, at 107. One wonders if excessive and often pejorative talk about "stupid networks" versus "smart edges" has made these basic concepts more contentious for some than they need to be.

nondiscriminatory network access to computer device manufacturers and dial-up online companies.[127] These authoritative "nudges" pushed the network to the e2e norm.[128] Consequently end-to-end arguments "have over time come to be widely considered the defining, if vague, normative principle to govern the Internet."[129]

While end-to-end was part of Internet architecture for a number of years prior, the concept was first identified, named, and described by Jerome Saltzer, David Reed, and David Clark in 1981.[130] The simplest formulation of the end-to-end principle is that packets go into the network and come out without change, and that is all that happens in the network. This formulation echoes the 1974 Cerf-Kahn paper, which describes packet encapsulation as a process that contemplates no alteration to the contents of the packets.[131]

The e2e principle suggests that specific application-level functions "ideally operate[] on the edges, at the level of client applications that individuals set up and manipulate."[132] By contrast, from the network's perspective, "shared ignorance is built into the infrastructure through widespread compliance with the end-to-end design principle."[133] In addition, and contrary to some claims, e2e is not really neutral; it effectively precludes prioritization based on the demands of some uses, and favors one set of applications over another.[134] The e2e principle also generally favors reliability at the expense of timeliness.[135]

The concept of e2e design is "closely related to, and provides substantial support for, the concept of protocol layering."[136] End-to-end tells us where to place the network functions within a layered architecture.[137] In fact, end-to-end guides how functionality is distributed in a multilayer network, so that layering must be applied first.[138] Both relate to the overall general design objectives of keeping

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127 *Broadband Policy*, *supra* note 32, at 507.

128 *Id.*

129 BARWOLFF, *supra* note 88, at 134.

130 VAN SCHEWICK, *supra* note 89, at 58.

131 *See* Cerf & Kahn, *supra* note 51.

132 *Emergence Economics*, *supra* note 32, at 258.

133 BRETT M. FRISCHMANN, INFRASTRUCTURE 322 (2012).

134 *Id.* at 324, 326. Richard Bennett, a persistent critic of the "mythical history" and "magical properties" of the Internet, claims that end-to-end arguments "don't go far enough to promote the same degree of innovation in network-enabled services as they do for network-independent applications." RICHARD BENNETT, DESIGNED FOR CHANGE: END-TO-END ARGUMENTS, INTERNET INNOVATION, AND THE NET NEUTRALITY DEBATE 27, 38 (2009), *available at* http://www.itif.org/files/2009-designed-for-change.pdf. To the extent this is a true statement, it reflects again that the Internet's many founding engineers made deliberate design choices.

135 *See* Saltzer et. al., *End-to-End Arguments in System Design* 4, M.I.T. LABORATORY FOR COMPUTER SCIENCE, http://web.mit.edu/Saltzer/www/publications/endtoend/endtoend.pdf.

136 *Horizontal Leap*, *supra* note 35, at 604–05.

137 *Id.* at 604.

138 VAN SCHEWICK, *supra* note 89, at 57–58.

"the basic Internet protocols simple, general, and open."[139]

With regard to the Internet, the end-to-end argument now has been transformed into a broader suggestion to leave much of the network power and functionality in the hands of the application.[140] Of course, the e2e principle can be prone to exaggeration, and there are competing versions in the academic literature.[141] One cannot have a modern data network without a core, and in particular, the transport functionality to connect together the myriad constituents of the edge, as well as the widespread distribution of the applications, content, and services provided by the edge. Elements of the core network, while erecting certain barriers (such as firewalls and traffic shaping) that limit pure e2e functionality,[142] may still allow relatively unfettered user-to-user connectivity at the applications and content layers. To have a fully functioning network, the edge and the core need each other. And they need to be connected together.

3. A Network of Networks: Interconnection

RFC 1958 puts it plainly: the goal of the Internet, its "why," is connectivity.[143] The Internet has both a physical architecture and a virtual one.[144] Unlike the earlier ARPANET, the Internet is a collection of IP networks owned and operated in part by private telecommunications companies, and in part by governments, universities, individuals, and other types of entities, each of which needs to connect together.[145] Kevin Werbach has pointed out that connectivity is an often under-appreciated aspect of Internet architecture.[146] "The defining characteristic of the Net is not the absence of discrimination, but a relentless commitment to interconnectivity."[147]

Jim Speta agrees that the Internet's utility largely depends on "the principle of universal interconnectivity . . . both as a technical and as an

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139 *Horizontal Leap*, *supra* note 35, at 605.
140 *Emergence Economics*, *supra* note 32, at 259.
141 Barbara van Schewick devotes considerable attention to the task of separating out what she calls the "narrow" and "broad" versions of the end-to-end principle. *See* VAN SCHEWICK, *supra* note 89, at 37–81. She finds "real differences in scope, content, and validity" between the two and plausibly concludes that the Net's original architecture was based on the broader version that more directly constrains the placement of functions in the lower layers of the network. *Id.* at 59. As one example, the RFCs and other IETF documents are usually based on the broad version. *See id.* at 105. For purposes of this paper, however, we need only recognize that some form of the end-to-end concept has been firmly embedded in the Net as one of its chief design attributes.
142 *See Broadband Policy*, *supra* note 32, at 453 n.199.
143 RFC 1958, *supra* note 103, at 2.
144 DeNardis, *supra* note 76, at 12.
145 *See id.* at 12.
146 *See Emergence Economics*, *supra* note 32, at 259.
147 *Broadband Policy*, *supra* note 32, at 522 (quoting Kevin Werbach, *Only Connect*, 22 BERKELEY TECH. L.J. 1233, 1273 (2007)).

economic matter."[148] In order to become part of the Internet, owners and operators of individual networks voluntarily connect to preexisting networks. This aspect of the Net goes to its "why," which is the overarching rationale of moving traffic from Point A to Point B. The early Internet was designed with an emphasis on internetworking and interconnectivity and moving packets of data transparently across a network of networks. Steve Crocker reports that in a pre-Internet environment all hosts would benefit from interconnecting with ARPANET, but that "the interconnection had to treat all of the networks with equal status" with "none subservient to any other."[149]

Today's Internet embodies a key underlying technical idea: open-architecture networking. Bob Kahn first articulated this concept of open architecture in 1972, and it became the basis for later Internet design. Under this design principle, network providers can freely interwork with other networks through "a meta-level 'internetworking architecture.'"[150] Critical ground rules require that each distinct network must stand on its own, communications must be on a best-effort basis, and there cannot be global control at the operations level.[151] Impetus for the best efforts concept then is the desire for as many different networks as possible to voluntarily connect, even if strong guarantees of packet delivery were not possible.

The Internet's goal of open and voluntary connectivity requires technical cooperation between different network service providers.[152] Networks of all types, shapes, and sizes voluntarily choose to interoperate and interconnect with other networks. They do so by agreeing to adopt the Internet's protocols as a way of passing data traffic to and from other entities on the Internet. For example, it has always been legally and technically permissible for a private network, such as a broadband operator, to opt out by ceasing to offer Internet access or transport services—to reject TCP/IP—and instead provide only proprietary services.[153] So, "[i]f you want to put a computer—or a cell phone or a refrigerator—on the network, you have to agree to the agreement that is the Internet."[154]

Bernbom says that the key elements of the network of networks include "[t]he autonomy of network participants, the rule-based requirements for interconnection, and the peer-to-peer nature of

[148] *Id.* (quoting James B. Speta, *FCC Authority to Regulate the Internet: Creating It and Limiting It*, 35 LOY. U. CHI. L.J. 15, 17 (2003)).
[149] Crocker, *supra* note 59.
[150] Leiner et al., *supra* note 46, at 103.
[151] *See id.* at 103–04.
[152] *See* RFC 1958, *supra* note 103, at 2.
[153] *See* FRISCHMANN, *supra* note 133, at 345.
[154] *Broadband Policy*, *supra* note 32, at 504 (quoting Searls & Weinberger, *supra* note 36).

interconnection agreements."[155] Ignoring one or more of these elements can diminish or eliminate a network's interoperability with the rest of the Internet.[156]

In their recent book *Interop*, Palfrey and Gasser observe that "[t]he benefits and costs of interoperability are most apparent when technologies work together so that the data they exchange prove useful at the other end of the transaction."[157] Without interoperability at the lower layers of the Internet, interoperability at the higher layers—the human and institutional layers—is often impossible.[158] Their concept of "interop" is to "embrace certain kinds of diversity not by making systems, applications, and components the same but by enabling them to work together."[159] If the underlying platforms are open and designed with interoperability in mind, then all players—including end users and intermediaries—can contribute to the development of new products and services.[160]

Interconnection agreements between different network providers typically are unseen, "in that there are no directly relevant statutes, there is no regulatory oversight, and there is little transparency in private contracts and agreements."[161] The fundamental goal is that the Internet must be built by interconnecting existing networks, and employing "best efforts" as the baseline quality of service for the Internet makes it easier to interconnect a wide variety of network hardware and software.[162] This also facilitates a more robust, survivable network of networks, or "*assured continuity*."[163] As a result, "the best effort principle is reflected in today's interconnection agreements across IP-networks taking the form of transit and peering agreements."[164]

We must not overlook the obvious financial implications of interconnecting disparate networks. "Interconnection agreements do not just route traffic in the Internet, they also route money."[165] A

155 Bernbom, *supra* note 71, at 5. Interestingly, he ties these same elements to maintaining the Internet as a commons. *See id.*
156 *See id.* at 23.
157 JOHN PALFREY & URS GASSER, INTEROP: THE PROMISE AND PERILS OF HIGHLY INTERCONNECTED SYSTEMS 22 (2012).
158 *See id.* at 23.
159 *Id.* at 108.
160 *See id.* at 121. Standard processes play a particularly important role in getting to interoperability. At least 250 technical interoperability standards are involved in the manufacture of the average laptop computer produced today. *Id.* at 163.
161 DeNardis, *supra* note 76, at 13.
162 *See* Solum & Chung, *supra* note 35, at 107.
163 *Id.*
164 Body of European Regulators for Electronic Communications, *An assessment of IP-Interconnection in the Context of Net Neutrality*, BoR (12) 33 at 5 (May 29, 2012) [hereinafter *IP-Interconnection*].
165 David Clark, William Lehr & Steven Bauer, *Interconnection in the Internet: The Policy Challenge*, MASS. INST. OF TECH., 2 (Aug. 9, 2011).

healthy flow of money between end users and access ISPs is important to sustain infrastructure investment, consistent with concerns about potential market power abuses.[166] Traditionally, interconnection agreements on the backbone were part of a relatively informal process of bargaining.[167] Transiting is where the ISP provides access for the entire Internet to its customers; peering is where two ISPs interconnect to exchange traffic on a revenues-neutral basis. The changing dynamics of Net interconnection economics include paid peering between content delivery networks (CDNs) and access ISPs.[168]

Interconnecting then is the baseline goal embedded in the Internet's architecture, creating incentives and opportunities for isolated systems to come together and for edges to become embedded in tightly interconnected networks. Werbach has shown that interconnectivity creates both decentralizing and centralizing trends in the Internet economy, with centripetal force (pulling networks and systems into the Internet commons) as well as centrifugal force (towards the creation of isolated gated communities).[169] Thus far, however, "the Internet ecosystem has managed to adapt IP interconnection arrangements to reflect (inter alia) changes in technology, changes in (relative) market power of players, demand patterns and business models."[170]

4. Agnostic Protocols: IP

RFC 1958 calls Internet Protocol ("IP") "the tool" for making the Internet what it is.[171] The design of the IP, or the "how," allows for the separation of the networks from the services that ride on top of them. IP was designed to be an open standard so that anyone could use it to create new applications and networks. By nature, IP is completely indifferent to both the underlying physical networks and the countless applications and devices using those networks. In particular, IP does not care what underlying transport is used (such as fiber, copper, cable, or radio waves), what application it is carrying (such as browsers, e-mail, Instant Messaging, or MP3 packets), or what content it is carrying (text, speech, music, pictures, or video). Thus, IP enables any and all user applications and content. "By strictly separating these functions across a relatively simply protocol interface the two parts of the network

[166] *See id.* at 2.
[167] *See id.* at 3.
[168] *See id.* at 2; *see also IP-Interconnection*, *supra* note 164, at 48 (observing that the emergence of CDNs and regional peering have together resulted in a reduced role for IP transit providers).
[169] *Emergence Economics*, *supra* note 32, at 260 (citing Kevin Werbach, *The Centripetal Network: How the Internet Holds Itself Together, and the Forces Tearing it Apart*, 42 U.C. DAVIS L. REV. 343, 348 (2008)).
[170] *IP-Interconnection*, *supra* note 164, at 48.
[171] RFC 1958, *supra* note 103, at 2.

were allowed to evolve independently but yet remain connected."[172]

In 1974, Vint Cerf and Robert Kahn issued their seminal paper on the TCP/IP protocol suite, in which the authors "present a protocol design and philosophy that supports the sharing of resources that exist in different packet switching networks."[173] In 1977, IP was split off to facilitate the different functionality of the two types of protocols. Based in large part on how Cerf and Kahn designed the Internet architecture, the Internet Protocol has become a wildly successful open standard that anyone can use. By 1990, when ARPANET was finally decommissioned, TCP/IP had supplanted or marginalized other wide-area computer network protocols worldwide, and the IETF had overseen further development of the protocol suite. Thus, IP was on the way to becoming the bearer service for the Net.[174]

TCP and IP make possible the Net's design as general infrastructure.[175] IP is the single protocol that constitutes the "Internet layer" in the OSI stack, while TCP is one of the key protocols in the "transport layer." To higher layers, IP provides a function that is connectionless (each datagram is treated independent from all others) and unreliable (delivery is not guaranteed) between end hosts. By contrast, TCP provides a reliable and connection-oriented continuous data stream within an end host.[176] IP also provides best efforts delivery because although it successfully transmits datagrams, it does not provide any guarantees regarding delays, bandwidth, or losses.[177]

On the Internet, TCP and IP are the dominant uniform protocols (UDP is a parallel to TCP and is heavily used today for streaming video and similar applications). Because they are standardized and non-proprietary, the things we can do on top of them are incredibly diverse. "The system has standards at one layer (homogeneity) and diversity in the ways that ordinary people care about (heterogeneity)."[178]

About the ARPANET, RFC 172 tells us to "assume nothing about the information and treat it as a bit stream . . . whose interpretation is left to a higher level process, or a user."[179] That design philosophy plainly carried over to the Internet. As Barwolff puts it, IP fashions "the spanning layer" that creates "an irreducibly minimal coupling between the functions above and below itself."[180] Not only does IP separate the

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[172] Doria, *supra* note 79, at 7.
[173] *Emergence Economics*, *supra* note 32, at 260 (quoting Cerf & Kahn, *supra* note 51 at 637,
[174] *See* Leiner et al., *supra* note 46, at 106.
[175] *See id.* at 104.
[176] *See* VAN SCHEWICK, *supra* note 89, at 85–87.
[177] *See id.* at 85.
[178] PALFREY & GASSER, *supra* note 157, at 108.
[179] Abhay Bhushan et al., *The File Transfer Protocol* at 6 (Network Working Group, Request for Comments #172) (June 1971), *available at* http://www.rfc-editor.org/rfc/rfc172.txt.
[180] BARWOLFF, *supra* note 88, at 136.

communication peers at either end of the network, but it generally maintains a firm separation between the entities above and below it.[181] This is another example of how two discrete elements, in this case modular design and agnostic protocols, work closely together to create a distinctive set of network functions. IP also interconnects physical networks through routers in the networks. Moreover, Frischmann believes that TCP/IP actually implements the end-to-end design.[182]

C. *The End Result: A Simple, General, and Open Feedback Network*

The four fundamental architectural components of the Internet are not standalones or absolutes; instead, they each exist and interact in complex and dynamic ways along a continuum. Together, these functional attributes constitute what I call the Internet design model, in which the resulting network is simple, general, and open. At the same time, the different layers create the logical traffic lanes through which the other three attributes travel and are experienced. Thus, in one sense, modularity provides the Internet's foundational superstructure.

We must keep in mind that these four attributes describe the Internet in its native environment, with no alterations or impediments imposed by other agents in the larger ecosystem. Where laws or regulations, or other activities, curtail one or more of the design attributes, the Net becomes less than the sum of its parts. It is only when the design features are able to work together that we see the full emergent phenomenon of the Net. In this Article, I use the term "integrity" to describe how the design elements fit together and function cohesively to create the user's overall experience of the Internet.

Every design principle, instantiated in the network, has its drawbacks and compromises. Technical improvements are a given.[183] The Internet certainly could be simpler (or complex), more general (or specialized), or more open (or closed).[184] Nor is the Internet an absolutely neutral place, a level playing field for all comers.

The design features reinforce one another. For example, the layering attribute is related to the end-to-end principle in that it provides the framework for putting functionality at a relative edge within the network's protocol stack.[185] RFC 1958 states that keeping the

[181] *See id.* at 137.
[182] *See* FRISCHMANN, *supra* note 133, at 320. Frischmann also observes that the e2e concept is found in many infrastructure systems. *See also Emergence Economics*, *supra* note 32, at 260 (stating that IP was designed to follow the e2e principle).
[183] *Broadband Policy*, *supra* note 32, at 453.
[184] As one example, David Clark reports that the decision to impose the datagram model on the logical layers deprived them of an important source of information that they could use in achieving the lower layer goals of resource management and accountability. *See* Clark, *supra* note 44, at 113. Certainly a future version of the Net could provide a different building block for the datagram. *See id.*
[185] *See* Doria, *supra* note 79, at 7.

complexity of the Net at the edges is ensured by keeping the IP layer as simple as possible.[186] In turn, putting IP in a central role in the Internet is also "related loosely to layering."[187] At the same time, the "best efforts" paradigm is "intrinsically linked" to the nature of IP operating in the transmission network,[188] because IP defines passing packets on a best efforts basis.[189] Further, "TCP/IP, defines what it means to be part of the Internet."[190] Certainly the combination of the four design attributes has allowed end users to utilize the Net as a ubiquitous platform for their activities.[191]

The end result is that IP helps fashion what some have called a "virtuous hourglass" from disparate activities at the different network layers. In other words, the Net drives convergence at the IP (middle) layer, while facilitating divergence at the physical networks (lower) and applications/content (upper) layers. The interconnected nature of the network allows innovations to build upon each other in self-feeding loops. In many ways, layering is the key element that ties it all together.

As the networks and users that comprise it continue to change and evolve, the Net's core attributes of modularity, e2e, interconnectivity, and agnosticism are constantly being pushed and prodded by technology, market, and legal developments. That is not to say that these developments are inherently unhealthy. Clearly there are salient exceptions to every rule, if not new rules altogether. The Internet needs to be able to adjust to the realities of security concerns like denial-of-service ("DoS") attacks and the needs of latency-sensitive applications like streaming video and real-time gaming. The question is not whether the Net will evolve, but how.[192]

III. INTERNET DESIGN AS FOUNDATIONAL, DYNAMIC, AND COLLECTIVE

The first part of this Article seeks to respond to a basic question: What types of technologies and technical design features afford the greatest potential to drive user benefits? In the previous section, we took a relatively micro view, attempting to isolate and describe the Internet's four fundamental design attributes. This section takes the discussion to a more macro level perspective on the Internet as a whole. Depending on who you ask—a technologist, a scientist, or an economist—the answer to that question about facilitating user benefits is the same: the Internet. Whether as a general platform technology, a

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186 *See* RFC 1958, *supra* note 103, at 2–3. The layer principle is related to, but separate from, the broad version of the end-to-end principle. *See* VAN SCHEWICK, *supra* note 89, at 104–06.
187 Doria, *supra* note 79, at 7.
188 *IP-Interconnection*, *supra* note 164, at 4.
189 *See* SEARLS, *supra* note 67, at 97. "Best effort" is what IP requires. *Id.* at 141.
190 Werbach, *supra* note 85, at 194.
191 *See Emergence Economics*, *supra* note 32, at 300–01.
192 *See id.* at 262.

complex adaptive system, or a common pool resource, the Net serves as the ideal platform to promote and enhance a myriad of human activities. In brief, the Net's basic design enables massive spillovers, emergent phenomena, and shared resources.

A. *The Internet as General Platform Technology*

One answer to the user benefits question has been articulated in the ongoing research on General Purpose Technologies ("GPTs"). A GPT is a special type of technology that has broad-ranging enabling effects across many sectors of the economy. Technologists typically define a GPT as a generic technology that comes to be widely used, to have many uses, and to have many spillover effects.[193]

Timothy Bresnahan and Manuel Trajtenberg first published the foundational work on GPTs in 1992. They describe how this particular type of technology is most likely to generate increasing returns, in line with economist Paul Romer's New Growth Theory, with economic growth coming from specific applications that depend on ideas in the "general" layer of technology. Specifically, GPTs play the role of "enabling technologies" by opening up new opportunities rather than offering complete, final solutions. The result, as they found it, is "innovational complementarities," meaning "the productivity of R&D in a downstream sector increases as a consequence of innovation in the GPT technology. These complementarities magnify the effects of innovation in the GPT and help propagate them throughout the economy."[194]

The Internet has been labeled a GPT with "the potential to contribute disproportionately to economic growth" because it generates value "as inputs into a wide variety of productive activities engaged in by users."[195] Currently, the Net is an infrastructure resource that enables the production of a wide variety of private, public, and social goods.[196] As the early Net pioneers see it, "[T]he Internet was not designed for just one application but as a general infrastructure on which new applications could be conceived, exemplified later by the emergence of the Web. The general-purpose nature of the service provided by TCP and IP made this possible."[197]

The GPT literature demonstrates that Internet technologies share key features of a GPT, all of which help make the Net an enabling technology. These features include: widespread use across key sectors

193 *See id.* at 276.
194 *Id.* (quoting Timothy Bresnahan & Manuel Trajtenberg, *General Purpose Technologies 'Engines of Growth'?* (1992), *reprinted in* 65 J. ECON. 1, 83–84 (1995)).
195 *Id.*
196 *See* FRISCHMANN, *supra* note 133, at 334.
197 Leiner et al., *supra* note 46, at 104.

of the economy and social life; representation of a great scope of potential improvement over time; facilitation of innovations generating new products and processes; and a demonstration of complementarities with existing and emerging technologies.[198]

By its nature, a GPT maximizes the overall utility to society. Lipsey observes that GPTs help "rejuvenate the growth process by creating spillovers that go far beyond the concept of measurable externalities," and far beyond those agents that initiated the change.[199] This has important implications when trying to tally the total sum of beneficial value and activity generated by the Internet.[200] GPT theory emphasizes "the broader complementarity effects of the Internet as the enabling technology changing the characteristics, as well as the modes of production and consumption of many other goods."[201]

Perhaps the most important policy-related takeaway about GPTs is that keeping them "general" is not always in the best interest of firms that might seek to control them. A corporation might envision greater profits or efficiency by making a tremendously useful resource scarcer, by charging much higher than marginal cost, or by customizing solely for a particular application. While these perceptions might be true in the short term, or for that one firm's profits, they can have devastating effects on the growth of the overall economy. The more general purpose the technology, the greater are the growth-dampening effects of allowing it to become locked-down in the interest of a particular economic agent.[202] The important feature of generative platforms, such as the Internet, is that users can easily do numerous things with them, many of which may not have been envisioned by the designers. If, for example, the Internet had been built solely as a platform for sending email and required retooling to do anything else, most applications and business models never would have been developed.[203]

B. *The Internet as Complex Adaptive System*

In addition to serving as a GPT, the Internet is also a complex adaptive system ("CAS") whose architecture is much richer than the sum of its parts. As such, the smaller scale interactions of ordinary people on the Internet lead to larger scale structures and patterns, including emergent and self-organizing phenomena.

Complexity can be architectural in origin. It is believed that the dense interconnections within the "network of networks" produce the

198 *See* Hofmokl, *supra* note 63, at 241.
199 *Emergence Economics*, *supra* note 32, at 280.
200 *See id.* at 279–80.
201 Hofmokl, *supra* note 63, at 241.
202 *See Emergence Economics*, *supra* note 32, at 277.
203 *See id.* at 277–78.

strongly non-linear effects that are difficult to anticipate.[204] Engineers understand that more complex systems like the Internet display more non-linearities; these occur (are "amplified") at large scales and do not occur at smaller scales.[205] Moreover, more complex systems often exhibit increased interdependence between components due to "coupling" between or within protocol layers.[206] As a result, global human networks linked together by the Internet constitute a complex society, where more is different.[207]

As scientists are well aware, emergence is not some mystical force that magically comes into being when agents collaborate. Emergent properties are physical aspects of a system not otherwise exhibited by the component parts. They are macro-level features of a system arising from interactions among the system's micro-level components, bringing forth novel behavior. Characteristics of emergent systems include micro-macro effects, radial symmetry, coherence, interacting parts, dynamical, decentralized control, bi-directional links between the macro- and micro- levels, and robustness and flexibility.[208]

The brain is an example of a CAS: the single neuron has no consciousness, but a network of neurons brings forth, for example, the perception of and appreciation for the smell of a rose. Similarly, when agents interact through networks, they evolve their ways of doing work and discover new techniques. Out of this combined activity, a spontaneous structure emerges. Without any centralized control, emergent properties take shape based on agent relationships and the conditions in the overall environment. Thus, emergence stems from behavior of agents, system structures, and exogenous inputs.[209]

Emergent systems exist in an ever-changing environment and consist of complex interactions that continuously reshape their internal relationships. The many independent actions of agents unify, but they do not necessarily work toward one particular structure or equilibrium. For example, emergent systems can be robust to change, and they can be far better at evolving toward efficiency than top-down systems. On the other hand, emergent structures can fall apart when their basic conditions are altered in such a way that they work against the health of the system as a whole. The line between emergence-fostering actions and emergence-stifling actions can be difficult to discern.[210]

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204 *See* de La Chapelle, *supra* note 38, at 16.
205 *See* RFC 3439, *supra* note 118, at 4.
206 *See id.* at 5.
207 *See* de La Chapelle, *supra* note 38, at 17.
208 *Emergence Economics*, *supra* note 32, at 248 n.141.
209 *See id.* at 248.
210 *See id.* at 248–49.

C. *The Internet as Common Pool Resource*

A third perspective on the Internet comes to us from modern economic theory, where many view the Net as a common pool resource ("CPR"). The term "commons" has had many uses historically, almost all contested.[211] Elinor Ostrom has defined it simply as "a resource shared by a group of people and often vulnerable to social dilemmas."[212] Yochai Benkler states that "'[t]he commons' refer to institutional devices that entail government abstention from designating anyone as having primary decision-making power over use of a resource."[213] The two principal characteristics that have been widely utilized in the analysis of traditional commons are non-excludability and joint (non-rivalrous) consumption.[214]

In turn, Ostrom has observed that a CPR can be "a natural or man-made resource system that is sufficiently large as to make it costly (but not impossible) to exclude potential beneficiaries from obtaining benefits from its use."[215] Ostrom and Hess have concluded that cyberspace is a CPR, similar as a resource to fishing grounds, grazing lands, or national security that is constructed for joint use. Such a system is self-governed and held together by informal, shared standards and rules among a local and global technical community. This is so even as the resource units themselves—in this case data packets— are typically individually owned.[216]

Frischmann points out that traditional infrastructures are generally managed as commons, which fits their role as a "shared means to many ends."[217] In the United States and elsewhere, government traditionally plays the role of "provider, subsidizer, coordinator, and/or regulator" of infrastructure.[218] Studies written about the Internet as a CPR tend to focus on the technology infrastructure and the social network issues, rather than the institutions developed about the distributed information per se.[219] However, Bernbom believes that many of the design elements of the Internet create the basic rules for managing it as a commons.[220]

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211 Charlotte Hess & Elinor Ostrom, *Ideas, Artifacts, and Facilities: Information as a Common-Pool Resource*, 66 LAW & CONTEMP. PROBS. 111, 115 (2003).
212 Hofmokl, *supra* note 63, at 229 (quoting UNDERSTANDING KNOWLEDGE AS A COMMONS: FROM THEORY TO PRACTICE 349 (Charlotte Hess & Elinor Ostrom eds., 2007)).
213 Yochai Benkler, *The Commons as a Neglected Factor of Information Policy*, (Sept. 1998), http://www.benkler.org/commons.pdf.
214 Hofmokl, *supra* note 63, at 227; *see also* LEWIS HYDE, COMMON AS AIR: REVOLUTION, ART, AND OWNERSHIP 27–31 (2010) (Commons is a kind of property—including the rights, customs, and institutions that preserve its communal use—in which more than one person has rights.).
215 ELINOR OSTROM, GOVERNING THE COMMONS: THE EVOLUTION OF INSTITUTIONS FOR COLLECTIVE ACTION 30 (1990).
216 Hess & Ostrom, *supra* note 211, at 121.
217 FRISCHMANN, *supra* note 133, at 4.
218 *Id.*
219 *See* Hess & Ostrom, *supra* note 211, at 128.
220 *See* Bernbom, *supra* note 71, at 5.

Viewing the Internet in its entirety as a CPR glosses over the functional specifics, which is a correctable mistake. Contrary to how some describe its resource role, the Internet is actually a complicated blend of private goods and public goods, with varying degrees of excludability and joint consumption. Hofmokl does an excellent job analyzing the physical, logical, and content layers of the Internet, pointing out where its attributes as a resource match up to those of the commons.[221] In particular, the physical layers (physical networks and computing devices) and the content layers (digitized information) are mostly pure private goods, showing excludability combined with rivalrous consumption.[222]

However, when we are talking about the design attributes of the Internet, the elements we are focused on—the technical standards and protocols, including TCP-IP-HTTP, that define how the Internet and World Wide Web function—all constitute exclusively public goods, free for everyone to use without access restrictions.[223] Further, as Frischmann duly notes, the Net's logical infrastructure—the open, shared protocols and standards—are managed as commons.[224] Thus, the key architectural components of the Net constitute a common pool resource, managed as a commons, even if many of the network's actual component parts—individual communications networks, proprietary applications and content, etc.—are private goods or a blend of private and public goods.[225] The Net's design attributes are what make it a commons resource.

Like a three-sided mirror, each of the cross-functional perspectives sketched out above are a partially correct reflection of reality, and yet remain incomplete without the others. As a GPT, the Net serves a vital function as a general, foundational platform for many people. As a CAS, the Net presents emergent properties, often with dynamic and unanticipated consequences. As a CPR, the Net provides a shared resource for all to utilize for a mix of purposes and ends. From its micro-functions, the Internet generates the macro-phenomena of a general platform, a complex system, and a shared resource.

IV. THE EMERGENCE OF NET EFFECTS: BENEFITS AND CHALLENGES

It seems almost a truism to point out that the Internet on whole has

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221 *See* Hofmokl, *supra* note 63, at 232–38.

222 *See id.* at 232–38. Hofmokl calls this "a dual structure within the Internet, of commercial and free access segments." *Id.* at 232.

223 *See* Hofmokl, *supra* note 63, at 235.

224 *See* FRISCHMANN, *supra* note 133, at 320 n.10.

225 For example, Bernbom divides the Internet into the network commons, the information commons, and the social commons. However, the notion that each of the Net's resources has the characteristics of a CPR seems to ignore the largely private goods nature of many of them. *See* Bernbom, *supra* note 71, at 1–2.

done positive things for modern society. In his recent book, *Infrastructure*, Brett Frischmann does an admirable job explicating a lengthy list of such benefits.[226] The more interesting point is to figure out exactly why that would be the case. Using the power of abductive reasoning (from effect to cause),[227] we can determine that the very design attributes outlined above have led to a raft of benefits for users, as well as some challenges. In other words, we can safely come to the presumption that the modular, end-to-end, interconnected, and agnostic functions of the Internet provides real economic and social "spillovers" value.[228] That means the Internet's social returns exceed its private returns, because society realizes benefits above and beyond those realized by individual network providers and users.[229]

Frischmann explains in some detail precisely how infrastructure generates such spillovers that result in large social gains.[230] In particular, managing the Internet's infrastructure as a commons sustains a spillover-rich environment.[231] Here are a few of the more important economic, social, and personal gains from the Internet's design attributes.

A. *Engine of Innovation*

Ideas are the raw material for innovation. In the ordinary transformational cycle, ideas become concepts that transform into inventions utilized for commercial or other purposes. They are the recipes for combining atoms and bits into useful things. While the physical components are limited, the ideas themselves essentially are unlimited—characterized by increasing returns, continued re-use, and ease of sharing. Innovation, by contrast, is the application of ideas—invention plus implementation. Ideas and innovation form an essential feedback cycle, where input becomes output and then becomes input again.[232]

If there is any one business lesson that has acquired near-universal empirical support and expert agreement, it is this: innovation is a good thing. The creation of new and different objects, processes, and services are at the heart of any rational conception of economic growth and the fulfillment of human potential. No matter what you call it—creativity, entrepreneurism, novelty, ingenuity—the global economy feeds on the

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226 *See* FRISCHMANN, *supra* note 133, at 317.
227 *See* DANIEL W. BROMLEY, SUFFICIENT REASON: VOLITIONAL PRAGMATISM AND THE MEANING OF ECONOMIC INSTITUTIONS 23–24 (2006).
228 *Emergence Economics*, *supra* note 32, at 297.
229 *See* FRISCHMANN, *supra* note 133, at 12.
230 *See id.* at 5.
231 *Id.* at 318.
232 *See Emergence Economics*, *supra* note 32, at 278–84.

constant infusion of the products of innovation.[233] The proliferation of new ideas and inventions, channeled through generative networks of agents, provides powerful fuel for economic growth and other important emergent effects.[234]

Network architectures affect economic systems by both enabling and constraining certain behaviors.[235] Barbara van Schewick has explained the strong linkage between the way the Net has been constructed—including modularity, layering, and a broad version of the end-to-end principle—and the prevalence of innovation.[236] Not surprisingly, the Internet as a networked platform helps enable all the attributes of an innovative environment. Generally speaking, a greater ability of agents to connect and explore new modes of production will facilitate the contingent connections that a top-down designer will not likely foresee. Better global information sharing and feedback between agents facilitates better local decisions. The system as a whole can take a leap forward when new innovations emerge from this process and are replicated throughout the network by willing agents. As a result, the Internet serves as a particularly effective innovation engine, rapidly developing, diffusing, and validating scores of novel inventions.

Indeed, numerous empirical studies show conclusively the types of institutional organizational and networked environments within which innovation actually thrives. In brief, innovation tends to flow from:

— the users, not the consumers or providers;
— the many, not the few;
— the connected, not the isolated;
— individuals and small groups, not larger organizations;
— the upstarts, not the established;
— the decentralized, not the concentrated;
— the flat, not the hierarchical; and
— the autonomous, not the controlled.[237]

Innovation is produced from those users motivated by many incentives, including profit, pride, and personal fulfillment. There is also a separate "demand side" perspective to innovation, based on extensive research showing that "venturesome" consumers adopting and using technology are crucial to maintaining economic prosperity.[238]

The Internet provides the enabling background conditions for the creation and dissemination of innovation and feedback loops: open, connected, decentralized, autonomous, upstarts, etc. Commentators

[233] *Id.* at 267.
[234] *See Adaptive Policymaking*, *supra* note 32, at 494.
[235] *See* VAN SCHEWICK, *supra* note 89, at 19–33.
[236] *See id.* at 115–281.
[237] *Emergence Economics*, *supra* note 32, at 267–68.
[238] *Id.* at 268.

have observed the strong correlation between robust, ends-oriented innovation and the architecture of the Internet.[239] Lee McKnight notes that "the Internet works its magic through rapid development and diffusion of innovations." The Internet Protocol acts as a "bearer service"—the general purpose platform technology linking technologies, software, services, customers, firms, and markets—so that the Internet is "an innovation engine that enables creation of a remarkable range of new products and services."[240] Michael Katz believes that "[t]he hourglass architecture allows innovations to take place at the application and transport layers separately. This ability for independent innovation speeds the rate of innovation and increases the ability of entrepreneurs to take advantage of new opportunities."[241]

In functional terms, one can envision the open interface to the Internet Protocol serving as the virtual gateway to its functionality, leaving all the applications and content and services residing in the higher layers free to evolve in a vast number of ways.

B. *Spur to Economic Growth*

Even a cursory review of contemporary economic statistics shows that the Internet has been and continues to be a real boon for global economies. As one example, the McKinsey study, "Internet Matters," shows that over the past five years the Internet accounts for over one-fifth of GDP growth in mature countries.[242] That same report explains that, for every job "lost" to the Internet, some 2.6 new jobs are created.[243] The Net also increases productivity of smaller businesses by at least ten percent and enables them to export twice as much as before.[244] Further, for every ten percentage point increase in broadband penetration (which of course enables high-speed Internet access), 0.9 to 1.5 percent is added to per capita GDP growth, with similar increases in labor productivity over the following five years.[245] Indeed, if the

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239 *Id.* at 269.

240 *Id.* (citation omitted) (quoting Lee W. McKnight, *Internet Business Models: Creative Destruction As Usual*, *in* CREATIVE DESTRUCTION: BUSINESS SURVIVAL STRATEGIES IN THE GLOBAL INTERNET ECONOMY 39, 40 (Lee W. McKnight, Paul M. Vaaler, & Raul L. Katz eds., 2001)).

241 *Horizontal Leap*, *supra* note 35, at 630 (citation omitted) (quoting Michael L. Katz, *Thoughts on the Implications of Technological Change for Telecommunications Policy, in* TRANSITION TO AN IP ENVIRONMENT: A REPORT OF THE FIFTEENTH ANNUAL ASPEN INSTITUTE CONFERENCE ON TELECOMMUNICATIONS POLICY 26 (2001)).

242 MATTHIEU PELISSIE DU RAUSAS ET AL., INTERNET MATTERS: THE NET'S SWEEPING IMPACT ON GROWTH, JOBS, AND PROSPERITY 16 (2011), *available at* http://www.mckinsey.com/~/media/McKinsey/dotcom/Insights%20and%20pubs/MGI/Research/Technology%20and%20Innovation/Internet%20matters%20-%20Nets%20sweeping%20impact/MGI_internet_matters_full_report.ashx.

243 *Id.* at 3.

244 *Id.* at 18.

245 *Id.* at 19.

Internet were a sovereign nation, its economy would rank as the fifth largest in the world by 2016.[246]

Economic growth arises from the discovery of new recipes, and the transformation of things from low-value to high-value configurations. In shorthand, it is turning ordinary sand into semiconductors.[247] Paul Romer explains it this way:

> Economic growth occurs whenever people take resources and rearrange them in ways that are more valuable. . . . Human history teaches us, however, that economic growth springs from better recipes, not just from more cooking. New recipes generally produce fewer unpleasant side effects and generate more economic value per unit of raw material.[248]

New Growth Theory reminds us that growth flows from within the system itself, and is directly and profoundly affected by conscious decisions made by economic actors. As Susan Crawford puts it in the context of networked economies, "[t]he economic growth-based . . . [story] is straightforward: the greatest possible diversity of new ideas that will support our country in the future will come from the online world because of its special affordances of interactivity, interconnectivity, and unpredictable evolution."[249]

C. *Conduit for Free Flow of Information*

Human communications are critical to the very fabric of our civilization. Communications is all about broadly accessible connectivity. In the past, the postal system, telegraph and telephony networks, book publishers, and other platforms enabled connectivity. Today, the broadband telecom sector provides increasingly ubiquitous core infrastructure that supports most aspects of our society. Innovation in communications and the organization of information fosters educational, political, and social development and reduces the transaction costs for conveying and exchanging ideas.

As we have seen, ideas are the fodder, or the raw material, for innovation, economic growth, and other beneficial Net effects. The free flow of information between and among people can lead directly to a raft of business plans, physical technologies, and social technologies that compete vigorously and effectively in the marketplace. Above and beyond the economic impact, of course, the free flow of information

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[246] David Dean et al., *The Internet Economy in the G-20*, BCG.PERSPECTIVES (Mar. 19, 2012), https://www.bcgperspectives.com/content/articles/media_entertainment_strategic_planning_4_2_trillion_opportunity_internet_economy_g20.

[247] *Emergence Economics*, *supra* note 32, at 270.

[248] *Id.*

[249] Susan Crawford, *The Internet and the Project of Communications Law*, 55 UCLA L. REV. 359, 365 (2007).

facilitates every form of information, entertainment, and political discourse. The open dissemination of and access to information through the Internet can play a critical role in deepening the forces of democracy.

Virtually all societies benefit from new ideas. The open flow of information helps ensure that an idea engendered in one place can have a global impact. Because of the non-rivalry and increasing returns of ideas, expansion of the world's stock of knowledge drives the underlying rate of growth in knowledge in every country that is exposed to it. Ideas equal human growth and all its emergent benefits.[250]

Ideas are understood to be a classic public good; we can all benefit from useful inventions. An adaptive society must find and maintain the means to explore new ideas. Mechanisms generating new ideas, which in human society are expressed culturally and politically, are as important as access to abundant resources for economic growth and economic adaptation. Ideas are also the currency of cyberspace. The availability of a ubiquitous communications and information platform in the form of the Internet enables users to promulgate and share ideas.[251] As a result, the concept of "More Good Ideas" can serve as a proxy for maximizing the Internet's end-to-end benefits, and hence, the free flow of information.[252]

D. *Tool for User Empowerment and Human Flourishing*

It is difficult to estimate the full social value of the Internet.[253] Studies show a positive correlation between Internet penetration, life satisfaction, overall happiness, and social trust.[254] This should not be surprising. As we have already seen, the Internet enables people to become not just better consumers, but enabled entrepreneurs, innovators, and citizens. In a highly networked economy, the benefits of innovation in physical and social technologies go far beyond traditional economic growth and generate a diversity of other material and non-material benefits.

Julie Cohen has examined the structural conditions necessary for human flourishing in a networked information environment. She has shown that three elements are necessary for such flourishing: access to knowledge (networked information resources); operational transparency about networked processes; and what she calls "semantic discontinuity," or a flexible regulatory architecture that allows the play of everyday

[250] *Adaptive Policymaking*, *supra* note 32, at 543.

[251] *Id.* at 549.

[252] *Broadband Policy*, *supra* note 32, at 437–38.

[253] FRISCHMANN, *supra* note 133, at 336. The author then proceeds to do so at some length and with considerable success. *Id.* at 336–45.

[254] Thierry Penard et al., *Does the Internet Make People Happy?* (CEPS/INSTEAD, Working Paper No. 2011-41, 2011).

practice.[255] The Internet, and its design architecture, hold the potential and promise to enable all three conditions.

Barbara van Schewick has found that the Internet's architecture—and in particular the broad version of the end-to-end principle—helps the network enhance individual freedom, provide for improved democratic participation, and foster a more critical and self-reflective culture.[256] User empowerment is "a basic building block" of the Internet and should remain embedded in all mechanisms whenever possible.[257] In fact, "making sure that the users are not constrained in what they can do" is doing nothing more than "preserving the core design tenet of the Internet."[258]

Yochai Benkler's *The Wealth of Networks* lays out the case for social production.[259] According to Benkler, the "wealth" of networks lies in their potential for widespread participation in making, sharing, and experiencing information. He shows that social production serves important values, including autonomy, democratic participation in the political sphere, construction of culture, justice and human development, and community. He also points out that "advanced economies rely on non-market organizations for information production much more than they do in other sectors." Benkler argues that "the basic technologies of information processing, storage, and communication have made nonproprietary models more attractive and effective than was ever before possible." Among other things, this enables new "patterns of social reciprocity, redistribution, and sharing." In a sufficiently open and ubiquitous network, the benefits of the traditional firm can apply to all individuals.

Some also see in the Internet the rise of "networked individualism," where individuals can project their views via a new social operating system.[260] Doc Searls makes some related points in *The Intention Economy*. He describes the rise of vendor relationship management (VRM) due to the demand-side potential of "free customers" with personalized demand.[261] Susan Crawford takes an expansive view of the non-pecuniary benefits of the Internet as an ideas and innovation platform that enables human interactivity. She sees the Net as allowing "innovation in social relationships at a system level,"

255 JULIE E. COHEN, CONFIGURING THE NETWORKED SELF: LAW, CODE, AND THE PLAY OF EVERYDAY PRACTICE 224 (2012).
256 VAN SCHEWICK, *supra* note 89, at 10.
257 Clark et al., *supra* note 99.
258 *Id.*
259 YOCHAI BENKLER, THE WEALTH OF NETWORKS: HOW SOCIAL PRODUCTION TRANSFORMS MARKETS AND FREEDOM (2006), *available at* http://www.benkler.org/Benkler_Wealth_Of_Networks.pdf.
260 *See generally* LEE RAINIE & BARRY WELLMAN, NETWORKED: THE NEW SOCIAL OPERATING SYSTEM (2012).
261 *See generally* SEARLS, *supra* note 67.

which goes beyond seeing the "content" layer of the Internet as the "social" layer.[262] The existence of such a social layer promotes diversity, the democratization of information (in creation, distribution, and access), and the decentralization of democracy.

Interestingly, some have posited that the basic foundations of the peer production concept are embedded in general purpose technologies (GPT) theory.[263] Hofmokl claims that traditional hierarchies are not necessary to coordinate the provision of goods in an information commons.[264] Instead, the Internet, making such cultural exchange possible on a massive scale with maximum flexibility and efficiency, enables what he calls the "architecture of participation".[265] He cites in particular both the end-to-end principle and the open TCP/IP network protocol, which were "made to share, not to exclude."[266] This architecture enables a participatory culture where the passive, static role of the audience is replaced by the creation and exchange of new media content.[267]

E. *Net Challenges*

Of course, as a reflection and heightening of human behavior, the Internet has other, less desirable facets as well. Its design architecture allows for at least three types of "Net challenges." These essentially are new ways to do bad things, new variations on social ills, and new forms of business models. Some of these challenges are unique to the Net, while others constitute societal problems that exist offline as well. In the name of more precise analysis, we must endeavor to keep these three sets of challenges separate and distinct from one another.

First, the Internet allows various "bad actors" and "bad actions." As a faithful reflection of humanity, the Net has its share of unseemly conduct and criminality. These bad actions include lower-layer network-based ills, like malware and DOS attacks, and upper layer ills, like child pornography and piracy of content. Zittrain says that the Net's generative nature, its openness and unpredictability, are precisely the qualities that allow worms, viruses, and malware to suffuse its networks.[268] As Vint Cerf points out, "[e]very layer of the Internet's architecture is theoretically accessible to users and, in consequence, users (and abusers) can exploit vulnerabilities in any of the layers."[269]

262 *Emergence Economics*, supra note 32, at 282.
263 Hofmokl, *supra* note 63, at 245.
264 *Id.* at 245.
265 *Id.* at 244.
266 *Id.*
267 *Id.*
268 JONATHAN ZITTRAIN, THE FUTURE OF THE INTERNET AND HOW TO STOP IT 45–49 (2008), *available at* http://futureoftheinternet.org/static/ZittrainTheFutureoftheInternet.pdf.
269 Vint Cerf, *Internet Governance: A Centroid of Multistakeholder Interests*, *in*

As just one example, the interoperability of networks, ordinarily a plus, also increases risks to cybersecurity.[270]

The point is not to ignore these policy challenges as if they will be miraculously solved by the Net's utopian design. These problems are very real, and they deserve to be taken seriously. Nor, on the other hand, should we deal with them in ways that overlook possible collateral damage to the rest of the Internet. Rather, we should want to tackle the challenges with the right policy implements, so as not to do violence to the Internet design principles and all the attendant Net benefits. Zittrain agrees that we need a strategy that "blunts the worst aspects of today's popular generative Internet and PC without killing those platforms' openness to innovation."[271]

Second, the Internet has introduced or heightened a variety of social ills, often rooted in the psychology of human behavior. For example, Sherry Turkle worries that technologies, such as the Internet and networked devices, substitute for real human connections.[272] Evgeny Morozov believes that, contrary to the flawed assumptions of "cyber-utopianism" about the emancipatory nature of online communities, the Net too often empowers the politically strong and disempowers the politically weak.[273] William Davidow warns that the Internet creates an over-connected environment that becomes unpredictable, accident-prone, and subject to contagions; in his view, the recent financial crisis was actually accelerated and amplified by the Net.[274] It is not obvious that these types of concerns automatically warrant direct government or other intervention, but it is useful to separate them out from the "parade of horribles" concerning pernicious impacts from use of the Internet.

Third, the Internet is a highly disruptive platform that has already undermined entire lines of business, even as new ones are being engendered. Economic and social value is shifting away from many incumbent business models, with innovation and growth increasingly arising from users at the edges of the Net. For example, low barriers to entry, digital technology, and pervasive Net access creates many

MULTISTAKEHOLDER INTERNET DIALOG, CO:LLABORATORY DISCUSSION PAPER SERIES NO. 1, INTERNET POLICY MAKING (2011), *available at* http://dl.collaboratory.de/mind/mind_02_neu.pdf.

270 PALFREY & GASSER, *supra* note 157, at 150.

271 ZITTRAIN, *supra* note 268, at 150.

272 SHERRY TURKLE, ALONE TOGETHER: WHY WE EXPECT MORE FROM TECHNOLOGY AND LESS FROM EACH OTHER xiv (2011). "We seem determined to give human qualities to objects and content to treat each other as things." *Id.*

273 EVGENY MOROZOV, THE NET DELUSION: THE DARK SIDE OF INTERNET FREEDOM xiv (2011).

274 *See* WILLIAM H. DAVIDOW, OVERCONNECTED: THE PROMISE AND THREAT OF THE INTERNET (2011). Of course this can be seen as the flip side to the general benefits of network interconnection and interoperability.

different ways for traditional goods and services to be found, produced, obtained, and consumed. In such circumstances, it is not surprising that incumbents will resist technological change, such as that wrought by the Internet.[275] However, such seismic shifts should not be labeled bad actions by bad actors, and thus, should not be reflexively counted as policy challenges deserving a swift political response.

We can briefly turn to online privacy as one example of an issue that many have argued merits some concerted political consideration. As it turns out, the Internet pioneers had been debating the role of privacy in the network from the beginning.[276] Braman has discovered that early decisions by those who designed the Net "created a situation that enabled the data mining" of concern to many.[277] However, the Net's designers also recognized that "there is a difference between reaching a consensus on general principles, such as the importance of protecting privacy, and reaching a consensus on the actual techniques to be used."[278] She also found "a tension between establishing standards for privacy protection and the need to minimize constraints on further experimentation and innovation."[279] Braman sums up the views of the Net design pioneers:

> They recognized that privacy is a multi-dimensional problem, that it arises at every stage of networking, and that it has to be revisited every time there is a change in technologies. They understood that the same user may hold conflicting views on privacy, depending on which activity is being undertaken and the role held. And they knew that the introduction of one technique for protecting privacy could open up other possible means of invading privacy.[280]

When discussing the public policy world, we have an unfortunate tendency to mix up the diagnosis and the remedy—the means and the ends. Policymakers need to have the proper tools to sort out whether a particular policy situation constitutes a bad act that requires a tailored remedy, a magnified social ill that needs to be better understood, or a new business model that should be allowed to challenge the status quo. For appropriate guidance, we must look to what the technologists, the scientists, and the economists say about the Internet—how its unique design architecture renders it a GPT, a CAS, and a CPR in macro terms. In short, we need a grounded public policy framework for the Internet.

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[275] *Emergence Economics*, *supra* note 32, at 296.
[276] Sandra Braman, *Privacy for Networked Computing*, 1969–1979, NAT'L SCIENCE FOUND., 1 (2011), http://microsites.oii.ox.ac.uk/ipp2010/system/files/IPP2010_Braman_Paper.pdf.
[277] *Id.* at 2.
[278] *Id.* at 3.
[279] *Id.*
[280] *Id.* at 17.

V. DEFERENCE AHEAD: RESPECTING THE INTERNET'S FUNCTIONAL INTEGRITY

The sundry human activities that occur via the Internet's upper layer functions of applications, content, and services constitute dynamic, evolutionary processes unseen by previous generations. For the most part, policymakers should be cautious about unnecessarily intruding into those processes, but instead allow them to play out in an enabled but not overly-prescriptive environment.[281] As for the functions that tend to occur in the middle layers—those software-derived protocols and standards that comprise the inner workings of the Internet—the prior note of caution and adaptability is transformed into a plea for due deference to the role and ongoing work of the designers.

A. *Revisiting the Layers Model*

1. Matching functions to layers

A "layered" approach can serve as a mental frame to assist policymakers and others when considering the Internet and the myriad activities that occur within and between its different functional components. As an overarching conceptual tool, this modular model would, for example, replace the existing "silos" approach under the Communications Act of 1934, which treats regulated entities and their service offerings in the context of legacy industries.[282]

The layered model encapsulates the functional architecture of the Internet and the reality of the market we have today. A version that effectively combines simplicity and precision is a four-layered approach: physical; logical; applications; and content/interactivity. I suggested that conceptual model back in 2004, and for many purposes it remains a constructive means of framing what actually happens on the Net. Most fundamentally, the first principle of the modular approach is that there is a network, and there is "stuff" that rides on top of the network.[283]

This Article delves more deeply into the different functions of the Net, and thus will require a more exacting layers model to guide our thinking. I will utilize a modified version of the seven-layer Open System Interconnection (OSI) Reference Model, first articulated in the

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281 *See Emergence Economics*, *supra* note 32; *Adaptive Policymaking*, *supra* note 32.

282 *Adaptive Policymaking*, *supra* note 32, at 563–67.

283 Mirroring our earlier discussion of Susan Crawford's "social relationships" level, Frischmann would add a fifth "social layer" to this framing—a layer comprised of social networks and activities. FRISCHMANN, *supra* note 133, at 319. While I sympathize with the interest in highlighting this largely beneficial aspect of Internet-based life, I resist the impulse to turn it into a wholly separate layer. To be true to the functional analysis, we should endeavor to focus on the specific operational elements of the network, rather than the emergent phenomena that is enabled as a result.

1970s.[284] To be clear, technologists do not uniformly recognize the authority of these seven layers, nor do the functions always correspond neatly to the layer in question. Nonetheless, the OSI stack provides a useful starting point for public policy considerations.

Here are the modified seven layers, with some functional examples:

Layer 7 – Content (such as video)
Layer 6 – Applications (such as email)
Layer 5 – Session (such as HTTP)
Layer 4 – Transport (such as TCP)
Layer 3 – Network (such as IP)
Layer 2 – Data Link (such as DOCSIS)
Layer 1 – Physical (such as fiber)

Again, one can quibble, as an engineering matter, over which particular network protocol functions match up with which layers, but the fundamentals are sound.[285] Moreover, the foundation of the seven-layers framework is the reality of how actors interact in today's market, rather than some artificial construct found on a chalkboard. Modularity comports with the technology-based ecosystem at the heart of the Internet. The interactions of market players are shaped and heavily influenced by the design of the architectural structure within which they exist. A seven-layers model helps highlight the technical and economic interdependence of different Net-based activities.

2. The Middle Layers: Defining the logical layers functions

The Internet's design attributes run all through it; indeed, they essentially define the Net. Yet, they originate in one specific set of layers in the middle—what could be called the "logical layers."[286] For purposes of this Article, the focus will be on the basic Internet addressing and routing functions that operate in these levels of the network, as well as government actions that threaten to disrupt their workings. Using layers as the framing mechanism for these specific functions should not detract from the larger arguments. The point is not to be wedded too tightly to any particular modularity model, but instead, to focus on the actual functions themselves in the network and how they have been derived.

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[284] *History and Development*, OSI MODEL, (last visited April 16, 2013), http://www.osimodel.org/.

[285] In a private conversation, Vint Cerf has explained that the modular nature of the Internet actually masks a fractal element, in which each layer contains sub-layers. HTTP can be considered a form of transport protocol operating over TCP, while IP can be layered over other network services that themselves do routing and ride on top of link layers. These fractal elements do not invalidate the layers design attribute but emphasize that these attributes are based on abstractions.

[286] *Layer 1: Logical Layer*, OPEN ICT FOR DEVELOPMENT, http://openict4d.wikidot.com/layer-1.

As previously mentioned, for present purposes I have adopted a seven-layer modified OSI stack. It makes most sense to further divide those seven layers into three discrete groupings of protocols: the Upper Layers; the Middle Layers; and the Lower Layers. Roughly speaking, the logical functions of the network reside in the "Middle Layers," with representative examples of the software protocols that reside there:

— Layer 5: session (HTTP, DNS)
— Layer 4: transport (TCP)
— Layer 3: network (IP)

For the most part, the logical layers' functions constitute the loci of the basic design principles. All four attributes of the Internet design model run through and help define these layers. There could be no end-to-end functionality, no interconnected networks, and no bearer protocols without the logical elements residing in the Middle Layers.

By contrast, the Lower Layer functions are the world of telecom networks and standards. Layer 2 defines the various communications standards, protocols, and interfaces, such as Ethernet, WiFi, DSL, and DOCSIS. Many of these items relate to the last-mile physical networks used to access the Internet. Layer 1 is the physical infrastructure itself. There may well be legitimate concerns about how these Lower Layer environments can be affected by government policy,[287] particularly to the extent that control over these functions impact the latitude and functionality of the higher layers. However, the actual operation of the underlying physical networks is not equivalent to the Internet's design attributes and operations, and thus is not germane to our analysis.

Upper Layer functions reside in Layers 6 and 7. Layer 6 is the world of end user applications, where people can fashion and attach software to the network for others to share and utilize, while Layer 7 is composed of all the content and services generated by these interactions. This is the point where the network essentially turns inside out, and the software—from browsers to search engines to email clients—is now exposed and accessible to ordinary users. Again, while I analyze these Upper Layer activities elsewhere,[288] these particular functions are not relevant to the thrust of this Article.

Others come with a slightly different division of network functions between the layers.[289] Kevin Werbach identifies the logical layer as that

[287] *See generally Broadband Policy*, *supra* note 32.
[288] *See Adaptive Policymaking*, *supra* note 32; *Emergence Economics*, *supra* note 32.
[289] For example, Scott Jordan divides up the OSI stack into two sub-groupings comprised of Layers 1–3 (functionality within the local access networks) and Layers 4–7 (functionality provided in end points outside the access networks). Scott Jordan, *Implications of Internet Architecture on Net Neutrality*, ACM TRANSACTIONS ON INTERNET TECH., 5:16 (May 2009), http://www.escholarship.org/uc/item/3466f4pp#page-1. Jordan's dichotomy demonstrates the crucial bridging function provided by interfacing with the Internet Protocol at Layer 3, especially when analyzing open Internet and network neutrality issues.

place in the network that ensures that the right bits get to the right place, the point of demarcation between software that talks to the network and software that talks to users.[290] I agree, and see the logical layers as those Middle Layer functions—Layers 3, 4, and 5—which face inward, toward the other parts of the network. In most cases, this is the combination of IP/TCP/HTTP protocols that makes up the Web. Werbach observes that this "glue" that holds the Internet/Web together constitutes "the most crucial points in the communications system stack for purposes of public policy."[291]

B. *Introducing The Internet Policy Principle*

1. From layers model to layers principle

The chief idea behind the layers model is to allow for a more concrete analysis of policy issues by placing each function at a proper layer of the network and providing a correct focus on the relevant operation of the Internet. The layers metaphor is intended to provide a flexible conceptual framing, a visual map, to guide decision-making.

Professor Lawrence Solum was one of the first to take the layers model and apply it to concrete issues in public policy. He fashioned the concept of the "layers principle," which amounts to the general exhortation to "*respect the integrity of the layers.*"[292] Solum's layers principle can be defined by the following statement: *"Public Internet regulators should not adopt legal regulations of the Internet (including statutes, regulations, common law rules, or interpretations of any of these) that violate the integrity of the* [*layered nature of Internet architectu*re], *absent a compelling regulatory interest and consideration of layer-respecting alternatives."*[293]

Professor Solum describes two interrelated corollaries that support his layers principle. The corollary of layers separation states that regulation should not violate or compromise the separation between the Internet's layers. This means that one network layer should not differentiate the handling of data on the basis of information available only at another layer, absent a compelling regulatory interest. Solum observes that the Net's transparency, a product of layers separation, is the key feature that enables low-cost innovation.[294] Thus, "the fact that layer violating regulations [inherently] damage [the] transparency [of the Internet,] combined with the fact that Internet transparency lowers

290 Kevin Werbach, *Breaking the Ice: Rethinking Telecommunications Law for the Digital Age*, 4 J. TELECOMM. & HIGH TECH. L. 59, 91–92 (2005).
291 *Id.* at 73. Werbach says that policymakers should police the logical layer as a competitive boundary, but not delve deeply into the logical layer and directly organize markets. *Id.* at 82.
292 Solum & Chung, *supra* note 35, at 4 (emphasis added).
293 *Id.* at 42 (emphasis added).
294 *Id.* at 6.

barriers to innovation, provides compelling support for the principle of layer separation."[295]

The corollary of minimizing layer crossing states that, if compelling regulatory interests require a layer-crossing regulation, that regulation should minimize "the distance between the layer at which the law aims to produce an effect and the layer directly targeted by legal regulation." Here Solum utilizes "the familiar idea of fit between the ends of regulation and the means employed to achieve those ends."[296] He observes that "[t]he fact that layer-crossing regulations result in inherent mismatch between the ends such regulations seek to promote and the means employed implies that layer-crossing regulations suffer from problems of overbreadth and underinclusion . . . ."[297] To avoid these problems, policymakers should minimize layer-crossing regulations.[298]

Identifying both the layer of the problem conduct and the layer where the proposed regulation would operate correctly focuses attention on the relevant operational elements of the Internet. In essence, the legal regulation can only be as effective as is permitted by the architecture of the Internet. And, in turn, the nature and limitations of the legal regulation will be determined by the nature of the code being implemented.[299] "Regulations that fail to respect the integrity of the layers preclude innocent uses of the Internet; they cannot achieve their regulatory goals; and they threaten the transparency of the Internet and consequently its ability to serve as the platform for innovation."[300] In brief, given the potentially dire consequences of compelling changes in the Net's layered design, policymakers should conform their proposed policy solutions to the network, and not the other way around.

2. Expanding the layers principle to other Internet functions

With all due respect to Solum (and my earlier *Horizontal Leap* paper), the layers principle is a helpful but incomplete framing mechanism for policymakers. While there is much to recommend it as an organizing abstraction, the modular view by itself comes up short to the reality of the Net's actual design and operation. The Internet is more complex than its layered architecture portrays. In many respects, the layers are the supporting structure, the scaffolding, through which the other design attributes can be expressed. Nonetheless, the layers by themselves do not capture the full essence of the Internet. Solely

295 *Id.* at 52.
296 *Id.* at 5.
297 *Id.* at 53.
298 *Horizontal Leap*, *supra* note 35, at 626.
299 Solum & Chung, *supra* note 35 at 82.
300 *Id.* at 6.

focusing on how the layers interrelate leaves out important elements of the way that traffic flows, networks interoperate, and protocols interact.[301] How the design elements fit together and operate cohesively can be seen as creating a "functional integrity" that describes the user's overall experience of the Internet.

Moreover, the collective view of the Internet relies on more than solely the layering principle. Looking to all four functional attributes of the Internet design model is more faithful to the richness and complexity of Internet architecture and its macro-level incarnations as a GPT, a CAS, and a CPR. Nor can the emergent Net benefits and challenges be fully described and understood without reference to the other design attributes. Indeed, one can imagine that tweaking even one of the architectural elements could result in a very different Internet. As Barwolff points out, "in 'Internet architecture' it is as futile to insist on the strict universality of any one principle in isolation, without considering other principles with which it combines to a system of principles that can only be applied with creative judgment to a given purpose."[302]

Solum himself seemed to understand the need to think beyond the layered nature of the Internet. He notes that the layers principle reconceptualizes the end-to-end principle, yielding a richer and more accurate model of the Internet's fundamental architecture.[303] Indeed, the end-to-end principle itself does not fully and accurately capture the fundamental relationship between Internet architecture and sound or optimal regulation.[304] Instead, he sees the "normative content" of the layers principle as a superset of the normative content of the end-to-end principle.[305] He also bemoans the fact that most Internet regulation misses an analysis of the implications of TCP/IP and its central and essential role in the design and the functioning of the Internet.[306] Moreover, Solum also points out that the evolution of the Internet's architecture did not begin or end with layering. Specifically, he observes that disparate networks interconnect via packet switching (late 1960s), TCP/IP is the common protocol that ties them together (mid-1970s), layering is the way to separate out functions (late 1970s), and end-to-end is the control structure at the end points (early 1980s).[307]

301 Interestingly, Solum's layers principle is primarily concerned with layers-crossing regulations; it does not appear to preclude direct regulation of the logical layers, a key concern raised by this paper.
302 BARWOLFF, *supra* note 88, at 134.
303 Solum & Chung, *supra* note 35, at 7.
304 *Id.*
305 *Id.* Solum states that the e2e concept emerged from the layers model as an articulation and abstraction of implicit ideas inherent in the layers model. *Id.* at 18.
306 *Id.* at 7.
307 *Id.* at 25–26.

So if we accept the premise that our framing device should extend beyond layers to encompass all four of the Net's chief design attributes, where does that take us? Perhaps Solum can again point us in the right direction. The layers principle, with its emphasis on how potential regulation can adversely affect the different layers, can be extended to the end-to-end principle, interconnectivity, and IP. For example, Solum posits that the greater the number of layers crossed, the worse the regulation; the fewer the layers crossed, the better the regulation.[308] We can utilize a similar approach with regard to the other three design attributes. This translates into a new corollary that *the greater the degree that each design attribute is violated, the worse the regulation.* A second corollary holds that *the greater the number of design attributes that are violated, the more harmful the regulation.* So at the outset, relative harm to the Internet's foundational, emergent, and collective nature can be tied to both the *degree* (depth) and the *scope* (span) of the architectural violations.

3. Sketching out the first dimension of an Internet policy framework

Taking into account the four fundamental design attributes of the Internet allows us to move beyond a fixation on just one element—modularity—to encompass more of the richness and complexity of the Net's functionality. The Internet design model in its entirety rightly should be seen as the architectural basis—the first dimension of "Code"—in a new Internet policy framework.

This proposed framework would come into play in situations where a policymaker or other similarly-situated entity is considering imposing specific obligations or restrictions on activities that utilize, comprise, or support the Internet. As with the layers principle, precision is what matters; the end goal must be closely tailored to the means employed. Where Middle Layer functions are involved in some way, the policymaker can be said to be potentially affecting the functional integrity of one or more of the four design attributes. Such ill-conceived policy mandates could be destructive of the Net's generative qualities.

Using the modularity attribute as an example, violations of the proposed principle would ordinarily involve situations where regulation is directed at a lower protocol layer in order to address problems that originate at an upper layer, particularly the content layer. Examples include: (1) the music distribution industry seeking to target the TCP/IP layers to combat peer-to-peer networking; (2) policymakers asserting control over Internet content; and (3) blocking or filtering

[308] *Id.* at 31.

requirements.[309]

We can also appropriate Solum's fit thesis, which focuses on "the familiar idea of fit between the ends of regulation and the means employed to achieve those ends."[310] With his layers principle, "the fact that layer-crossing regulations result in [an] inherent mismatch between the ends such regulations seek to promote and the means employed implies that layer-crossing regulations suffer from problems of overbreadth and underinclusion . . . ."[311] Such technology strictures often represent a poor fit to the perceived market challenge, threatening to be under-inclusive (and thus not particularly effective) and/or over-inclusive (and thus imposing collateral damage on innocent activities).[312] Importantly, whether or not a policymaker cares about harming substantial innocent uses through an overly broad proposed course of action (overinclusive), that same policymaker at least should be concerned about the lack of effectiveness of that same proposal (underinclusive).

This same concept of overbreadth/underinclusion can also be applied to the other three design attributes. Generally speaking, the more narrowly the regulation focuses on the actual Internet design function it is attempting to control, the less it will impair other functions, reduce transparency, or cause substantial "innocent use" problems. In the layers model, for example, the severity of the design function violation is greater when the regulation is attempted at a lower layer in order to address problems at a higher layer.[313]

From the foregoing discussion, one can reasonably conclude that there should be a strong presumption against function-violating regulations. As with the layers model, this is especially true where such a regulation affects or has the potential to affect a large number of users (such as the nation's largest ISPs or backbone operators, an entire nation or nations, or most available TCP ports).[314] As indicated above, the amount of this harm can be measured both in terms of the depth or extent (*degree corollary*) of the violation of a particular Net design element, and the number of design elements (*scope corollary*) that are affected. With regard to the latter factor, examples would include cross-layer regulation (turning the Internet upside down), injection of unneeded central functions (turning the Internet inside out), interference with voluntary network interconnections (turning Internet connectivity from open to closed), and skewed packet carriage (turning the Internet's

309 *Horizontal Leap*, *supra* note 35, at 637.
310 Solum & Chung, *supra* note 35, at 5.
311 *Id.* at 53.
312 *Id.* at 5, 52–53.
313 *Horizontal Leap*, *supra* note 35, at 637–45.
314 *Horizontal Leap*, *supra* note 35, at 645.

bearer protocols from indifferent to differential). We will address several real-life examples in the last section of the Article.

Thus, as a general matter, policymakers should refrain from addressing a policy concern:

— occurring at one particular layer of the Internet by affecting a separate, unrelated layer;

— occurring at one particular end of the Internet by introducing a separate, unrelated function at the core of the network;

— occurring with one particular network of the Internet by imposing on the connectivity of other networks; or

— occurring with one particular service offering by transforming the agnostic bearer protocols into prescriptive, differential protocols.

In short, policymakers should avoid adopting top-down or inside-out technical mandates that, by degree and/or scope, violate the functional integrity of the Net.

4. Meeting potential objections

In the next Part, I will expand this functional "Code" analysis into an actual three-dimensional policy framework by yoking it to possible institutional and organizational tools—the Rules and Players. Here, though, I want to address some potential objections to relying on the Internet design model as the technical basis for a guiding Internet policy framework.

First, some may argue that looking to the Net's design attributes to inform policymaking amounts to a type of Internet exceptionalism—the notion that we must treat the Internet differently than other technology platforms. And given both its exceptional roots and its extraordinary impact on society, I plead guilty—with a caveat. To treat the Internet differently is not the same thing as denying that there should be any regulation of its activities. We are, or should be, well past that stage. As Mueller has observed, the Internet battles of the near past too often devolved into disputes between what he calls "cyber-libertarians" (those who adhere to "naïve technological determinism") and "cyber-conservatives" (those "realists" who believe, among other things, that the Net is inevitably constrained and dominated by nation-states).[315] While admittedly these are two unrealistic extremes, the point is that

[315] MILTON L. MUELLER, NETWORKS AND STATES: THE GLOBAL POLITICS OF INTERNET GOVERNANCE 2–3 (2010). Winner defines naïve technological determinism as the idea that "technology develops as the sole result of an internal dynamic and then, unmediated by any other influence, molds society to fit its pattern." Winner, *supra* note 97, at 19–20.

there was often little debating room available in between.

By contrast, I prefer to think that "respecting the functional integrity of the Internet" is an example of adaptive policymaking, a means for taking full account of all salient characteristics of the technology and the market being examined. Context is all. After all, most conscientious legislators would not consider regulating roads, electric grids, or any other platform/system/resource without carefully considering how and why it functions. Why should we approach the Internet with any less attention to what matters? If labels are necessary, perhaps that view makes me a "cyber-contextualist."

Second, some might object that the Internet does not always, or even usually, operate as the four design attributes suggests. For example, the growing inclusion of "cross-layer design" in wireless networks may raise questions about the continuing legitimacy of the classic layering model.[316] Christopher Yoo makes a related point and argues that the Internet has changed tremendously from its early years, to a technology platform that no longer obeys many of its original design attributes.[317]

At any moment in time, the Internet is not simply the sum of four basic design features; numerous additional software and hardware elements have been added over the years that in some ways mute or alter their collective power. In any vast engineering enterprise, there are always tradeoffs and exceptions. Here we are not seeking absolutes or certitudes, however, but only (and importantly) a presumption against unnecessary government intrusion and a continuum of possible concerns.

More to the point, many of the so-called exceptions to the Net's design principles, such as the prevalence of content delivery networks, the rise of cloud computing, and the growing "Internet of Things," constitute the addition of network overlays and underlays to the logical layers. The Middle Layer design attributes continue to operate as before, even if modified from below in Lower Layer functions by new types of access and transport networks (underlays), and from above in Upper Layer functions by new online business models (overlays). Cross-layer designs too constitute the "exception that proves the rule," as they normally would exploit rather than replace the existing network modularity. Further, Yoo's larger argument is that the government generally should stay out of the ever-evolving Internet space, a

316 *See generally* Vineet Srivastava & Mehul Motani, *Cross-Layer Design: A Survey and the Road Ahead*, IEEE COMM. MAG., Dec. 2005, at 112.

317 *See, e.g.*, Christopher S. Yoo, *Network Neutrality or Internet Innovation?* REGULATION, Spring 2010, at 22 (The recent emergence of different interconnection regimes and network topologies, such as secondary peering, multihoming, server farms, and CDNs, differs substantially from traditional Internet architecture.).

conclusion not inconsistent with the thrust of this Article.

Third, some may argue that a proposed reliance on analyzing the impact on design attributes seeks to freeze the Internet in place, resistant to any further useful changes. Some of these critics contend that today's Net requires substantial improvement because it "doesn't respond linearly to increased demand or deployment of bandwidth; is highly vulnerable to attack, abuse, and misuse; demands too much time and skill to administer; is not scalable; and is effectively impossible to upgrade without exceptional effort."[318]

Obviously technical experts can contest those conclusions. The larger point is that the broad deference suggested here would allow "natural" evolution of the Internet within its normal standards bodies and processes, free from unnecessary and even harmful political prescriptions. The intention is not, as Bennett puts it, to "freeze these descriptions into regulation."[319] The Internet's design features are not laws. But they have and should come organically from the bottom-up, through decades of rough consensus achieved by expert engineering in open, transparent, extra-governmental processes. And they are directly responsible for the rich user benefits we see today.

A similar complaint is that identifying and giving special status to the Net's logical layer functions somehow amounts to a tech mandate that dictates how businesses using the Net should operate. However, the direction here is for policymakers to avoid interfering with the current operation of the Net and the way its design features are articulated. The Middle Layer functions may well have a normative purpose in the minds of many Internet engineers in terms of how the Internet is meant to operate. Regardless, individual networks and other entities are free to join, or not join, the larger community of the Internet.

Moreover, much of the rationale for keeping the Internet "open" is that the various enterprises operating on top of it don't necessarily have to be. There is a basic difference (aside from a single letter) between being "on" the Net and being "of" the Net. For the most part, people talk about the Internet when they are really referring to entities engaged in various activities that take place using the Net as a platform technology. Such entities are free to emulate as much or as little of its openness and transparency as they choose. Here, instead, we are concerned with those design attributes that are "of" the Internet.

Generally speaking, our public policy regime should want to protect and promote the Internet's real normative value. But that does not necessarily mean that the Internet cannot improve over time, evolving to meet new technical and societal challenges. We should

318 BENNETT, *supra* note 134, at 6–7.

319 *Id.* at 39.

avoid foreclosing those possibilities. Nor, as the next section should make clear, does it mean that we should reflexively turn to the government as the agent that will safeguard the Net's considerable worth to society. Deference to the voluntary standards processes and players of the Internet means allowing its users to decide what works best for them. Much as the Net's Middle Layers took hold and flourished beyond direct government and market control, we should maintain that same hands-off approach for its future evolution.

VI. TWO OTHER DIMENSIONS: MATCHING CODE TO RULES AND PLAYERS

Just as important as what you do is how you do it. In assessing how to approach a perceived policy concern involving the Internet, there is more to the process than just pointing to a design model to figure out which functional aspect of the network to target. One also must determine the institutional tool to utilize, and the organizational entity to carry it out. The Internet policy principle introduced in the previous section—respect for the functional integrity of the Internet—goes to the operational analysis necessary to minimize harm to the "Code." In this case, the focus is on the four design attributes of the Internet. However, the impact (positive or negative) on the Internet can vary greatly, depending on whether and how the proposed external action affects its modular, end-to-end, interconnected, and agnostic architecture.

This section will touch on the two remaining dimensions—institutions and organizations—necessary to complete a viable Internet policy framework. These Rules and Players elements are necessary to carry out any effective functional solution to an Internet-based policy challenge. What increasingly has come to be labeled "governance," the tool for enabling a certain ordering in social relations, is just a blend of different institutions and organizations.

Most observers assume that traditional law and regulation are the only tools that a policymaker can wield to rein in unwelcome activities. But the law as created and implemented can be a blunt instrument. As Nissenbaum aptly phrases, "the law plugs holes that technology leaves open; it . . . defines away alternatives."[320] Fortunately, there is far more than the law and law-defining entities. A wide array of choices is available in both areas: the institutional overlay (or, which tool should we use, from laws to regulations to standards to best practices to norms) and the organizational overlay (or, which entity should we use, from the legislature to government agencies to multistakeholder groups). Collectively those decisions create different kinds of governance

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[320] Nissenbaum, *supra* note 92, at 1385.

mechanisms that can be applied to the Net feature in question.[321]

A. *The Institutional Implements: Rules of the Game*

There is a wide and often underappreciated range of societal instruments that can be utilized in support of policymaking. Much of human interaction and activity is structured in terms of overt or implicit rules. Institutions—the rules of the economic game—create the incentive structure of commercial relationships. Markets require conscious political effort to foster the trust-generating institutions necessary to make them function at all.[322]

For years, the school of New Institutional Economics (NIE) has been wrestling with questions about the appropriate institutions for a market economy. Neoclassical economics was generally dismissive of institutions and has lacked empirical data about their role. The fundamental tenets of NIE are that institutions matter and can be analyzed by tools of economic theory. In particular, institutions, from law and contracts to norms and behavior codes, help reduce information uncertainty and transaction costs.

Different institutional arrangements also lead to different trajectories and different combinations of static and dynamic performance characteristics—including differential prices, diversity of services, rate of new service introduction, and ubiquity of access to services and content. A gamut of institutional choices differs by degree of coercion, flexibility, accountability, and formality. For example, social control can often be achieved through more informal, decentralized systems of consensus and cooperation, such as norms, rather than through laws.[323]

B. *The Organizational Entities: Players of the Game*

In addition to institutions (what economists consider the rules of the political/economic game), we also have the various entities that actually play the game. Organizations are groups of individuals bound together by a common purpose to achieve certain agendas. They comprise a special kind of institution with additional features including criteria to establish their boundaries, principles of sovereignty, and chains of command. In addition to government actors, they include political, social, and educational bodies, such as corporations, political parties, law firms, trade unions, and universities. "Much like

[321] *See, e.g.*, Kleinwachter, *supra* note 38, at 482 (every network layer and every associated service should have its own special governance model of stakeholder combinations, as part of a "Multilayer-Multiplayer Mechanism.").

[322] For a more extensive discussion of identifying and selecting the optimal institutions and organizations for public policy challenges, see *Adaptive Policymaking*, *supra* note 32, at 514–26.

[323] *Id.* at 514–15.

institutions, organizations run the gamut from formal to informal, accountable to non-accountable, fixed to flexible."[324]

Typical political bodies in the United States include the executive branch, the legislative branch, the judicial branch, and the "fourth branch" of independent agencies.[325] Corporations are also part of this organizational ecosystem,[326] along with many other types of entities, such as non-governmental organizations (NGOs).

Each organization is its own complex adaptive system, which among other things means that we should look beneath the surface to recognize the actions of the disparate players within. The treatment of an organization as a social actor should not ignore the potential conflict within the organization. Moreover, organizational perspectives dictate how one views a policy issue. Whether you are a corporate CEO, a public interest advocate, a political appointee chosen to run a government agency, or a career bureaucrat in that same agency, what you see depends on where you stand.

C. *The Basics of Multistakeholder Governance*

The following three sections on the right types of institutions and organizational structures for the Internet easily could warrant a more extensive and fulsome treatment. For present purposes, I will provide some basic observations and then sketch out several possible ways forward.

1. The Rise of Multistakeholder Models

In some quarters these days multistakeholderism is all the rage. Many industry sectors have concluded that more traditional forms of regulation should be replaced by a system that includes representatives from the affected industry and other so-called "stakeholders" who stand to gain or lose materially based on the outcome. While the literature is large and growing quickly, some have called for a more thorough research agenda on these multistakeholder organizations, or MSOs.[327]

Forms of multistakeholder models ("MSMs") include self-regulation, where the industry itself takes the lead in devising codes of conduct and best practices meant to govern the way business is done, and co-regulation, where the government is seen as having more or less an equal stake in the process and substantive outcome of the deliberations. In fact, in many cases, MSMs are initiated or promoted by the government. Marc Berejka, for example, believes that policymakers are just another group of stakeholders who can help to

[324] *Id.* at 527.
[325] *Id.* at 527–28.
[326] *Id.* at 528–30.
[327] *See, e.g.*, Waz & Weiser, *supra* note 72, at 3–4.

coax or guide the development of new practices and norms for the Internet.[328]

The major rationale for adopting an MSM approach is that institutional change is slower than technological or economic change, and softer power institutions like MSOs are more decentralized and adaptable.[329] Scheuerman has conducted a detailed analysis of "the social acceleration of time"[330] and shown how the Internet has only exacerbated the problem for policymakers. Relying on more collaborative administrative regimes with supportive stakeholders can increase creativity, improve implementation, and heighten democratic participation.

On the other hand, some argue that such projects will lack legitimacy because the stakeholders' self-interest undermines collaborative endeavors, compared to a rule-bound, deterrence-based system. The challenge is to balance flexibility and adaptability of soft power solutions with legitimacy and accountability (by both policymakers and economic actors) and the potential for enforceability of hard power solutions. One takeaway is that social control can often be achieved through more informal, decentralized systems of consensus and cooperation, rather than classic command-and-control measures.[331]

MSOs do not come to power or accountability easily; they usually must build their legitimacy *a posteriori*, rather than enjoying it *a priori*.[332] A chief concern is to promote trust among stakeholders, either through formal or informal institutions.[333] Indeed, "for any group, capture is always what the other groups are guilty of."[334] That may be one reason why, at its core, the MSM typically is process, more than ends, driven.[335]

Drake identifies different models of MSM participation along a continuum, from Type 1 (weakest) to Type 4 (strongest).[336] He highlights five problems with many MSM groups: (1) the scope of participation is too narrow; (2) the developing world needs more outreach; (3) an often yawning gap exists between nominal and effective participation; (4) processes are "inevitably configured by

328 *See* Marc Berejka, *The Dynamics of Disruptive Innovation: A Case for Government Promoted Multi-Stakeholderism*, 10 J. TELECOMM. & HIGH TECH. LAW 1 (2012).
329 *Adaptive Policymaking*, *supra* note 32, at 525.
330 *Id.*
331 *Id.* at 522.
332 de La Chapelle, *supra* note 38, at 24.
333 Berejka, *supra* note 328, at 2.
334 de la Chapelle, *supra* note 38, at 23.
335 MUELLER, *supra* note 315, at 264.
336 William Drake, *Multistakeholderism: Internal Limitations and External Limits*, *in* MULTISTAKEHOLDER INTERNET DIALOG, CO:LLABORATORY DISCUSSION PAPER SERIES NO. 1, INTERNET POLICY MAKING 68 n.1 (2011), *available at* http://dl.collaboratory.de/mind/mind_02_neu.pdf.

asymmetries among agents in terms of wealth, power, access to information, connections, and influence"; and (5) government commitment to MSMs appears thin.[337] Interestingly, aside from the OECD, there is no general movement toward increased multistakeholder models in other intergovernmental organizations.[338]

2. A working definition of polycentric groups and practices

Polycentric groups and practices can be seen as a sub-species—in Drake's strongest, "Type 4" form—of multistakeholder models. A polycentric governance system is an arrangement to organize political matters in a way that involves local, national, regional, and international agents and institutions on equal footing whenever appropriate. Such a system can be defined as the development and application of shared technical principles, social norms, and rules and practices intended to reach decisions and programs for the evolution and usage of certain resources. All participants have an opportunity to raise their agenda and discuss urgent issues in shared fora, which are meant to operationalize, structure, and distribute common challenges among the actual decision-making and rule-setting institutions.

Nobel Prize winning economist Elinor Ostrom has been a leader in defining and analyzing polycentric systems of governance. She believes they constitute one approach that can be used for collective-action problems, such as dealing with common pool resources (CPRs).[339] Such problems typically take the inputs and efforts of many individuals—including "public entrepreneurs"—in order to achieve joint outcomes.[340]

Frischmann says that "a commons management strategy is implemented by a variety of institutional forms, which are often mixed (property and regulation, private and communal property)".[341] There are no magic formulas for solving collective-action problems, although Ostrom clearly disfavors what she calls "monocentric hierarchies."[342] The two types of systems typically identified for solving societal problems are the open competitive markets for private goods, and centralized, top-down governmental organizations. To Ostrom, polycentric governance represents a third and more effective way to manage CPRs.[343]

337 *Id.* at 69–71.
338 *Id.* at 71. This includes bodies such as WIPO, WTO, the United Nations, and the European Union. *Id.*
339 Elinor Ostrom, *Polycentric Systems As One Approach For Solving Collective-Action Problems* 2–3 (Sept. 2, 2008), *available at* http://ssrn.com/abstract=1304697.
340 *Id.* at 1–2.
341 FRISCHMANN, *supra* note 133, at 8.
342 Ostrom, *supra* note 339, at 4, 16.
343 *Id.* at 1.

Ostrom's research also shows that "in a self governed, polycentric system, participants make many, but not necessarily all, rules that affect the sustainability of the resource system and its use."[344] "The costs of effective self-organization are lower when authority exists to create institutions whose boundaries match the problems faced."[345] Polycentric systems may not work if some stakeholders have significant influence, or "capture." Successful CPR systems thus tend to be "polycentric," with small units nested in layered systems.

In addition to well-defined boundaries of the resource system, other design principles that underlie the most robust polycentric systems include a proportional equivalence between benefits and costs, affected individuals participating in enacting the rules, monitoring, graduated sanctions, conflict resolution mechanisms, minimal recognition of rights, and nested enterprise.[346] A variety of such governance regimes may achieve sustainability.[347]

D. *Polycentrism in the Internet Space*

1. Harnessing Rules and Players for Middle Layers Functions

Back in 1997, the pioneers of the Internet presciently identified a key challenge for its continued successful evolution. "The most pressing question for the future of the Internet is not how the technology will change, but how the process of change and evolution itself will be managed."[348] Even though standards can have public-interest effects, they are established not by legislatures but by private standards-setting organizations like the IETF.[349] This raises many questions about the role of values in protocol design, the processes that can bestow legitimacy on these organizations, and government's responsibility to encourage certain kinds of standardization processes.[350] As Lawrence Lessig puts it, "code writers are increasingly lawmakers."[351]

The concept of "Internet Governance" has its roots in multilateral volunteerism, but unfortunately that provenance largely has been replaced by disputes over the Internet's perceived challenges to national sovereignty.[352] In order to operate, the Internet relies on many thousands of technical standards, developed by a diversity of standards organizations.[353] There is no "top-level Steering Group" to control the

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344 Ostrom, *supra* note 339, at 8.
345 *Id.* at 3.
346 *Id.* at 12–16.
347 *Id.* at 7.
348 Leiner et al., *supra* note 46, at 108.
349 DeNardis, *supra* note 76, at 7.
350 *Id.*
351 LAWRENCE LESSIG, CODE 79 (Version 2.0 2006).
352 Kleinwachter, *supra* note 38, at 480-84.
353 *The Importance of Voluntary Technical Standards for the Internet and Its Users*, *supra* note

Internet; instead there are "multiple collaborating standards and governance bodies that participate in various aspects of the Internet Ecosystem depending upon their expertise and focus."[354] Further, the Internet's traditional institutions are formal and informal standards and norms, developed by organizations like IETF, and guided by, for example, the Internet Architecture Board ("IAB"). These standards and norms have been buttressed, or in some cases thwarted, by laws, treaties, and regulations of various nations. This multiplicity of institutions and organizations seems to map well to the polycentric governance principles and "collective choice arena" enunciated by Ostrom.

As explained earlier, the appropriate way to think about the Internet as a CPR is to focus on the logical layers protocols. And the best way to incorporate Ostrom's insights about governing CPRs is to examine the specific institutions and organizations that match up with her preferred definition. The "Ostrom Test" for whether the Internet's Middle Layers functions constitute a CPR requires actors who are major users of the resource, and involved over time in making and adopting rules within collective choice arenas regarding the inclusion or exclusion of participants, appropriation strategies, obligations of participants, monitoring and sanctioning, and conflict resolution.[355] Initially that fit appears to be a good one.

Much like the design principles that define the Net's architecture, the institutions and organizations that have sprung up to help define these attributes have their own philosophy of process: decentralized, open, transparent, consensual, and peer-reviewed. This should not be surprising; as Ostrom has documented, the probability is higher that a small community with shared values will develop adequate rules to govern its relationships.[356] For example, de la Chapelle sees certain common elements in ICANN, and in the Internet Governance Forum (born in 2006); these include openness, transparency, equal footing, bottom-up agenda setting, an iterative consultation process, a governance workflow, self-organization, links with legitimating authority, self-improvement processes, a pattern of open-forum, topic-based working or steering groups, and a local replication ability.[357] He also notes the potential implementation pitfalls: ensuring truly inclusive participation, fighting information overload, synthesizing discussions, preventing capture, composing diversified working groups, creating

45, at 2.

354 Letter from Sally Wentworth & Lucy Lynch, Dirs., The Internet Soc'y, to Annie Sokal, Nat'l Inst. of Stan. and Tech. at 3, *available at* http://www.nist.gov/nstic/governance-comments/Internet-Society-nstic-noi-response-jul2011-isoc-final.pdf (last visited Mar. 5, 2013).

355 Ostrom, *supra* note 339, at 8.

356 ELINOR OSTROM, UNDERSTANDING INSTITUTIONAL DIVERSITY 27 (2005).

357 de la Chapelle, *supra* note 38, at 19–22.

neutral steering groups, reaching closure, and building legitimacy.[358]

A separate question is whether we need guiding principles for Internet governance bodies. Solum believes, for example, that "Internet governance institutions should be biased in favor of maintaining the integrity of the layers."[359] That view is not necessarily universal. David Clark and others note that there is a fundamental disagreement whether, going forward, Internet architecture should incorporate inherent values that have been widely accepted through societal debate, or instead be adaptable to a wider range of stakeholder values in an evolving societal context.[360] They suggest what could be termed a new "Internet Science," that accounts for both issues of technical optimization and making choices in the larger legal and social context in which the Internet is embedded.[361] Clark and his various co-authors also have proposed a "tussle" space that would inform both the choice of design features and principles, and the institutions and organizations selected to host the various debates.[362] The concept is that the Internet should be modularized along "tussle space boundaries," so that interested stakeholders can debate and decide the best places in the network for control decisions to be made.[363]

Finally, various interested groups also are considering ways that the Internet can and will evolve over time. ISOC, for example, has discussed four different scenarios that could develop over the next decade (Porous Garden, Moats and Drawbridges, Common Pool, and Boutique Networks), based on whether the future is more generative or reductive, command-and-control or decentralized and distributed.[364] A variety of researchers have been debating whether the Net should continue evolving through incremental changes, or whether a "clean-

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358 *Id.* at 22–24.

359 Solum & Chung, *supra* note 35, at 50.

360 Brown et al., *supra* note 93.

361 *Id.* § 6.

362 Marjory S. Blumenthal and David D. Clark, *Rethinking the Design of the Internet: The End-to-End Arguments vs. the Brave New World*, 1 ACM TRANSACTIONS ON INTERNET TECH. 70, 99 (2001), *reprinted in* COMMUNICATIONS POLICY IN TRANSITION: THE INTERNET AND BEYOND 91, 129 (Benjamin M. Compaine & Shane Greenstein eds., 2001) ("There is a continuing tussle between those who would impose controls and those who would evade them. . . . This pattern suggests that the balance of power among the players is not a winner-take-all outcome, but an evolving balance."); *see also* Clark et al., *supra* note 75.

363 Clark et al., *supra* note 99, at 351. As one pertinent example, Clark cites the need to conduct "deep control points analysis" to address where ultimate network control resides for matters like IP address assignment, user-selected routing and DNS resolution, and new information-bearing layer underlays. Brown et al., *supra* note 93, § 5. *See also* David Clark, Control Point Analysis (2012) (Telecomms. Pol'y Res. Conf. Submission), *available at* http://ssrn.com/abstract =2032124 (explaining that control point analysis can help us understand the power relationships created by specific design decisions surrounding the Internet).

364 *Internet Futures Scenarios*, INTERNET SOC'Y (2009), http://www.internetsociety.org/sites/default/files/pdf/report-internetfutures-20091006-en.pdf.

slate approach" is preferable using a new design architecture.[365]

The important point is that these types of conversations originate and can be settled within the right community of stakeholders, and not imposed from outside, or above. In the Internet world, engineers have good reason to believe that they possess more legitimacy than governments to make basic technical decisions about how the Net operates.[366]

2. IETF as Polycentric Role Model

Since its inception the IETF has operated at the center of the standards development community for the Internet. The IETF has standardized, among hundreds of other protocols, IP, TCP, DNS, HTTP, and BGP.[367] The organization "has succeeded in gaining widespread adoption for its specifications, based on a strong set of social norms and an effective procedural regime" for developing standards.[368] Although each standards development mechanism has its positive and negative attributes, Werbach finds that "the IETF is rare in its ability to function so effectively despite its radically decentralized and open structure."[369]

Rough consensus and running code have been the foundational principles of the IETF's work since at least 1992.[370] The IETF itself "has found that the process works best when focused around people, rather than around organizations, companies, governments or interest groups."[371] Historically this cooperative approach was used by the engineers who built the ARPANET, the Packet Radio and Packet Satellite networks, and the Internet, who worked on open mailing lists, and swiftly took technical decisions based on pragmatism and the best argument presented.[372] All genuine Internet institutions like the IETF have developed a track record that proves the effectiveness of this open cooperative approach for technical matters.

Some argue that the RFC process mirrors the peer review process

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365 Doria, *supra* note 79, at 25–45. Interestingly, Vint Cerf himself has commented that, had he been able to revisit the Internet's original design decisions, he would have considered utilizing software-defined networking (SDN) to separate out the data plane from the control plane. Among other benefits, he says this would allow networks to be controlled via software from external servers – in essence, a fully programmable network. Mark Hachman, *Vint Cerf: SDN Is a Model for a Better Internet*, April 16, 2013, http://www.slashdot.org/topic/datacenter/vint-cerf-sdn-is-a-model-for-a-better-internet/.

366 Werbach, *supra* note 85, at 200.

367 *The Importance of Voluntary Technical Standards for the Internet and Its Users*, *supra* note 45, at 2.

368 Werbach, *supra* note 85, at 200.

369 *Id.* at 193.

370 BARWOLFF, *supra* note 88, at 139.

371 RFC 3935, *supra* note 75, at 3.

372 Janet Ellen Abbate, *From ARPANET to Internet: A history of ARPA-sponsored computer networks, 1966–1988*, UNIVERSITY OF PENNSYLVANIA, http://repository.upenn.edu/dissertations/AAI9503730/.

in academia, and this should be considered the equivalent of scholarly publication.[373] In fact, the process for drafting, sharing, and adopting RFCs is "tough and effective," with more peer reviewers than any common scholarly publication system,[374] "but with additional emphasis on openness and transparency."[375] There should be little surprise that "the RFC process is a model that has been taken up for use by decision-makers working on other large-scale sociotechnical systems."[376] As Kleinwachter puts it, the RFC procedure "became a special form of legislation and broadened our understanding of regulation and governance in the Information Age."[377]

Of course, like any entity comprised of human beings, IETF has been seen to have its flaws. "With the success of the Internet has come a proliferation of stakeholders—now with an economic as well as an intellectual investment in the network."[378] One obvious question that arises is the extent to which corporate or commercial interests have begun influencing the IETF's work, and whether or not this is a bad thing. "Controlling a standard is competitively valuable, so firms can be expected to engage with standards bodies in ways calculated to serve their own interests."[379] Standards wars can be controlled by large corporate interests,[380] and the processes themselves contested by the participants.[381] Some participants in its working groups have complained, or even quit, following clashes with others purportedly representing less innovative commercial interests.[382]

At the same time, standards bodies typically have no enforcement authority.[383] Rather, "[i]t is the nature of the Internet itself as an interoperable network of networks that enforces compliance with standard protocols."[384] In other words, the true source of the "war" may lie outside the Middle Layers routing and addressing functions, in the marketplace itself. "There is a potential conflict for these corporations

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373 Brian E. Carpenter & Craig Partridge, *Internet Requests for Comments (RFCs) as Scholarly Publications*, 40 ACM SIGCOMM COMPUTER COMM. REV., no. 1, Jan. 2010, at 31, *available at* http://www.sigcomm.org/sites/default/files/ccr/papers/2010/January/1672308-1672315.pdf.

374 *Id.*

375 *Id.* at 32.

376 Braman, *supra* note 65, at 2.

377 Kleinwachter, *supra* note 38, at 474.

378 Leiner et al., *supra* note 46, at 108.

379 Werbach, *supra* note 85, at 199.

380 PALFREY & GASSER, *supra* note 157, at 164–65.

381 *Id.* at 165–66.

382 *See, e.g.*, Eran Hammer, *OAuth 2.0 and the Road to Hell*, HUENIVERSE (July 26, 2012), http://hueniverse.com/2012/07/oauth-2-0-and-the-road-to-hell ("At the core of the problem is the strong and unbridgeable conflict between the web and the enterprise worlds. . . . [Most of the individuals who participate] show up to serve their corporate overlords, and it's practically impossible for the rest of us to compete.").

383 Bernbom, *supra* note 71, at 15.

384 *Id.*

between cooperation (using standard protocols to interoperate with the rest of the Internet) and competition (employing proprietary technology to gain market advantage)."[385] Bernbom believes their influence "is less through their participation in standards-making bodies" and more through the product-oriented decisions they make about what protocols to use and what standards to follow in the design of network hardware and software.[386]

Past history yields examples of how major economic consequences can flow from industry's selection of a particular Web standard.[387] In 1997, RFC 2109 was adopted, which provides that a cookie generated by a particular website can only be retrieved by that website. Nonetheless, DoubleClick's workaround project created a "third party" cookie that can follow users from site to site.[388] That approach was blessed by RFC 2965, which won the day with the support of the advertising industry. On the other hand, the use of Network Address Translation ("NAT") in broadband networks has flourished despite the fact that it has never been formally adopted as an Internet standard. Indeed, the IETF has treated NATs as a violation of the Internet's end-to-end architecture, perpetrated by industry.[389]

One also can argue that open processes like those employed by the IETF actually are closed to most people, even those with significant interest in the proceedings, given the cost in time and money to participate. Many Internet governance debates and issues are not readily visible to the general public.[390] Some also cite the need for "deepening democracy" so that civil society can fully participate in Internet governance processes and decision-making; the key for them is realistic accessibility.[391] On the other hand, there are very effective IETF participants who never come to the face-to-face meetings, and participate instead through the online processes.

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385 *Id.* at 14.

386 *Id.*

387 Nissenbaum, *supra* note 92, at 1381–82.

388 *Ad targeting: DoubleClick Cookies*, GOOGLE http://support.google.com/adsense/bin/answer.py?hl=en&answer=2839090.

389 Doria, *supra* note 79, at 14. *See e.g.*, T. Hain, *Architectural Implications of NAT* (Network Working Group, Request for Comments No. 2993) (Nov. 2000), *available at* http://www.iab.org/documents/correspondence-reports-documents/docs2000/rfc2993 [hereinafter RFC 2993] (describing NAT's negative architectural implications); DeNardis, *supra* note 76, at 14 (arguing that the e2e principle has waned over the years with the introduction of NATs, firewalls, and other intermediaries).

390 DeNardis, *supra* note 76, at 17.

391 Anriette Esterhuysen, *A Long Way to Go: Civil Society Participation in Internet Governance*, *in* MULTISTAKEHOLDER INTERNET DIALOG, CO:LLABORATORY DISCUSSION PAPER SERIES NO. 1, INTERNET POLICY MAKING 54, 58 (2011), *available at* http://dl.collaboratory.de/mind/mind_02_neu.pdf.

E. *A Modest Proposal: Modular Governance*

Real-world experience proves that the norms and principles developed by the IETF and other non-governmental bodies are no less successful and workable globally, as traditional governmental regulation nationally.[392] Nonetheless the two worlds of the "borderless cyberspace" and the "bounded real space" cannot be separated, but instead form an interdependence that should be harnessed in a productive model of "co-governance."[393]

The notion that "'institutions matter' is particularly relevant to CPR goods, where classic market mechanisms cannot function" in efficient ways.[394] This suggests that neither governments (political power) nor markets (economic power) are the best types of exclusive arrangements for Internet governance issues involving Middle Layers addressing and routing functions. Obviously neither source of authority and influence can be successfully eluded, but a third approach is possible, imbued with the design principles and processes and bodies that can optimize the Net's enabling power.

I have a few suggestions on how to more formally incorporate multistakeholder models and polycentric governance into the Internet policy world.

First, applying the Internet policy principle to the logical layers functions elucidates a clear implication: national and global political bodies should defer to the existing and evolving community entities and processes already at work in the Net space. As indicated earlier, maximum deference should be given to the Middle Layers functions, the pure "public commons" that constitutes the Internet's core attributes. That technical community, through a significant degree of transparency, participation, expertise, and accountability, is actively engaged in figuring out where and how to draw the line between the way the Net has been operating and where it will go from here. As Werbach puts it, "There is simply no reason for government to interfere with this system. In fact, to do so would risk destabilizing the Internet industry."[395] To borrow Benkler's apt phrase, policymakers should practice "regulatory abstinence"[396] as part of a global "keep out" zone.

Second, we must recognize that the Internet is not just global, but also national, regional, and local.[397] We should consider recognizing a more explicit system of national overlays and underlays (aimed respectively at Upper Layers and Lower Layers activities) to existing

392 Kleinwachter, *supra* note 38, at 476.
393 Kleinwachter, *supra* note 38, at 476-75.
394 Hofmokl, *supra* note 63, at 228.
395 Werbach, *supra* note 85, at 200.
396 BENKLER, *supra* note 259, at 393.
397 RICHARD COLLINS, THREE MYTHS OF INTERNET GOVERNANCE 9–10 (2009).

global design (the Middle Layers logical functions). In the United States, for example, the FCC could continue to serve as the lead agency for the physical infrastructure layers of access networks, while the Federal Trade Commission would continue in its current role as supervising user activities in the content and applications worlds.[398] This approach would help protect the Middle Layers' integrity and freedom from undue government interference.

One possible way to approach this institutional underlay-overlay challenge is to create what Crépin-Leblond calls a "merged hybrid system," where a bottom-up process for Internet governance interfaces with the more rigid top-down decision-making processes of national governments.[399] "Rather than risking a head-on collision, such dialogue would encourage those involved to focus on reducing friction by defending the line that both groups are acting in the 'public interest.'"[400] The differences between the two sides could be seen as more like a semi-permeable boundary than an actual fixed separation. The multistakeholder process can shine a light of transparency on government processes, forcing accountability, while the government can provide "catalysis, reach, competence, support and a framework for the bottom-up multistakeholder model to thrive in."[401] Perhaps we should look initially for multilateral recognition of ISOC and ICANN as legitimate international bodies, along with the IAB, IETF, and others.

Third, it may make sense to begin talking about the best way for the U.S. Government, as a national political body, to oversee—but not interfere with—the polycentric governance process and output for the logical layers of the Internet. In essence, democratic government can help set the overarching social goals for society, while the "technocracy" of the Net sector can devise the technical means. One potential nominee for this governmental oversight role is the National Institute of Standards and Technology ("NIST"), an agency of the Department of Commerce focused on measurements and standards involving the physical sciences. NIST already has been involved in

398 Werbach believes that the FCC should recast itself as a standardization organization in virtually everything it does. Werbach, *supra* note 85, at 206. Certainly the FCC can and should retrench to a more limited but deep role of overseeing last-mile network infrastructure, conducting conflict adjudication, and incenting communications industry standards.

399 Olivier M.J. Crépin-Leblond, *Bottom Up vs. Top Down: ICANN's At Large in Internet Governance*, *in* MULTISTAKEHOLDER INTERNET DIALOG, CO:LLABORATORY DISCUSSION PAPER SERIES NO. 1, INTERNET POLICY MAKING 60, 62 (2011), *available at* http://dl.collaboratory.de/mind/mind_02_neu.pdf.

400 *Id.*

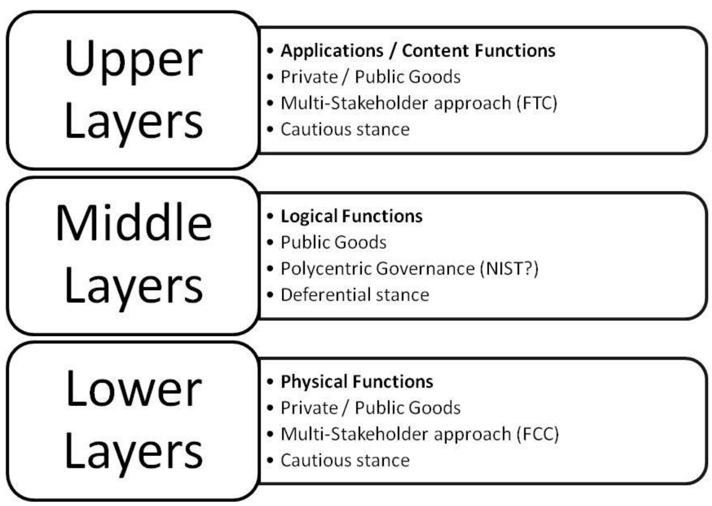
401 *Id.* This approach may work well, for example, when confronting the reality that the United States continues to be involved in at least one logical layers function, the Domain Name System, through its contractual agreement with ICANN. *See* COLLINS, *supra* note 397, at 160–61 (describing the clash between U.S. control over ICANN and other nations' claims for authority over the Internet).

establishing recommendations for elements of Internet policy, at least from the U.S. perspective.[402] Perhaps the first step would be to shift the existing Department of Commerce role in the ICANN agreement to a more standards-centric governmental entity like NIST. This could be a possible prelude to allowing ICANN eventually to function more on its own as a polycentric governance body.

VII. PUTTING IT ALL TOGETHER: EXAMPLES OF INTERNET POLICY IN THREE DIMENSIONS

Most fashioners of regulation seek to discipline the behavior of certain entities, in order to make them do what otherwise they would refrain from doing, or refrain from what otherwise they would prefer to do.[403] As we have seen, the forms and devisers of regulation of economic and other activities range widely, from direct mandates through government intervention to a host of "softer" institutions and organizations. This is especially the case in the Internet space. Here is a schematic summarizing the approach suggested in this Article:

Figure 1: Proposed Internet Policy Framework



Zittrain memorably said that "[s]ilver bullets belong to the realm of the appliance."[404] Many regulatory interventions by government in

402 *See, e.g.*, DEP'T OF COMMERCE, NAT'L INSTITUTE OF STANDARDS AND TECH., RECOMMENDATIONS FOR ESTABLISHING AN IDENTITY ECOSYSTEM GOVERNANCE STRUCTURE (2012), *available at* http://www.nist.gov/nstic/2012-nstic-governance-recs.pdf (recommending a private sector-led governance framework for an "Identity Ecosystem").
403 *Adaptive Policymaking*, *supra* note 32, at 509.
404 ZITTRAIN, *supra* note 268, at 152.

the Internet space tend to be either under- or over-inclusive, and traditional prescriptive regulation often can lead to both outcomes simultaneously.[405] In the case of attempts to discipline the market practices of broadband access providers, for example, prescriptive regulation risks both over-regulating legitimate network functions, and under-regulating undesirable behavior.[406] The risks actually are far more pronounced in the larger Internet arena constituted by the Middle Layers. Solum pointed this out in his own work, observing that the challenge to would-be regulators is to devise solutions that avoid being under-inclusive or over-inclusive, do not lead to "mission creep" by the authority in charge, and deal adequately with the prevailing lack of information about impacts.[407]

According to Kingdon, ideas tend to float freely through the "policy primeval soup," waiting for an opportunity to become relevant as possible solutions to a problem.[408] He goes on to explain that "sometimes ideas fail to surface in a political community, not because people are opposed to them, not because the ideas are incompatible with prevailing ideological currents, but because people simply found the subjects intellectually boring."[409] We need to take that challenge head on. Below we will briefly examine a few real-world examples where we can benefit from fitting a three-dimensional approach encompassing Code, Rules, and Players to a pressing policy concern that affects the Net's operations.

A. *Copyright Protection over Rogue Websites: SOPA and PIPA*

As mentioned in Part I, Congress by early 2012 was on the verge of passing the SOPA and PIPA copyright bills. The Internet Blackout Day had the desired effect of putting off further consideration of the legislation, although the political process did not yield a satisfactory debate over the technical aspects of the proffered solution, or any viable alternatives. Indeed, the debate over creating new technical and enforcement mechanisms to protect copyrighted material continues to play out in the context of international trade negotiations, such as ACTA (Anti-Counterfeiting Trade Agreement) and TPP (Trans-Pacific Partnership Agreement),[410] and the coming TTIP (Transatlantic Trade and Investment Partnership).[411] The combination of vague and

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405 *Broadband Policy*, *supra* note 32, at 508; *see also* ZITTRAIN, *supra* note 268, at 150.
406 *Broadband Policy*, *supra* note 32, at 511.
407 *See generally* Solum & Chung, *supra* note 35; *see also Broadband Policy*, *supra* note 32, at 512–14.
408 *See* KINGDON, *supra* note 27, at 134.
409 KINGDON, *supra* note 27, at 133.
410 *See* Levine, *supra* note 4.
411 *United States to Negotiate Transatlantic Trade and Investment Partnership with the European Union*, OFFICE OF THE UNITED STATES TRADE REPRESENTATIVE (Feb. 13, 2013), http://

potentially far-reaching standards, the authority of an international treaty, and the behind-closed-doors government-to-government actions of treatymakers, is especially troubling.[412] Whatever the infirmities of the congressional process of gathering information and making decisions, they cannot challenge the "closed code" environment of international treatymaking, and a potentially poor mix of Code, Rules, and Players.[413]

Invoking my proposed Internet policy framework, both SOPA and PIPA suffered from the same common Code defect: seeking to regulate IP layer attributes (Middle Layers functions) in order to address content layer concerns (Upper Layers activities). Attempting to map IP addresses to content layer information is a classic layers violation, one that is both over-inclusive (by harming substantial innocent uses) and under-inclusive (by failing to address more effective and technically feasible alternatives).[414] One also can see the proposed action as a violation of end-to-end design, as it would compel new intelligence to be placed in the core of the network to the detriment of some user activities at the outer edges. In addition, the drive to greater voluntary connectivity within the Internet could be dampened by banning certain network end points. Finally, IP's "best effort" delivery mechanism could be thwarted by the prioritization of certain forms of content over others. Thus the technical mandates would have violated the Net's functional integrity by both degree and scope.

Interestingly, the short letter to Congress from the Internet engineers referenced earlier made very similar points.[415] The engineers agreed that DNS filtering and other functional mandates problematically target network functions. They also concurred that the bills would be both ineffective (because many workarounds are possible) and over-inclusive (because many legitimate uses and users would be adversely affected).[416] In other words, Congress was considering legislation that, while laudable in its goals, was aimed at the wrong functional target: the DNS and other logical- or applications-layers operations. The legislation suffered from a lack of fitness. Nefarious practices by scofflaws would go unhindered and unpunished, while substantial innocent uses would suffer. Moreover, what most users might define as "most fit" on the Internet—the short and long tails of Internet-based

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www.ustr.gov/about-us/press-office/fact-sheets/2013/february/US-EU-TTIP.

[412] *See* Michael A. Carrier, *SOPA, PIPA, ACTA, TPP: An Alphabet Soup of Innovation-Stifling Copyright Legislation and Agreements*, 11 NW. J. TECH. & INTELL. PROP. 21 (2013); Peter K. Yu, *The Alphabet Soup of Transborder Intellectual Property Enforcement*, 60 DRAKE L. REV. 16 (2012).

[413] *See* Levine, *supra* note 4, at 132-40; *see also* Bridy, *supra* note 26, at 157-162.

[414] *See* Solum & Chung, *supra* note 35.

[415] Higgins & Eckersley, *supra* note 12.

[416] *Id.* at 1.

activity—also would be degraded. Other engineering experts chimed in to readily identify both the under-inclusionary and over-inclusionary risks from the copyright legislation.[417]

Some in the Internet community endorsed a different policy solution: the so-called "follow the money" approach. This proposal was contained in an alternative bill, the Online Protection and Enforcement of Digital Trade Act ("OPEN"), which discarded the functional elements of the SOPA and PIPA bills.[418] In addition to moving enforcement to the International Trade Commission ("ITC"), the bill zeroed in on disrupting the chief incentives—the lucrative nature of stealing and selling someone else's content—by empowering financial institutions to deny access to funding and credit.[419] The chief virtue of such an approach is that it shifts the focus from the logical layers to the more appropriate content and applications layers, thereby avoiding many of the under-targeting and over-targeting technical concerns raised by the Net engineers. While many in the Net community applauded the OPEN bill as clearly superior to the SOPA-PIPA model, Yochai Benkler earlier had challenged this type of approach as a dangerous path that could lack due process.[420] Whatever its specific merits, however, the "follow the money" scheme at least begins to move the dialogue to the appropriate place in the network. It constitutes the right type of solution, even if perhaps not the right solution.

Beyond technical concerns with SOPA and PIPA, the institutional device being employed—a federal statute—and the organizational bodies being empowered—the federal courts—constitute the more traditional top-down ways that policymakers think about addressing perceived problems. One can posit that the fit of Rules and Players here is also lacking with regard to highly technical elements of the Internet, operating in evolving and fast-moving standards-setting processes.

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[417] CROCKER ET AL., *supra* note 7, at 10–13. *See also* Friedman, *supra* note 11 (the legislation's attempt to "execute policy through the Internet architecture" creates very real threats to cybersecurity, by both harming legitimate security measures and missing many potential workarounds).

[418] The OPEN Act was introduced in the Senate by Senator Ron Wyden (D-OR) on December 17, 2011, and in the House by Congressman Darrell Issa (R-CA) on January 18, 2012. *See* S. 2029, 112th Cong. (2011); H.R. 3782, 112th Cong. (2012).

[419] A similar approach is employed in the Internet Gambling Prohibition and Enforcement Act of 2006, under which United States-based banks and credit card companies are prohibited from processing payments to online gambling sites. *See* H.R. 4411, 109th Cong. (2006).

[420] Benkler resists the notion that disrupting payments systems is a good answer; he sees it instead as a new, extralegal path of attack that also targets entire websites rather than specific offending materials. Yochai Benkler, *WikiLeaks and the PROTECT-IP Act: A New Public-Private Threat to the Internet Commons*, 140 DAEDALUS 154, 155 (2011). He particularly decries the employment of private firms offering critical functionalities to a website—whether DNS, cloud storage, or payment systems—to carry out the attacks, outside the constraints of law and the First Amendment.

B. *Global Internet Governance(s)*

As a calendar year bookend to the SOPA/PIPA debates, the latter half of 2012 brought a new Internet policy challenge to the forefront: what is the appropriate global organizational body to consider questions of Internet governance? As we have seen, standards bodies like the IETF long have been that kind of organization for a host of Internet protocols, while ICANN presides over the few core functions of the Domain Name System and IP address allocation. Nonetheless the International Telecommunication Union ("ITU") now seems poised for the first time to take on self-delegated regulation of Internet-based activities.

For nearly 150 years, the ITU has been a leading global body governing international telecommunications standards and traffic. As an arm of the United Nations, the ITU engages in government-to-government negotiations over how telecommunications traffic between countries is to be regulated. In particular the ITU has facilitated spectrum coordination, assisted in standards-setting, and played a critical role in encouraging deployment and adoption of communications networks in developing economies.

The International Telecommunications Regulations ("ITRs")—the governing, binding international regulations for circuit-switched telecom service providers—have not been revised since 1988. In December 2012, the ITU convened its World Conference on International Telecommunications ("WCIT") to consider a number of member-nation proposals for such revisions.[421] As it turns out, several of those proposals for the first time would have placed the ITU in the role of overseeing and even regulating international Internet traffic.[422] Ominously, in the past countries like China and Russia have recommended an "International Code of Conduct for Information Security," which would make all Internet governance decisions subject to government approval.[423] These member-nation proposals are not out of keeping with the ITU's recently stated ambitions. In 2010, a majority of the ITU's 193 countries resolved to "increase the role of [the] ITU in Internet governance so as to ensure maximum benefits to the global community."[424]

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[421] World Conference on International Telecommunications, www.itu.int/en/wcit-12/Pages/default.aspx (last visited Mar. 28, 2013).

[422] *See Security Proposals to the ITU Could Create More Problems, Not Solutions*, CENTER FOR DEMOCRACY AND TECHNOLOGY (Sep. 6, 2012), https://www.cdt.org/files/pdfs/Cybersecurity_ITU_WCIT_Proposals.pdf.

[423] Doria, *supra* note 79, at 22–23.

[424] Int'l Telecomm. Union [ITU], *Facilitating the Transition from IPv4 to IPv6*, ITU Admin. Council Res. No. 180 (2010), *compiled in* RESOLUTIONS AND DECISIONS OF THE ADMINISTRATIVE COUNCIL OF THE INTERNATIONAL TELECOMMUNICATION UNION (2011), *available at* http://www.itu.int/pub/S-CONF-PLEN-2011/en.

It is no great secret why the ITU has been considering taking these steps into Internet governance. The world is moving quickly to packet-switching and the Internet Protocol, the basic architecture of the Internet.[425] The ITU believes it stands to lose importance as more and more of the world's telecommunications traffic and infrastructure escapes its jurisdiction.[426]

As the WCIT loomed, the ITU's proposed involvement in the Internet space was widely decried on both substantive grounds[427] and process grounds.[428] ISOC in particular weighed in with its concerns.[429]

Certainly the ITU is a problematic enough organization on the process front. As a UN body based on a "one country, one vote" structure, and having limited involvement by entities who are not national governments, minimal expertise in technical Internet matters, and little transparency in process, the ITU flunks the test for broad-based polycentric governance. Moreover, even the ITU's claim to uniquely represent the nations of the world is belied by the fact that it has more non-voting business members than member states.[430]

In fact the ITU is a notable example of an international body that has failed to embrace a multistakeholder model.[431] Just a few years ago, the body rejected some modest suggestions on ways to increase the ability of outside stakeholders to participate meaningfully in the ITU's processes.[432] In the run-up to the WCIT, the ITU showed some signs of willingness to open up its processes to third parties.[433] However, those efforts were limited and have been roundly criticized as insufficient.[434]

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425 *See, e.g.*, Petition to Launch a Proceeding Concerning the TDM-to-IP Transition, *In re* AT&T Petition to Launch a Proceeding Concerning the TDM-to-IP Transition, WC Docket No. 12-__, (filed Nov. 7, 2012) (FCC should open rulemaking to consider eliminating certain legacy rules on IP networks, and conduct trial of local IP network interconnection).

426 COLLINS, *supra* note 397, at 161.

427 *See, e.g.*, Brian Pellot, *UN Agency Threatens Internet's Future*, FREESPEECHDEBATE (July 31, 2012), http://freespeechdebate.com/en/2012/07/un-agency-threatens-internets-future ("Proposed ITR regulations could shift [the Net's] decentralized, bottom-up approach to top-down control by government actors with their own national agendas.").

428 Patrick S. Ryan & Jacob Glick, Presentation to the North American Network Operators' Group 55th Meeting, The ITU Treaty Negotiations: A Call for Openness and Participation (June 2012), *available at* http://ssrn.com/abstract=2077095 (last visited Mar. 10, 2012).

429 *Internet Society Board of Trustees Expresses Concern About the Potential Impact of the World Conference on International Telecommunications on the Internet*, INTERNET SOC'Y (Aug. 7, 2012), http://www.internetsociety.org/news/internet-society-board-trustees-expresses-concern-about-potential-impact-world-conference [hereinafter *Internet Society Press Release*].

430 COLLINS, *supra* note 397, at 178.

431 Drake, *supra* note 336, at 72.

432 *Id.*

433 Press Release, International Telecommunications Union, Landmark Decision by ITU Council on Proposal for Consultation and Open Access to Key Conference Document (July 13, 2012), http://www.itu.int/net/pressoffice/press_releases/2012/46.aspx#.URRTSaXkgm4. Of course, the mere fact that the ITU itself labeled this modest action as "landmark" speaks volumes.

434 See, e.g., Carl Franzen, U.N. Telecom Agency Releases Secret Treaty, Critics Unswayed, TPM (July 13, 2012, 7:59 PM), http://idealab.talkingpointsmemo.com/2012/07/un-telecom-

The ITU was called on instead to undertake far more significant procedural reforms, including at minimum widely sharing the treaty conference proposals, opening the proposals database for review and comment, and implementing a robust model for multistakeholder participation and representation.[435] To date, such reforms have not been forthcoming.

The substantive elements are also highly troubling. As a fundamental matter, the vertical silo model of regulation long (and still) championed by the ITU and most telecommunications regulators clashes directly with the layered, end-to-end nature of the Internet.[436] More specifically, certain proposals would have made ITU-T[437] recommendations mandatory, thereby supplanting the traditional voluntary multistakeholder bodies for standards development.[438] Other proposals would have created a new model for Internet interconnection, disrupted existing methods of Internet naming, numbering, and addressing, regulated IP routing, and extended the ITRs to Internet companies.[439] European telecommunications carriers submitted their own proposal to expand the ITRs to include Internet connectivity, and sought a "sending party network pays" compensation scheme that essentially would have levied a content fee on foreign websites.[440] In its understated manner, ISOC "expressed concern" that these and other measures "could have a negative impact on the Internet."[441]

Employing the WCIT as an Internet governance mechanism would have violated all three dimensions of my proposed Internet policy framework: the wrong functional and operational targets (Upper Layers activities and Middle Layers protocols), the wrong institutional tool (an

agency-releases-secret-treaty-critics-unswayed.php.

435 Ryan & Glick, *supra* note 428, at 22.

436 *Id.* at 4. *See generally Horizontal Leap*, *supra* note 35.

437 Margaret Rouse, DEFINITION: ITU-T (Telecommunication Standardization Sector of the International Telecommunications Union), TECH TARGET, http://searchnetworking.techtarget.com/definition/ITU-T ("The ITU-T (for Telecommunication Standardization Sector of the International Telecommunications Union) is the primary international body for fostering cooperative standards for telecommunications equipment and systems. It was formerly known as the CCITT. It is located in Geneva, Switzerland.").

438 Five of the world's leading Net governance groups—IETF, W3C, IEEE, ISOC, and IAB—recently declared their commitment to voluntary standards as part of their affirmation of "OpenStand." *See The Importance of Voluntary Technical Standards for the Internet and Its Users*, *supra* note 45, at 4; OPENSTAND, http://www.open-stand.org (last visited Mar. 10, 2013).

439 *See Internet Society Press Release*, *supra* note 429.

440 Int'l Telecomm. Union [ITU], *Revision of the International Telecommunications Regulations—Proposals for High Level Principles to be Introduced in the ITRs*, Council Working Group Contribution No. 109 (2012), *available at* http://www.itu.int/md/T09-CWG.WCIT12-120620-C/en. *See also* Laura DeNardis, Presentation at the Telecommunications Policy Research Conference: Governance at the Internet's Core: The Geopolitics of Interconnection and Internet Exchange Points in Emerging Markets 1 (Sept. 21, 2012), *available at* http://papers.ssrn.com/sol3/papers.cfm?abstract_id=2029715 (suggesting that the ETNO proposal amounts to a telephony-style content tax).

441 DeNardis, *supra* note 440.

international telecommunications treaty), and the wrong organizational body (the UN's chief telecommunications regulator). The solution is straightforward: the ITU should stick to what it has been doing well with regard to allocating radio spectrum and advancing broadband networks in emerging economies (both classic Lower Layers activities), thereby limiting itself to the boundaries of international telecommunications. The ITU certainly should refrain from getting involved in other domains outside its scope of substantive expertise and legitimacy.

C. *Broadband Network Management*

Over the past decade, public discussions over open Internet policy have focused on the potential need for laws or regulations to discipline the market behavior of broadband network access providers. A significant part of the public policy concern stems from the sizable "spillovers gap" between the commercial value of broadband infrastructure and its overall social value as an optimal platform for accessing the Internet. With privately owned broadband networks in particular, there is always the possibility of conflicts of interest between the platform owners and the platform users.[442]

Until recently, few on either side of the debate attempted to raise alternative institutional approaches, including the possible involvement of standards and best practices promulgated by expert network engineers. I devoted an earlier paper to this very question, and suggested a variety of "tinkering" measures that could be adopted as part of a national broadband policy.[443] While policymakers should be cautious, I still see a legitimate place for government to ask questions, monitor markets, and where necessary impose a mix of structural and behavioral solutions to perceived problems in the broadband market.[444]

One example of multistakeholder thinking is to develop a new type of body staffed by engineers representing some of the Internet's leading private and public stakeholders. In 2010, Google, Verizon, and other

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442 Werbach, *supra* note 85, at 185. Van Schewick goes further to claim that broadband providers actually control the evolution of the Internet, and that "it is highly unlikely they will change course without government intervention." VAN SCHEWICK, *supra* note 89, at 10. My broadband paper recognizes the concerns but comes to a somewhat different policy conclusion. *Broadband Policy*, *supra* note 35, at 470–71.

443 *Broadband Policy*, *supra* note 32, at 515–32. Rejecting what I called the "prescriptive" approach to broadband regulation, I suggested a number of "adaptive policy projects" focused on different implements, including: feeding the evolutionary algorithm by adding market inputs; fostering agent connectivity by harnessing infrastructure; shaping the fitness landscape by utilizing market incentives; and enhancing feedback mechanisms by creating more transparency and accountability. *Id.*

444 By contrast, in this Article I urge outright deference by governments to the Net's working institutions and organizations, due to what I see as the sizable "competency gap" between that world and current political systems. The Net community should be allowed to continue attaining a relative degree of success in minding its own affairs.

entities founded the Broadband Internet Technical Advisory Group ("BITAG").[445] The entities involved share the general conviction that the sometimes thorny issues of commercial management of broadband networks best should be considered, at least in the first instance, by technical experts through open membership and transparent processes, and not the government. The premise is to address perceived problems at the right place in the network (as determined by Internet engineers), using the right policy implement (best practices), wielded by the right type of entity (an MSO). As one example, the end-to-end design attribute does not preclude making the broadband network more secure by moving certain security functions within the network "core."[446]

The FCC, to its credit, seems to understand the role that entities like BITAG can play in current broadband policy, and then-Chairman Genachowski has spoken favorably about it.[447] Should the D.C. Circuit reverse the FCC's Open Internet Order,[448] it will be interesting to see whether and how such types of entities and institutions could help fill any resulting policy gaps.[449] The jury is still out on the ultimate success of BITAG, and its working structure and output are akin to a typical MSO, rather than a more radically open and decentralized polycentric entity like the IETF. Nonetheless this type of body has the potential to avoid highly detailed technology mandates from regulators, relying instead on the more flexible, adaptable, and inclusive approaches that traditionally have been utilized in the standards world.

Some resist the notion of any significant government role in the broadband space. Jim Cicconi of AT&T has even called out the U.S. Government for purported hypocritical behavior, because it sought to ward off any ITU involvement in the Internet while at the same time embracing FCC regulation of data roaming, broadband network management (commonly called network neutrality), and IP-to-IP interconnection.[450] Cicconi claims that "there is a principle at stake here. Either government regulates the Internet, or it doesn't. And the

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445 BROADBAND INTERNET TECHNICAL ADVISORY GROUP, http://www.bitag.org (last visited Mar. 10, 2013).

446 *See* FRISCHMANN, *supra* note 133, at 356; VAN SCHEWICK, *supra* note 89, at 366–68.

447 Julius Genachowski, Opening Statement at the Inaugural Meeting of the Open Internet Advisory Committee, July 20, 2012, *available at* http://www.fcc.gov/events/open-internet-advisory-committee-meeting.

448 Fed. Commc'n Comm'n, FCC 10–201, *available at* http://hraunfoss.fcc.gov/edocs_public/attachmatch/FCC-10-201A1.pdf.

449 Kevin Werbach for one does not believe it is optimal for the FCC to be deeply engaged in the details of broadband network management. Instead, a form of "regulation by standardization" may be a more effective means for the FCC to implement a positive agenda, where the Commission looks for and blesses open standards solutions. Werbach, *supra* note 85, at 212–21.

450 Jim Cicconi, *The IP Platform: Consumers Are Making the Transition . . . Can Regulators Do the Same?*, AT&T PUB. POL'Y BLOG (June 15, 2012, 12:39 PM), http://attpublicpolicy.com/uncategorized/jim-cicconi-the-ip-platform-consumers-are-making-the-transition%E2%80%A6can-regulators-do-the-same.

U.S. can't have it both ways . . . . Either we believe in the principle or we don't."[451]

Of course, much as some online companies can hide behind the "don't regulate the Internet" mantra to avoid government involvement in their commercial activities, the broadband companies have appropriated it for similar reasons. Cicconi's statement belies some (intentionally?) fuzzy thinking. The broadband companies provide access to the Internet, it is true, but the legitimate basis for the FCC's (and ITU's) jurisdiction in this space comes from the Lower Layers functionalities—the Layer 1 physical infrastructure and Layer 2 datalink protocols that allow networks and devices to connect in the first place. Here, the Layer 3 functionality provided by IP does not equate to the Internet; instead it serves as the ubiquitous bearer platform on top of the broadband network functions, one that can just as easily be used to transmit proprietary voice service, or private data capabilities. IP indeed is a quite unique transmission protocol, but by itself its involvement with a particular communications service offering does not provide any "magic pixie dust" that warrants a complete lack of government involvement with that offering.

Further, concerns raised in the open Internet/network neutrality debate about the practices of broadband access providers stem from users' necessary reliance on such companies, and their control over Layers 1 and 2 functionalities, to reach the Internet. All Internet-based activities uniquely require an unimpeded last-mile connection. As I have discussed elsewhere, broadband providers merit government oversight because they deploy communications infrastructure that is relatively scarce, profoundly important, and reliant on public resources. They also occupy a unique role in the network, one that allows them to transport, inspect, manipulate, and apportion capacity for what could be called "other people's packets."[452]

Network neutrality regulation imposed by a communications regulatory body like the FCC can be seen as one specific means of policing the Lower Layers communications interfaces to the Middle Layers and Upper Layers functions. However, other solutions involving different combinations of Code, Rules, and Players certainly are possible.[453] For example, once a broadband provider of its own volition

[451] *Id.*
[452] *See Broadband Policy*, *supra* note 32.
[453] As I have noted elsewhere, FCC network neutrality regulations are not necessarily the best solution to address concerns about broadband provider behavior. As one example, employing an open-access model, which would limit potential regulation to the Layer 2-Layer 3 wholesale interface, arguably is a preferable functional solution and would constitute a better fit under the Internet policy framework. *See Broadband Policy*, *supra* note 32, at 518–19. Of course such an option currently is politically untenable in the United States, although ironically should involve less intrusive government scrutiny and regulation of broadband provider activities than many

has agreed to join its network to the Internet, and seeks to offer users something called "Internet access," it could be held accountable (by a governmental or non-governmental body) to the terms of that voluntary agreement. Under this approach, to the extent it represents to users that it is providing full and unfettered access to the Internet, the broadband provider could be called upon not to impede the Net's functional integrity. Another related option is to look beyond the statutory concept of "nondiscrimination" found in the Communications Act, and instead utilize a common law standard such as permissive bailment, and its general duty of care to customers.[454] Regardless of one's viewpoint on the policy diagnosis, however, we must agree to a uniform understanding of the pertinent technology functions if there is to be much hope of adopting contextual, effective policy solutions.

Conclusion

> *If the Internet stumbles, it will not be because we lack technology, vision, or motivation but because we cannot set a direction and march collectively into the future.*[455]

This Article has argued that one can successfully achieve a guiding three-dimensional public policy framework for the online age, founded on the basic principle of "respect the functional integrity of the Internet." Absent a compelling regulatory interest and careful consideration of tailored remedies that work in accord with the Internet's core functions, policymakers should not adopt laws or regulations that violate its modular, end-to-end, interconnected, and agnostic nature. Generally speaking, appropriately tailored regulation will avoid adversely affecting end users, in terms of both the degree and the scope of impact on the Internet's design attributes. By seeking to preserve the overall functional integrity of the Internet, adaptive policymakers can help preserve the emergence of innovation, economic growth, and other salient effects.

Stakeholders should also look to employ the appropriate institutional and organizational overlays to address the perceived policy challenge. At its best the government's role should be to experiment with the optimal background conditions for a dynamic, unpredictable, and evolving Internet environment—and then stand back to let the process itself unfold.

Returning again to John Kingdon, perhaps the "idea" of the Internet we need to protect is an *actual* idea: a fundamental agreement

forms of network neutrality rules.

[454] *Id.* at 504–05. Nonetheless, just because the FCC may possess the legal authority to regulate broadband access providers does not mean it should be exercised in the first instance.

[455] Leiner et al., *supra* note 46, at 108.

about a way of community and sharing and gaining information, one that is more open, more available, than any other medium we have seen before.[456] I would submit that the most basic idea about the Internet is its protocols—literally, its agreed way of doing things. More than a thing or a place or a process, the Internet constitutes just that agreement. As we have seen, the essence of the Internet itself is in its logical layers functions, and managed as a commons they amount to a genuine public good in both an economic and a societal sense. Policymakers should endeavor to give way to the comparative wisdom and efficacy of polycentric processes and outcomes.

When advocates plead, "Don't regulate the Internet," they are glossing over the real points of significance. Government regulation of many Internet-based activities is more or less a given; regulation of its Middle Layers functions is not. This is not to say we should refrain from regulating certain Lower Layers functions—the individual physical communications networks and standards—or Upper Layers activities—the applications and content and services—although there may be sound reasons to be cautious about such regulation.[457] However, that caution relates more to the workings of the tangible economic markets in those facilities and goods and services, rather than to the logical essence of the Internet. The Middle Layers are where the primary design attributes work their unique magic. That is the GPT level, the CAS enabler, the CPR good. It is where vested stakeholders can and do operate to best effect, where polycentrism hits its sweet spot.

So, while the corrective of "Don't regulate the wrong parts of the Internet" doesn't quite sing as a slogan, we should consider retaining its essence, at least for the core functions of its design architecture that make sense. My suggested substitute is, "Respect the functional integrity of the Internet." We should give due deference to the Internet's design attributes because we share the unique values of its creators, we laud the (mostly) amazing outcomes, we honor the unusual polycentric processes and players that somehow have kept it going, year after year.

I am aware that this new formulation can be seen as a public policy equivalent of giving way to "rough consensus and running code." Defer to the relative messiness of dedicated volunteers and sprawling organizations and multilayered processes? Given where we are in the constant evolution of the substance, processes, and people of the Middle Layers, though, the presumption against government interference should be strong. Obviously, political and market realities will continue to intrude into the public goods space of the Internet's logical layers. The

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456 See KINGDON, supra note 27, at 131.

457 *See, e.g.*, *Emergence Economics*, *supra* note 32, at 257; *Adaptive Policymaking*, *supra* note 32, at 563; *Broadband Policy*, *supra* note 32, at 519.

U.S. government still has significant connections to ICANN. Dominant industry players will play games with standards processes. The ITU will try to figure out a way to be relevant in the IP age. More congressional hearings will be held and treaties negotiated with the intent of building copyright protection into the Net's design architecture. Indeed, the next policy battle over Internet self-governance may well be fought behind closed doors, in the context of a far-reaching international trade agreement.

But if Kingdon is correct, ideas truly do mean something in public policy. And perhaps the Kingdonian policy window now has been opened just a crack, with a rare opportunity for all sides to rethink their respective positions. With a lot of effort, and some luck, "Respect the functional integrity of the Internet" is an idea whose time in the venerable "garbage can" of politics has finally arrived. And then, as William James reminds us, a political approximation of truth will have happened to a pretty cool idea.[458]

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[458] JAMES, *supra* note 1.