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The Internet is a Semicommons

James Grimmelmann
Cornell Law School, james.grimmelmann@cornell.edu

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*James Grimmelmann**

I. INTRODUCTION

As my contribution to this Symposium on David Post's *In Search of Jefferson's Moose*[1] and Jonathan Zittrain's *The Future of the Internet*,[2] I'd like to take up a question with which both books are obsessed: *what makes the Internet work?* Post's answer is that the Internet is uniquely Jeffersonian; it embodies a civic ideal of bottom-up democracy[3] and an intellectual ideal of generous curiosity.[4] Zittrain's answer is that the Internet is uniquely generative; it enables its users to experiment with new uses and then share their innovations with each other.[5] Both books tell a story about how the combination of individual freedom and a cooperative ethos have driven the Internet's astonishing growth.

In that spirit, I'd like to suggest a third reason that the Internet works: it gets the property boundaries right. Specifically, I see the Internet as a particularly striking example of what property theorist Henry Smith has named a *semicommons*.[6] It mixes private property in individual computers and network links with a commons in the communications that flow

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1. DAVID G. POST, IN SEARCH OF JEFFERSON'S MOOSE: NOTES ON THE STATE OF CYBERSPACE (2009).

2. JONATHAN ZITTRAIN, THE FUTURE OF THE INTERNET—AND HOW TO STOP IT (2008).

3. *See* POST, *supra* note 1, at 116 ("How do you build a democratic system that would scale, that would get stronger as it got bigger, and bigger as it got stronger? . . . But like the American West of 1787, cyberspace is (or at least it has been) a Jeffersonian kind of place.").

4. *See id.* at 202 ("The perfect Jeffersonian world, then, is one that has as much protection for speech as it can have, but only as much protection for intellectual property as it needs. Sounds like cyberspace!").

5. *See* ZITTRAIN, *supra* note 2, at 71–74 (defining and analyzing generativity); *id.* at 149 ("This book has explained how the Internet's generative characteristics primed it for extraordinary success . . . .").

6. *See generally* Henry E. Smith, *Semicommon Property Rights and Scattering in the Open Fields*, 29 J. LEGAL STUD. 131 (2000) (introducing semicommons concept).

through the network.[7]   Both private and common uses are essential. Without the private aspects, the Internet would collapse from overuse and abuse; without the common ones, it would be pointlessly barren. But the two together are magical; their combination makes the Internet hum.

Semicommons theory also tells us, however, that we should expect difficult tensions between these two very different ways of managing resources.[8] Because private control and open-to-all-comers common access necessarily coexist on the Internet, it has had to develop distinctive institutions to make them play nicely together. These institutions include the technical features and community norms that play central roles in Post's and Zittrain's books: everything from the layered architecture of the Internet's protocols[9] to Wikipedia editors' efforts to model good behavior.[10] As I'll argue, the dynamic interplay between private and common isn't just responsible for the Internet's success; it also explains some enduring tensions in Internet law, reveals the critical importance of some of the Internet's design decisions, and provides a fresh perspective on the themes of freedom and collaboration that Post and Zittrain explore.

Here's how I'll proceed: In Part II of this essay, I'll set up the problem. Part II.A will use Post's and Zittrain's books to describe two critical facts about the Internet—it's designed and used in ways that require substantial sharing and openness, and it's sublimely gigantic. Part II.B will explain why this openness is problematic for traditional property theory, which sees resources held in common as inherently wasteful. Part II.C will explain how commons theory can make sense of commonly held resources, but only at the price of introducing a new problem: an internal tension about the scale at which these resources should be held. The theory of tangible common-pool resources tells a tragic story that emphasizes the need to keep the group of those with access to the commons small. But the theory of peer-produced intellectual property tells a happier tale, one that emphasizes the importance of massive collaboration—of openness to as many people as possible.

In Part III, I'll resolve this tension between pressures for smallness and pressures for bigness by showing how a semicommons can accommodate both. Part III.A will introduce Henry Smith's theory of the semicommons, which he illustrates with the example of fields open to common grazing for sheep but held in private for farming. Part III.B will explain how treating the Internet as a semicommons elegantly transforms the small-and-private

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7. *Id.* at 131.

8. *See* Smith, *supra* note 6, at 145 ("[T]he open-field system is a mixture of common and private ownership, and the question is, why not one or the other?"); *infra* Part III.

9. *See* POST, *supra* note 1, at 80–86 (discussing layering); ZITTRAIN, *supra* note 2, at 67–69 ("Layers facilitate polyarchies . . . ."); *infra* Part IV.A.

10. *See* ZITTRAIN, *supra* note 2, at 142–43, 147–48 (discussing "netizenship" and "personal commitments" of Wikipedia editors); *infra* Part IV.B. *See generally* ANDREW DALBY, THE WORLD AND WIKIPEDIA: HOW WE ARE EDITING REALITY (2009) (describing the history and norms of Wikipedia in detail).

versus large-and-common antithesis into a compelling synthesis. Simultaneously treating network elements as private property and the "network" as a commons captures the distinctive benefits of both resource models. And in Part III.C I'll briefly describe how semicommons theory is implicit in Zittrain's argument.

In Part IV, I'll demonstrate the analytical power of this way of looking at the Internet—in particular, how it makes sense out of a wide range of technical and social institutions commonly seen online. Part IV.A will illustrate the importance of layering in enabling uses of the Internet at different scales to coexist. Part IV.B will discuss how user-generated content (UGC) sites solve semicommons governance problems. And Part IV.C will consider the role of boundary-setting in the failure of Usenet and the success of e-mail. Finally, in Part V, I'll briefly argue that semicommons theory usefully helps us focus on the interdependence between private and common, rather than seeing them as implacable opposites.

II. PROPERTY AND THE PROBLEM OF SCALE

David Post and Jonathan Zittrain both link the Internet's extraordinary growth to its extraordinary openness. You don't need to ask anyone's official permission to create a new community or a new application online. Result: more freedom and more innovation, enabling the Internet to outcompete proprietary, controlled networks.[11]

But this openness, which draws on property-theoretic ideas about sustainable commons, comes with its own theoretical puzzle. Big things have a tendency to collapse under their own weight, and the Internet is nothing if not big.[12] The conventional wisdom in property circles is that a commons in any finite resource becomes increasingly untenable as its scale increases.[13] The intellectual "commons" that many intellectual property scholars celebrate escapes this trap because (and only because) information isn't used up when it's shared.[14] That tells us why writers and musicians and inventors and programmers can benefit from robust sharing and a rich public domain, but it doesn't seem to be directly relevant to the underlying question of why the Internet didn't flame out spectacularly several orders of magnitude ago, as users took advantage of its openness to use up its available capacity.

This part will articulate, in somewhat more detail, the nature of this theoretical tension between openness and size on the Internet. Part II.A will

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11. *See* POST, *supra* note 1, at 103 ("Perhaps it was a coincidence that the network that became 'the Internet' was the one that operated this way . . . . I doubt it, though."); ZITTRAIN, *supra* note 2, at 30 ("The bundled proprietary model . . . had been defeated by the Internet model . . . .").

12. *See infra* Part II.A.

13. *See infra* Part II.B.

14. *See infra* Part II.C.

discuss the problem of scale, using Post's musings on Jefferson as the point of departure. Part II.B will tell what I call the "Tragic" story within commons theory—that a commons can be a sustainable alternative to private property or direct regulation, but only for small-scale resources. Part II.C will tell a different story, which I call the "Comedic" one: that for nonrival information goods, where exhaustion isn't an issue, unrestricted sharing can have benefits far outweighing costs.

A. *On Being the Right Size (for an Internet)*

In Search of Jefferson's Moose takes its title, its cover art, and its central metaphor from the stuffed moose that Thomas Jefferson proudly displayed in Paris in 1787.[15] Jefferson was serving as the United States' official representative in France, and he saw himself as a cultural and intellectual ambassador, not just a political one. The French naturalist George Buffon had written that New World animals were smaller than their Old World counterparts, owing to the defectively cold and wet American climate.[16] While Jefferson's *Notes on the State of Virginia* attempted to refute this analysis with facts and figures, the moose offered a more demonstrative proof that American species could stand tall with the best that Europe had to offer.[17]

In Post's telling, the political subtext is hard to miss. Jefferson's moose was big, standing seven feet tall; it was novel, existing only on the North American continent;[18] and it was robust, an example of the rude good health of North American wildlife.[19] It was, in short, a metaphor for the newly formed United States, another product of North America. Contemporary political theory considered large republics inherently unstable, and the United States was the largest republic in human history.[20] Jefferson's moose was meant to "dazzle" his visitors into what Post calls an "'Aha!' moment" of belief—that creatures of its size could thrive in the New World, and so could the equally large American republic.[21]

Jefferson's metaphor for the United States thus becomes Post's metaphor for the Internet. He's looking for a way to dazzle his readers into their own

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15. POST, *supra* note 1, at 16–18.

16. *Id.* at 63–64.

17. *See id.* at 63–68 (citing THOMAS JEFFERSON, NOTES ON THE STATE OF VIRGINIA (Frank Shuffelton ed., Penguin Books 1999) (1785)).

18. Or so Jefferson thought when he referred to the moose as a "species not existing in Europe." He was wrong; *Alces alces* also thrives in Scandinavia and Russia. *See* VICTOR VAN BALLENBERGHE, IN THE COMPANY OF MOOSE 1 (2004) ("Simply put, moose are giant deer that live in the northern forests of Europe, Asia, and North America."). *See generally* LEE ALAN DUGATKIN, MR. JEFFERSON AND THE GIANT MOOSE: NATURAL HISTORY IN EARLY AMERICA 81–100 (2009) (describing Jefferson's search for a moose specimen and his not-always-reliable research methods).

19. POST, *supra* note 1, at 63–68.

20. *See id.* at 110–16.

21. *Id.* at 209.

"Aha!" moments about it. Post wants his readers to believe that it really is there, that it really is something new, and that it really does work. Just as Jefferson's moose was meant to impress visitors with its scale, the first half of *Jefferson's Moose* is meant to impress readers with the Internet's scale.

This point bears emphasis. The Internet is sublimely large; in comparison with it, all other human activity is small. It has more than a billion users,[22] who've created over two hundred million websites[23] with more than a trillion different URLs,[24] and send over a hundred billion e-mails a day.[25] American Internet users consumed about ten exabytes of video and text in 2008—that's 10,000,000,000,000,000,000 bytes, give or take a few.[26] Watching all the videos uploaded to YouTube alone in a single day would be a full-time job—for fifteen years.[27] The numbers are incomprehensibly big, and so is the Internet.[28]

These statistics tell us beyond peradventure that the Internet has been wildly successful, but they don't by themselves tell us why. Post's answer is that the Internet is built in a uniquely Jeffersonian way. Technologically, it depends on bottom-up, self-organized routing.[29] Its political and social structures, as well, are self-organized in a bottom-up fashion, with decisions made by local groups on the basis of consensus and voluntary association.[30] These features are also characteristic of Jefferson's ideal democratic republic, making the Internet the truest realization yet of his political vision.[31] People choose to go to the Internet for the same reasons Jefferson

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22. *See* Press Release, comScore, Inc., Global Internet Audience Surpasses One Billion Visitors, According to comScore (Jan. 23, 2009), http://www.comscore.com/Press_Events/Press_Releases/2009/1/Global_Internet_Audience_1_Billion/%28language%29/eng-US.

23. Netcraft, December 2009 Web Server Survey, http://news.netcraft.com/archives/2009/12/24/december_2009_web_server_survey.html (last visited Apr. 10, 2010); *see also The VeriSign Domain Report*, DOMAIN NAME INDUSTRY BRIEF (VeriSign, Mountain View, Cal.), Dec. 2009, at 2, *available at* http://www.verisign.com/domain-name-services/domain-information-center/domain-name-resources/domain-name-report-dec09.pdf (over 187 million registered domains).

24. *See* Posting of Jesse Alpert & Nissan Hajaj to Official Google Blog, http://googleblog.blogspot.com/2008/07/we-knew-web-was-big.html (July 25, 2008, 10:12 PDT).

25. CISCO SYS., INC., CISCO 2008 ANNUAL SECURITY REPORT 13 (2009), *available at* http://www.cisco.com/en/US/prod/collateral/vpndevc/securityreview12-2.pdf.

26. ROGER E. BOHN & JAMES E. SHORT, HOW MUCH INFORMATION? 2009: REPORT ON AMERICAN CONSUMERS app. B, at 32 (2009), *available at* http://hmi.ucsd.edu/pdf/HMI_2009_ConsumerReport_Dec9_2009.pdf.

27. *See* YouTube, YouTube Fact Sheet, http://www.youtube.com/t/fact_sheet (last visited Apr. 10, 2010) (reporting twenty hours of video uploaded per minute). My calculation assumes a forty-hour workweek. If you didn't stop to sleep or eat, you could watch a day's worth of YouTube videos in only three years and a few months.

28. *Cf.* James Grimmelmann, *Information Policy for the Library of Babel*, 3 J. BUS. & TECH. L. 29, 38–40 (2008) (comparing the Internet to Borges's infinite Library of Babel).

29. *See* POST, *supra* note 1, at 80–99.

30. *See id.* at 126–41.

31. *See id.* at 107–17.

expected them to settle the American West: to build new lives and new communities for themselves on a firm foundation of liberty.[32]

Zittrain's theory of the Internet's success is that it's a *generative* system, open to unfiltered contributions from anyone and everyone.[33] The Internet lets its users innovate and share their innovations with each other without being thwarted by gatekeepers who can veto proposed changes and system designers who can make change impossible in the first place.[34] This greater openness to unanticipated developments gives the Internet a powerful flexibility: it can draw on the best of what all its users have come up with.[35] Like Post's, this is a bottom-up story: these new protocols, technologies, and communities are being assembled by individuals, rather than being dictated from on high.

Property theory has a word for this form of resource management: *commons*. Post focuses on the self-assembly inherent in the Internet Protocol (IP)[36] and on self-governance,[37] while Zittrain focuses on technical innovation[38] and norm creation,[39] but these are very much the same story. The Internet's users are individually empowered to use the network as they see fit. There's no Internet Tycoon who owns the whole thing and can kick everyone else off; there's no Internet Czar who sets the rules for everyone else. That makes the Internet, on this view, a nearly ideal commons: a resource that everyone has a privilege to use and no one has a right to control.

So far, so good. But there's a reason that Post calls it the "problem" of scale.[40] Size is more than just proof of success; it also creates new and distinctive problems of its own. The biological metaphor is helpful. Following Haldane's classic *On Being the Right Size*, Post writes, "Large organisms are not and cannot be simply small organisms blown up to larger size."[41] A moose blown up by a factor of ten, to be seventy feet tall instead

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32. *See id.* at 116–17, 172–78 (discussing Jefferson's vision of the settlement of the American West).

33. *See* ZITTRAIN, *supra* note 2, at 19–35; *see also* Jonathan L. Zittrain, *The Generative Internet*, 119 HARV. L. REV. 1974 (2006).

34. ZITTRAIN, *supra* note 2, at 80–90.

35. *See id.* at 31 (discussing "procrastination principle" of deferring decisions by leaving architecture open initially); *cf.* Carliss Y. Baldwin & Kim B. Clark, *The Architecture of Participation: Does Code Architecture Mitigate Free Riding in the Open Source Development Model?*, 52 MGMT. SCI. 1116 (2006) (discussing importance of "option values" in open source software projects).

36. POST, *supra* note 1, at 73–99.

37. *Id.* at 133–41, 178–86.

38. ZITTRAIN, *supra* note 2, at 80–90.

39. *Id.* at 90–96, 134–35, 141–48, 223–25.

40. *See, e.g.*, POST, *supra* note 1, at 60 (titling one chapter, "Jefferson's Moose and the Problem of Scale I").

41. *Id.* at 61. Haldane's essay itself links biological and political scale, concluding with a passage on the maximum size of a democratic state (increasing with technological change) and the impossibility of socialist governance of truly large states. J.B.S. Haldane, *On Being the Right Size*, 152 HARPER'S MAG. 424, 427 (1926) ("I find it no easier to picture a

of seven, would have one thousand times the body mass but only one hundred times the bone cross section. It would quite literally collapse under its own weight.

The same is true of computer networks: some architectures that work well with one hundred users fail embarrassingly with one million—or one billion. Post gives another back-of-the-envelope demonstration to show that a centrally operated Internet could not possibly have a strong enough skeleton[42] to support all of the communications between its billion-plus users.[43] Thus, the decentralization and ad hoc ethos that Post and Zittrain celebrate about the Internet are technological necessities. It took packet switching and distributed best-efforts routing to make a global network on the scale of the Internet feasible.

Property theory has its own problem of scale. If Buffon thought that nature made large New World wildlife impossible, and if political theorists thought human nature made large republics impossible, and if network engineers thought that physics made large decentralized networks impossible, then property theorists have long thought that large commons were self-defeating.[44] Anything held in common would be overused or underproduced, and the larger the relevant community, the more severe the problem.[45] As the Internet asymptotically approaches the whole of human experience, it would seem that its usability ought to be trending toward a limit of zero. The benefits of openness are clear, but so are the immense costs of wasteful and self-interested overuse. Since the Internet, like Jefferson's moose or the aerodynamically unlikely bumblebee that Zittrain uses as a metaphor for Wikipedia,[46] unarguably *is*, this success requires explanation. To find one, we will need to delve deeper into property theory.

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completely socialized British Empire or United States than an elephant turning somersaults or a hippopotamus jumping a hedge."). Had Haldane been exposed to the Internet, he might have noted that it has an inordinate fondness for pictures of cats.

42. The major networks that carry the heaviest volumes of Internet traffic are referred to as "backbones." *See, e.g.*, ZITTRAIN, *supra* note 2, at 158. Note the use of the plural.

43. *See* POST, *supra* note 1, at 68–79.

44. The intuition, as Henry Smith notes, goes back to Aristotle. *See* Henry E. Smith, *Governing Water: The Semicommons of Fluid Property Rights*, 50 ARIZ. L. REV. 445, 451 n.25 (2008) (citing ARISTOTLE, THE POLITICS AND THE CONSTITUTION OF ATHENS 33 (Stephen Everson ed., Benjamin Jowett trans., 1996)).

45. *See infra* Part II.B.

46. ZITTRAIN, *supra* note 2, at 148 ("Wikipedia is the canonical bee that flies despite scientists' skepticism that the aerodynamics add up." (citing YOCHAI BENKLER, THE WEALTH OF NETWORKS: HOW SOCIAL PRODUCTION TRANSFORMS MARKETS AND FREEDOM 76–80 (2006))). In his conclusion, Post applies his own biological metaphor to Wikipedia, writing that Wikipedia might well be "a pretty good moose, something we could bring with us . . . to show to people of the Old World." POST, *supra* note 1, at 209.

B. *The Tragedy of the (Rival) Commons*

In order to make sense of the Internet as a species of commons, we first need to situate the commons within property theory. Our starting point is the standard distinction between two kinds of resources: *private goods* and *pure public goods*.[47]

Private goods such as cars, farms, and handbags have two key characteristics. First, they're rival: one person's use of the good makes it unavailable for someone else. Only one person at a time can carry a handbag or plant the same furrow. Second, they're excludable: it's possible to prevent people from using the good. We can hold tightly to handbags and put fences around farms. These distinctions are illustrated in the following, wholly conventional figure:

	Rival	Nonrival
Excludable	Private	Toll
Nonexcludable	Common	Public

For rival goods, excludability has three salutary effects. First, it helps prevent wasteful underuse. If you own a resource but my proposed use is higher value than yours, it will be profitable for both of us for you to sell it to me.[48] Second, it prevents dissipation of the resource's value as we fight over it; without excludability I could simply take the resource from you and you could take it back, ad nauseam. Third, it promotes efficient investment: companies will invest in creating or improving resources if they can also reap the gains from the increase in value.[49]

Things are trickier when excludability fails. Resources that are rival but not excludable are *common goods* (in the bottom-left quadrant of the diagram). Common goods are subject to a wasteful race that Garrett Hardin termed the "tragedy of the commons" in his influential 1968 article.[50] As he argued,

> Adding together the component partial utilities, the rational herdsman concludes that the only sensible course for him to pursue is to add another animal to his herd. And another; and another. . . . But this is the conclusion reached by each and every rational herdsman sharing a

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47. *See generally* RICHARD CORNES & TODD SANDLER, THE THEORY OF EXTERNALITIES, PUBLIC GOODS, AND CLUB GOODS 8–13 (1986); Charlotte Hess & Elinor Ostrom, *Ideas, Artifacts, and Facilities: Information as a Common-Pool Resource*, LAW & CONTEMP. PROBS., Winter/Spring 2003, at 111, 119–21.

48. *See* Harold Demsetz, *Toward a Theory of Property Rights*, 57 AM. ECON. REV. 347, 354–55 (1967). Excludability, by making it possible to "own" a resource, thus makes it possible to transact over it. *See* Steven N.S. Cheung, *The Structure of a Contract and the Theory of a Non-exclusive Resource*, 13 J.L. & ECON. 49, 64–67 (1970).

49. *See, e.g.*, Harold Demsetz, *The Public Production of Private Goods*, 13 J.L. & ECON. 293, 293–94 (1970) (giving example involving slaughterhouse that supplies both meat and leather).

50. Garrett Hardin, *The Tragedy of the Commons*, 162 SCIENCE 1243 (1968).

commons. Therein is the tragedy. Each man is locked into a system that compels him to increase his herd without limit—in a world that is limited. Ruin is the destination toward which all men rush, each pursuing his own best interest in a society that believes in the freedom of the commons. Freedom in a commons brings ruin to all.[51]

The tragedy flows from the lack of excludability. The herdsmen race to graze more sheep because no one can stop them, and they know that no one will stop the others. If excludability could be restored and the sheep could somehow be kept off the pasture, the race would be terminated before it got out of hand.[52] As Hardin put it, "the necessity of abandoning the commons"[53] would require "mutual coercion, mutually agreed upon"[54] to establish effective restrictions on overuse.

Hardin assumed that these restrictions could take one of two forms: "private property" or governmental "allocation."[55] A sole private owner absorbs the full costs and benefits of using the pasture and therefore will choose the right number of sheep to graze.[56] A government regulator, on the other hand, could allow multiple shepherds access, but limit the number of sheep each may graze so that the total comes out right. Either way, the key is to recreate excludability.[57] On our diagram, these are moves from the bottom-left quadrant to the top-left.

Henry Smith has generalized this dichotomy by recasting it as a division between two organizational forms: *exclusion* and *governance*.[58] Exclusion, which corresponds to private property, involves giving one designated gatekeeper complete control over the resource.[59] In a governance regime, on the other hand, multiple users are allowed to use the resource, but are subject to rules specifying how, when, and in what ways.[60] An exclusion regime puts a fence around the pasture and gives one person the key; a governance regime brands all the sheep and limits the number each person may graze. The exclusion/governance distinction focuses on the

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51. *Id.* at 1244 (omission in original).

52. Others had made a similar observation about another scarce natural resource that functioned as a commons: fisheries. *See* Peder Anderson, *"On Rent of Fishing Grounds": A Translation of Jens Warming's 1911 Article, with an Introduction*, 15 HIST. POL. ECON. 391 (1983); H. Scott Gordon, *The Economic Theory of a Common-Property Resource: The Fishery*, 62 J. POL. ECON. 124 (1954); *see also* Cheung, *supra* note 48.

53. Hardin, *supra* note 50, at 1248.

54. *Id.* at 1247.

55. *Id.* at 1245.

56. *See* Demsetz, *supra* note 48, at 355.

57. *See* CORNES & SANDLER, *supra* note 47, at 43; Hardin, *supra* note 50, at 1247 ("Consider bank-robbing. The man who takes money from a bank acts as if the bank were a commons. How do we *prevent* such action?" (emphasis added)).

58. Henry E. Smith, *Exclusion Versus Governance: Two Strategies for Delineating Property Rights*, 31 J. LEGAL STUD. S453, S454–55 (2002).

59. *Id.* at S454.

60. *Id.* at S455.

institutional characteristics that matter, rather than on the formal label of "property" or "regulation."

Exclusion and governance both depend on a source of authority to enforce the rules that recreate excludability. To use Hardin's term, "coercion" was essential.[61] But, as scholars of the commons have recognized, that coercion need not come from above, in the form of the state.[62] It could also come from below, from the other users of the resource themselves.

Elinor Ostrom's work shows that many communities have successfully managed common resources.[63] Her list of successes includes Spanish irrigation ditches, Japanese forests, and even Swiss grazing meadows—Hardin's signature example of failure, turned on its head. These communities have created and then enforced on themselves a governance regime controlling use of their common resource. These bottom-up institutions are neither archaic holdovers nor illusory bulwarks; under the right circumstances, common ownership can thrive for hundreds of years.

It doesn't always work, though. Many common ownership regimes have succeeded, but many others have failed.[64] The question thus becomes, what distinguishes the commons that work from the ones that suffer Hardin's tragic fate? Ostrom and others give lists of the core factors that make a commons sustainable, including good institutions to gather information about the resource, forums to discuss its management, graduated sanctions to punish misusers, and community participation in making and enforcing the rules.[65]

In this tradition, one factor stands out as essential to the success of a commons: community coherence. Mancur Olson's theory of collective action argues that small groups can better coordinate their actions than large ones.[66] Ostrom emphasizes the importance of well-defined boundaries, not just around the resource, but around the community too.[67] Robert Ellickson's study of Shasta County ranchers found their norm-based self-regulation worked because they formed a "close-knit group."[68] These communities can transform a *commons* into a *common-pool resource*:[69] they supplement their internal governance regime with exclusion towards

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61. Hardin, *supra* note 50, at 1247.
62. *See* ELINOR OSTROM, GOVERNING THE COMMONS 13–15 (1990).
63. *Id.* at 51–88.
64. *See id.* at 143–78 (discussing "institutional failures and fragilities").
65. *See id.* at 88–102.
66. MANCUR OLSON, THE LOGIC OF COLLECTIVE ACTION: PUBLIC GOODS AND THE THEORY OF GROUPS 22–36 (1971).
67. *See* OSTROM, *supra* note 62, at 91–92.
68. ROBERT C. ELLICKSON, ORDER WITHOUT LAW: HOW NEIGHBORS SETTLE DISPUTES 15–40, 177–82 (1991).
69. *See* Hess & Ostrom, *supra* note 47, at 120.

outsiders.[70]   Only a small, well-defined, tightly knit group can recognize outsiders to keep them away, monitor and act against its own members with the necessary intensity, and have a sufficiently strong incentive to bother.

Size, in other words, ought to be fatal to commons self-management. All else being equal, a small and coherent community is more likely to succeed at running a commons; a large and diffuse one is more likely to botch the job. The bigger the group, the greater the tendency towards ruin.

Let's call this strain of commons theory the Tragic story. Its basic lesson is Hardin's: commonly held resources are vulnerable to self-interested overuse.   That fate can be staved off through a variety of arrangements, including private property, governmental regulation, or common self-management.   This last institutional form requires community members to craft their own rules of appropriate use, monitor each other's behavior, and punish violators.[71] This is a fragile enterprise; only strong and well-defined communities will be able to sustain the constant work of self-control required. Success requires closing the commons off to outsiders; to throw the community open to them is to court disaster.

This Tragic story has been frequently told about the Internet. Telecommunications analysts predict an impending bandwidth crunch, as users   deplete   the   limited   supply   of   available   connectivity.[72] Telecommunications companies complain that selfish bandwidth hogs are destroying the Internet experience for other customers.[73]   Scholars warn that weak incentives to cooperate make Wikipedia unsustainable[74]—or perhaps online sharing more generally is doomed.[75]   The Tragic story

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70. This arrangement is also described in the literature as a "limited-access commons," *see, e.g.*, Smith, *supra* note 58, at S458, or "limited common property," *see, e.g.*, Carol M. Rose, *The Several Futures of Property: Of Cyberspace and Folk Tales, Emission Trades and Ecosystems*, 83 MINN. L. REV. 129, 132 (1998).

71. OSTROM, *supra* note 62, at 42–45, 92–100.

72. *See, e.g.*, BROADBAND WORKING GROUP, MASS. INST. OF TECH. COMMC'N FUTURES PROGRAM, THE BROADBAND INCENTIVE PROBLEM 2 (2005), *available at* http://cfp.mit.edu/ docs/incentive-wp-sept2005.pdf ("The broadband value chain is headed for a train wreck. . . . The broadband locomotive left the station with a critical missing piece: the incentive for network operators to support many of the bandwidth-intensive innovations planned by upstream industries and users."); Bret Swanson, *The Coming Exaflood*, WALL ST. J., Jan. 20, 2007, at A11 ("Today's networks are not remotely prepared to handle this exaflood.").

73. *See, e.g.*, Kim Hart, *Shutting Down Big Downloaders*, WASH. POST, Sept. 7, 2007, at A1 ("Comcast has punished some transgressors by cutting off their Internet service, arguing that excessive downloaders hog Internet capacity and slow down the network for other customers.").

74. *See* Eric Goldman, *Wikipedia's Labor Squeeze and Its Consequences*, 8 J. ON TELECOMM. & HIGH TECH. L. 157, 159–61 & n.12 (2010).

75. Lior Jacob Strahilevitz, *Wealth Without Markets?*, 116 YALE L.J. 1472, 1493–504 (2007) (reviewing BENKLER, *supra* note 46) ("Taken together, these challenges are daunting, and they might push social production to the peripheries of the new economy.").

explains skepticism about YouTube's business model[76] and fears about the rise of malware, botnets, and denial-of-service attacks.[77]

If, as the Tragic story predicts, bigger means riskier, then the immense Internet ought to be an immense smoking ruin. Peer-to-peer file sharing and video downloads always look poised to overwhelm capacity in a host of I-want-mine overuse. Just as soon as a few more people crank up their usage, or one really clever bad apple figures out how to use it *all up*, it'll be the endgame for the Internet. As of this writing though, the Internet still stands, the Tragic story notwithstanding. To make sense of why that might be, let's return to commons theory—another strand of which has come to almost exactly the opposite conclusion.

C. The Comedy of the (Nonrival) Commons

So far, we've been discussing rival resources, in the left-hand column of the diagram. Here, to repeat, the traditional economic view is that efficiency flows from excludability; commons theory accepts that view but offers a different, bottom-up way of creating exclusivity.

Now, let's turn to the right-hand column, where nonrival resources dwell. Once again, traditional economic theory prizes excludability, albeit with considerably less certitude than for rival resources. But this time, commons theory takes an altogether more radical turn—arguing that exclusivity itself is overrated.

The starting point of the analysis is that many nonrival goods can be shared with others for much less than it costs to make them in the first place. Information in digital form, for example, can be copied and transmitted around the world for almost nothing. But even tangible goods can often be shared without imposing costs on current users: at 2:00 a.m., a second car on the road doesn't limit the first driver's ability to use the highway, too.[78]

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76. *See, e.g.*, Farhad Manjoo, *Do You Think Bandwidth Grows on Trees?*, SLATE, Apr. 14, 2009, http://www.slate.com/id/2216162/ ("YouTube has to pay for a gargantuan Internet connection to send videos to your computer and the millions of others who are demanding the most recent Dramatic Chipmunk mash-up. . . . [N]ot even Google can long sustain a company that's losing close to half a billion dollars a year.").

77. *See, e.g.*, ZITTRAIN, *supra* note 2, at 43–54 (describing the "untenable" state of online security).

78. Brett M. Frischmann, *An Economic Theory of Infrastructure and Commons Management*, 89 MINN. L. REV. 917, 945–46 (2005). To be more precise, as Brett Frischmann explains, goods vary in their capacity to accommodate multiple uses. But even a good with a finite capacity can still be effectively nonrivalrous if that capacity is also renewable. *Id.* at 950–56. A stretch of highway may be able to accommodate 2000 cars per hour, but its use at 6:00 a.m. has essentially no effect on its ability to accommodate cars at 6:00 p.m. As long as we're beneath the level of use at which adding cars would create a traffic jam *now*, the highway is nonrival. Yochai Benkler has developed this point into a theory of "sharable" goods. *See* Yochai Benkler, *Sharing Nicely: On Shareable Goods and the Emergence of Sharing as a Modality of Economic Production*, 114 YALE L.J. 273, 330–44 (2004).

Where the nonrival resource is also nonexcludable, and thus a *pure public good*, this is a problem. As soon as the seller has created the good—say, a photograph of a sheep—everyone else can have access to it for free; only suckers and patsies would pay for it if they didn't have to. But that leaves the photographer with no economic incentive to go out and spend days taking the perfect photograph, so she won't create it in the first place, which leaves no original for others to copy. Result: everyone loses.[79]

The conventional response here has been to focus on making the resource more excludable.[80] This is the usual economic apology for granting a photographer copyright over her photographs, for example.[81] It allows her to prevent the nonrival sharing that would otherwise flood the market with cheap copies and undercut her ability to recoup her costs.[82] The same logic also explains various self-help substitutes for intellectual property, such as end-user license agreements and digital rights management (DRM): they all recreate excludability.[83] If she can move all the way up the right-hand column and make the resource perfectly excludable, then she can capture the full social value of her work, giving her an efficient incentive for the optimal level of creativity.[84] In this respect, at least, full excludability makes public nonrival goods look like private rival goods.[85]

But excludability's prevention of free riding is not a free lunch. For one thing, it's expensive to establish: IP laws have to be enforced, licenses have to be drafted, and DRM has to be programmed.[86] For another, excludability can be harmful *in itself*. Even though the good (being nonrival) could be shared freely or cheaply, a rational owner will instead price it to maximize her profits. But that means she'll sell it for more than some people would

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79. *See* WILLIAM M. LANDES & RICHARD A. POSNER, THE ECONOMIC STRUCTURE OF INTELLECTUAL PROPERTY LAW 19–21 (2003).

80. *See, e.g.*, U.S. CONST. art. I, § 8, cl. 8 ("To promote the Progress of Science and useful Arts, by securing for limited Times to Authors and Inventors the *exclusive* Right to their respective Writings and Discoveries." (emphasis added)).

81. *See, e.g.*, LANDES & POSNER, *supra* note 79, at 112–13.

82. *See* Trotter Hardy, *Property (and Copyright) in Cyberspace*, 1996 U. CHI. LEGAL F. 217, 221–28.

83. *See* Niva Elkin-Koren, *Making Room for Consumers Under the DMCA*, 22 BERKELEY TECH. L.J. 1119, 1119–20 (2007).

84. *See* Demsetz, *supra* note 49, at 300–03 (arguing that the resulting equilibrium "allocates resources efficiently to the production of the public good").

85. There are, however, other important ways in which they differ. Because these nonrival goods have high fixed (or first-copy) costs but very low marginal costs, there's an enormous competitive advantage to being the bigger competitor in a market. Your average costs will be lower than your competitors, helping you undercut their prices and seize the whole of the market. This gives these markets—one kind of "network industry"—distinctive economics and creates special managerial and regulatory challenges. *See generally* CARL SHAPIRO & HAL R. VARIAN, INFORMATION RULES: A STRATEGIC GUIDE TO THE NETWORK ECONOMY (1999); OZ SHY, THE ECONOMICS OF NETWORK INDUSTRIES (2001). The semicommons analysis developed in this essay may have implications for these industries.

86. It also has other unfortunate side effects: it cripples otherwise useful devices and smothers innovation. *See* Wendy Seltzer, *The Imperfect Is the Enemy of the Good: Anticircumvention Versus Open Development*, 25 BERKELEY TECH. L.J. (forthcoming 2010).

have been willing to pay;[87] the good ends up being used less than would have been socially efficient.[88] Thus, the conventional economic narrative of intellectual property law is of a dialectic pitting her ex ante incentives to create the information good against the ex post value of broad access to it.[89] Whatever balance we choose is likely to impose costs on both sides.

Scholars have therefore looked for ways to avoid the difficulties of finding market incentives to create public goods. One approach is right there in the name: the government could directly invest in these "public" goods. That's the conventional way of paying for physical public goods, like lighthouses.[90] At times, governmental investment has also been used to pay for information goods, such as the NEA's grants to artists and prizes for scientific discoveries.[91] Once government funding succeeds in bringing these goods into existence, they can be given away freely. *Voilà*: no costs from imposing excludability.[92]

Commons theory takes this idea—maximal circulation of information goods at no cost—and runs with it. The key move is the recognition that solving the ex post distribution problem can also, paradoxically, help solve the ex ante production problem.[93] Making information more widely available doesn't just benefit passive couch-potato information consumers;

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87. In a world in which she cannot price discriminate perfectly and costlessly, that is. If she could, perfect price discrimination would also in theory lead to an efficient outcome, one in which she appropriates all the value of the good, rather than other users. *See* James Boyle, *Cruel, Mean, or Lavish? Economic Analysis, Price Discrimination and Digital Intellectual Property*, 53 VAND. L. REV. 2007, 2021–35 (2000) (discussing "Econo-World" view of price discrimination). But that world isn't our world, and, in ours, price discrimination is costly and imperfect, leaving us to argue over second bests. *See, e.g.*, Yochai Benkler, *An Unhurried View of Private Ordering in Information Transactions*, 53 VAND. L. REV. 2063, 2072 (2000).

88. *See* Niva Elkin-Koren, *Copyright Policy and the Limits of Freedom of Contract*, 12 BERKELEY TECH. L.J. 93, 99–100 (1997).

89. *See* Shyamkrishna Balganesh, *Forseeability and Copyright Incentives*, 122 HARV. L. REV. 1569, 1577–79 (2009).

90. *See* R.H. Coase, *The Lighthouse in Economics*, 17 J.L. & ECON. 357, 360–62 (1974) (discussing British lighthouse system, maintained by Trinity House, a governmental body). *But see id.* at 363–72 (discussing history of private lighthouses in Britain).

91. *See, e.g.*, MASHA GESSEN, PERFECT RIGOR: A GENIUS AND THE MATHEMATICAL BREAKTHROUGH OF THE CENTURY, at vii–xi (2009) (predicting that the $1,000,000 prize for proof of Poincaré Conjecture is likely to be refused by mathematician who proved it); DAVA SOBEL, LONGITUDE: THE TRUE STORY OF A LONE GENIUS WHO SOLVED THE GREATEST SCIENTIFIC PROBLEM OF HIS TIME 16 (2006) (describing the £20,000 prize offered in 1714 for discovery of an accurate method of determining longitude while at sea).

92. On the other hand, having the government pay for it doesn't solve the problem of deciding *how much* to pay for it. Here, it's even more difficult to decide how much the government should spend for the sheep photograph. Since the photograph will ultimately be given away for free, the government will find it well-nigh impossible to learn how much each individual would have been willing to pay for it. *See* Paul A. Samuelson, *The Pure Theory of Public Expenditure*, 36 REV. ECON. & STAT. 387, 388–89 (1954).

93. *See* Frischmann, *supra* note 78, at 946–59.

it also helps other information producers.[94] Information goods are critical inputs into the production of other information goods, so increasing their circulation gives creators more to work with.

Information is the oxygen of the mind; lowering the cost of air lets minds breathe more freely.[95] All creativity is influenced and inspired by what has come before; all innovation incrementally builds on past inventions. The public domain is not simply a negative space of the unprotected, but a positive resource of immense richness available to all.[96] On this account, reducing the excludability of nonrival information goods will often lead to more information production, not less, because the reduced incentives for creators will be more than outweighed by the increased access to raw materials.[97]

In a further twist, scholars of the information commons have argued that often we don't need *any* external incentives for the production of information goods.[98] In these cases, we can dispense with excludability completely. Some people take photographs of sheep because they want the pictures for themselves; others want to express a vision of pastoral serenity; still others want to hone their skills with a camera, or to show off those skills to potential employers. This diversity of motivations means that even though the vast majority of photographers in the world are unpaid, they're still enthusiastically snapping pictures. Steven Weber's studies of open source software and Yochai Benkler's theory of peer production emphasize that personal expression, generosity, reciprocity, desire to show off, and other purely social motivations can be just as strong as economic ones.[99]

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94. Indeed, one of the other virtues of commons theory is its willingness to recognize that "consumers" and "producers" are often the exact same people, that individuals move between these roles seamlessly in their cultural, social, and intellectual lives. *See, e.g.*, Jack M. Balkin, *Digital Speech and Democratic Culture: A Theory of Freedom of Expression for the Information Society*, 79 N.Y.U. L. REV. 1, 4 (2004) ("Freedom of speech . . . is interactive because speech is about speakers and listeners, who in turn become speakers themselves. . . . [I]ndividual speech acts are part of a larger, continuous circulation."). The idea, however, has led to some unfortunate portmanteaus. *See, e.g.*, DON TAPSCOTT & ANTHONY D. WILLIAMS, WIKINOMICS: HOW MASS COLLABORATION CHANGES EVERYTHING 124–27 (2008) ("prosumer"); Erez Reuveni, *Authorship in the Age of the Conducer*, 54 J. COPYRIGHT SOC'Y U.S. 285, 286–87 (2007) ("conducer").

95. *Cf.* Int'l News Serv. v. Associated Press, 248 U.S. 215, 250 (1918) (Brandeis, J., dissenting) ("The general rule of law is, that the noblest of human productions—knowledge, truths ascertained, conceptions, and ideas—become, after voluntary communication to others, free as the air to common use.").

96. *See generally* JAMES BOYLE, THE PUBLIC DOMAIN: ENCLOSING THE COMMONS OF THE MIND (2008).

97. *See* Frischmann, *supra* note 78, at 990–1003 (arguing that this claim is likely to hold for certain kinds of infrastructural information).

98. *See, e.g.*, Yochai Benkler, *Coase's Penguin, or, Linux and* The Nature of the Firm, 112 YALE L.J. 369, 423–36 (2002).

99. *See* BENKLER, *supra* note 46, at 59–90; STEVEN WEBER, THE SUCCESS OF OPEN SOURCE (2004).

When they think about the ideal scale of an information commons, these thinkers generally say, "the more the merrier."[100] There are network effects from increased participation; the more people who are sharing with you, the greater the riches available for you to draw on. They don't cost you anything; indeed they may actively help out your own creative processes, for example by pointing out bugs in your open-source software.[101] If the community is engaged in cooking up a batch of informational stone soup, the larger the community grows, the richer the soup becomes, and the less of a burden the cooking places on any individual member.[102] Moreover, as Benkler argues, increased community scale leads to more opportunities for productive collaboration, so that sharing catalyzes creativity and vice-versa, accelerating the virtuous circle.[103]

Let's call this strain of commons theory the "Comedic" story.[104] It applies to nonrival resources, and particularly to information goods. To review, its basic argument is that repudiating excludability is often better than embracing it. Since the resources are nonrival, free riding poses no threat of waste. Instead, a commons ensures the maximum possible use of valuable information, avoiding the waste associated with exclusive rights. The incentives to produce and share come from the internal and social motivations of participants, motivations that under the right circumstances may even be supplied by the commons itself.

Like its doppelgänger, the Comedic story has also frequently been told about the Internet.[105] The blogosphere, built on an ethos of sharing one's own thoughts and linking to others', is numerically dominated by noncommercial blogs written for personal reasons; even bloggers who make money selling ads still give the actual words away.[106] The last half-decade on the Web has been the great era of UGC sites like YouTube, Flickr, Facebook, and Twitter—all of which offer users access to content uploaded, for unpaid sharing, by other users. Sharing makes the Web go round.[107]

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100. The phrase comes from Carol Rose, *The Comedy of the Commons: Custom, Commerce, and Inherently Public Property*, 53 U. CHI. L. REV. 711, 768 (1986).

101. *See* ERIC S. RAYMOND, THE CATHEDRAL AND THE BAZAAR: MUSINGS ON LINUX AND OPEN SOURCE BY AN ACCIDENTAL REVOLUTIONARY 33–36 (2001).

102. Eric Raymond gives the metaphor of a "magic cauldron" that produces soup *ex nihilo*, then argues that open source software is that cauldron made real. *See id.* at 115.

103. BENKLER, *supra* note 46; Benkler, *supra* note 98, at 415 ("[T]here are increasing returns to the scale of the pool of individuals, resources, and projects to which they can be applied.").

104. The inspiration for this term comes from Carol Rose's remarkable *Comedy of the Commons*, *supra* note 100.

105. *See, e.g.*, Benkler, *supra* note 98, at 404–05.

106. *See* SCOTT ROSENBERG, SAY EVERYTHING: HOW BLOGGING BEGAN, WHAT IT'S BECOMING, AND WHY IT MATTERS 163–97 (2009).

107. *Cf.* Eben Moglen, *Anarchism Triumphant: Free Software and the Death of Copyright*, FIRST MONDAY, Aug. 2, 1999, http://firstmonday.org/htbin/cgiwrap/bin/ojs/index.php/fm/article/view/684/594 ("So Moglen's Metaphorical Corollary to Faraday's Law says that if you wrap the Internet around every person on the planet and spin the planet, software flows in the network. It's an emergent property of connected human minds that

There's also a strong argument that many of these sharing-based sites are successfully outcompeting their more restricted competitors. Wikipedia's outrageous success, as compared with Nupedia, Citizendium, Knol, Encarta, and every other would-be online encyclopedia, could reasonably be attributed to its extraordinary openness to unfiltered contributions from anyone.[108]

And on a deeper level, one noted by both Post[109] and Zittrain,[110] the Internet is itself largely built with nonproprietary technical standards, free for anyone to reuse and implement for themselves.[111] Even when private companies develop and commercialize services, they've thrived best when the companies have released well-documented public interfaces, free for anyone to use and build upon in making new mashup applications.[112] Even much of the software on which the Internet itself runs is the freely shared product of collaborative open-source development, carried out collaboratively worldwide . . . on the Internet.[113]

III. The Semicommons

It should by now be clear that the Tragic and Comedic stories point in diametrically opposite directions. The Tragic story embraces exclusion; it tells us that the only way to make a commons work is to make it small and jealously keep outsiders out.[114] The Comedic story rejects exclusion; it tells us that the best way to make a commons thrive is to make it large and invite in as many participants as possible.[115] As applied to the immensity of the Internet, the Comedic story predicts utopia and the Tragic story predicts utter devastation.

The Internet's success at scale suggests that there must be something to the Comedic story's optimism, but so far, we have no good theoretical

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they create things for one another's pleasure and to conquer their uneasy sense of being too alone.").

108. *See, e.g.*, ZITTRAIN, *supra* note 2, at 133 (closure of Nupedia); Randall Stross, *Encyclopedic Knowledge, Then vs. Now*, N.Y. TIMES, May 3, 2009, at BU3 (end of Encarta); On Wikipedia, On Citizendium, http://onwikipedia.blogspot.com/2010/01/on-citizendium.html (Jan. 18, 2010, 16:06) ("stagnat[ion]" of Citizendium); Erick Schonfeld, *Poor Google Knol Has Gone from a Wikipedia Killer to a Craigslist Wannabe*, TECHCRUNCH, Aug. 11, 2009, http://techcrunch.com/2009/08/11/poor-google-knol-has-gone-from-a-wikipedia-killer-to-a-craigslist-wannabe/ (decline of Knol).

109. POST, *supra* note 1, at 133–41.

110. ZITTRAIN, *supra* note 2, at 141.

111. These same standards were in many cases developed in open participatory processes, where all-important decisions were made on a consensus basis. *See* MILTON L. MUELLER, RULING THE ROOT: INTERNET GOVERNANCE AND THE TAMING OF CYBERSPACE 89–94 (2002).

112. *See* Tim O'Reilly, *What Is Web 2.0*, O'REILLY, Sept. 30, 2005, http://oreilly.com/web2/archive/what-is-web-20.html; *cf.* ZITTRAIN, *supra* note 2, at 181–85 (discussing "API neutrality").

113. *See generally* GLYN MOODY, REBEL CODE: THE INSIDE STORY OF LINUX AND THE OPEN SOURCE REVOLUTION (2001).

114. *See supra* Part II.B.

115. *See supra* Part II.C.

reason to pick one or the other. The Tragic story seems perfectly plausible as a description of the sad fate awaiting all of the shared and all-too-exhaustible aspects of the Internet: bandwidth, server space, processor cycles, and human attention. The Comedic story seems equally plausible as a description of the great achievements that result from instant, inexpensive, worldwide sharing of inexhaustible information. Our task for this part will be to reconcile the two.

A. *The Open-Field Semicommons*

I'd like to suggest that the right abstraction is Henry Smith's theory of a *semicommons*:

> In a semicommons, a resource is owned and used in common for one major purpose, but, with respect to some other major purpose, individual economic units—individuals, families, or firms—have property rights to separate pieces of the commons. Most property mixes elements of common and private ownership, but one or the other dominates. . . . In what I am calling a semicommons, both common and private uses are important and impact significantly on each other.[116]

On Smith's account, a resource must satisfy two conditions to be a good candidate for semicommons ownership. There must be multiple possible uses of the resource that are efficient at different scales, so that one use is naturally private, and one is naturally common. These uses must also have significant positive interactions with each other, so that there will be a benefit from allowing both rather than choosing one. The combination of scale mismatch and positive interactions offers rewards for mixing private and common.[117]

Smith's "archetypal example of a semicommons is the open-field system of medieval [Europe]."[118] Sheep could be grazed freely across the fields of a village during fallow seasons, but during growing seasons, individual farmers had exclusive rights to their strips of land. The same fields were held in common for grazing and privately for farming: a semicommons. As he shows, the open-field system displayed both scale mismatch and positive interactions.[119]

First, the two valuable uses of its land—grazing sheep and raising crops—were efficient at different scales. Medieval grazing had scale economies: one shepherd could watch a large flock on a correspondingly large pasture.[120] Medieval farming was a labor-intensive, small-scale affair. Each farmer could plow, seed, tend, and harvest only a limited

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116. Smith, *supra* note 6, at 131–32.
117. *See id.* at 168.
118. *Id.* at 132. Yes, sheep and pastures again. Hardin's tragic commons and Ostrom's potentially sustainable one are the same as Smith's semicommons, just theorized differently.
119. *Id.*
120. *Id.* at 135–36.

quantity of land. Nor was there much benefit in teaming up; two men couldn't plow the same furrow, and combining holdings would have tempted each farmer to shoulder less than his share of the work.[121]

Thus, grazing made sense as a commons in which each villager was entitled to contribute sheep to a large flock grazed across large tracts of land. This is a natural governance regime: the extent of each villager's use could easily be monitored by counting his sheep. On the other hand, farming made sense as private property in which each villager farmed his own small plot of land. This is a natural exclusion regime: it's easy to tell who's harvesting from which piece of land.[122]

As for positive interactions, the same land could profitably be used for both farming and grazing. Land needs to sit fallow between growing seasons;[123] a village might as well graze sheep during the off-season.[124] Better still, the best source of fertilizer for the fields was the manure left behind by the sheep.[125] Thus, the private plots of land worked better for their private purpose *because* they were also open to the common use of grazing sheep.

In addition to explaining why a semicommons might come into being, Smith's theory also explains some of the distinctive threats it will face from strategic behavior.[126] I'd like to emphasize three. First, in a semicommons, users will be tempted not just to overuse the common resource, but to strategically dump the costs onto others' private portions, bearing none of the costs themselves.[127] On a rainy day, when trampling hooves will do the most damage and create the most mud, a shepherd might be tempted to direct the herd onto someone else's plot of land and well away from his own.[128] Second, users may be tempted to take expensive and socially wasteful precautions to guard against others' strategic uses—say, sitting outside all day in the rain to watch the shepherd.[129] And third, private users will be tempted to disregard the commons use in pursuit of their private gain;[130] imagine a farmer who decides to plant a profitable crop that's poisonous to sheep. The semicommons only makes sense if the benefits from combining the private and common uses outweigh the costs from these kinds of strategic behavior.[131]

Semicommons also have important strategies for dealing with these challenges. One is sharing rules, in which some of the private portions of

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121. *See id.* at 136–38.

122. *See* Robert C. Ellickson, *Property in Land*, 102 YALE L.J. 1315, 1327–30 (1993).

123. And sometimes during them, as required by crop rotation.

124. Smith, *supra* note 6, at 132, 135.

125. *Id.* at 136.

126. *Id.* at 138–41.

127. *Id.* at 138–39.

128. *Id.* at 149.

129. *Id.* at 140–41.

130. *Id.* at 141.

131. *Id.* at 141–42.

the resource are collected and divided among the various users.[132] Smith gives the example of general average in admiralty, in which all those with an interest in a ship or its cargo must contribute proportionately to reimburse anyone whose property is damaged in the course of avoiding a common peril.[133] That eliminates the captain's temptation to throw other people's cargo overboard first. In our hypothetical village, pooling some of the crops after each season would be a sharing rule protecting victims of excessive trampling.

Another characteristic semicommons device is boundary-setting.[134] Smith's example here is scattering; each villager's landholdings were divided into multiple small strips in different fields, rather than one larger plot.[135] Scattering was costly; farmers sometimes got confused about which strip was theirs.[136] But it also made abusive herding less attractive. With many thin strips, it's harder for the shepherd to park the sheep over his own plot while they poop, and over someone else's plot while they stomp. Getting the property boundaries right thus helps prevent strategic behavior.

B. *The Internet Semicommons*

Smith's semicommons model accurately describes the Internet. We'll see every element of it online: private and common uses of the same resource, efficient at wildly different scales, but productively intertwined; strategic behavior that also causes these uses to undermine each other;[137] sharing rules and boundary-setting to keep the whole thing functioning.[138] The productive but fraught interplay between private and common uses in a semicommons elegantly captures the tension between the Tragic and Comedic stories on the Internet.

Let's start with the private and common uses. On the one hand, the computers and network cables that actually make up the Internet are private personal property, managed via exclusion. My laptop is mine and mine alone. If I decide to laser-etch its case, or to wipe it clean and reinstall the operating system, no one can stop me. Nor can anyone else decide what outlet it's plugged into; if you try to treat it as common property and take it home with you, you'll be brought up on charges. The same goes for Rackspace's servers[139] and Level3's fiber-optic network:[140] private property, all of it.

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132. *Id.* at 142 & n.27.
133. *Id.*
134. *Id.* at 161–67.
135. *Id.* at 146–54.
136. *Id.* at 147–48.
137. *See infra* Part IV.A.
138. *See infra* Part IV.C.
139. *See* Rackspace, Definitions and Technical Jargon of the Hosting Industry, http://www.rackspace.com/information/hosting101/definitions.php (last visited Apr. 10, 2010) ("In a managed hosting environment, the provider owns the data centers, the network, the server and other devices, and is responsible for deploying, maintaining and monitoring

On the other hand, as a communications platform,[141] the Internet is remarkably close to a commons, managed via governance in the form of technical standards and protocols.[142] Fill out an IP datagram with the 32-bit IP address of a computer you'd like to send a message to, and dozens of routers will cheerfully cooperate to get it there.[143] The destination computer has also likely been configured to collaborate with you. Send it an HTTP GET message and you'll get back a Web page;[144] send it an SMTP HELO and it will get ready to accept an e-mail from you.[145] With this kind of support—yours for the asking—you and your friends can set up a new website, a new online application, a new protocol, a new peer-to-peer network, a new whatever you want. That's common use of a fairly profound sort—precisely as Post and Zittrain describe.[146]

Next, these private and common uses are efficient at different scales. Private property makes sense for individual computers and cables; the

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them. . . . Dedicated Hosting . . . allows customers to lease pre-configured, dedicated equipment and connectivity from the provider.").

140. *See* Level3, Our Network, http://www.level3.com/index.cfm?pageID=242 (last visited Apr. 10, 2010) ("The Level 3 Communications® Network today operates as one of the largest IP transit networks in North America and Europe.").

141. To be clear, I'm focusing more on tangible *communications platform* as a common use, rather than the intangible *information* exchanged on it. The nonrivalry of information and the Comedic story explain why the Internet is so valuable as a communications platform; they don't actually make the Internet into information or eliminate the challenges of rivalry. We've faced the problem of exchanging nonrival information over rival communications infrastructure for a long time; the Internet is just better at the task than its predecessors. *See generally* Frischmann, *supra* note 78, at 1005–22 (describing the Internet as infrastructure). Robert Heverly has written an important and illuminating article on how intellectual property law makes information a semicommons of positively interacting private and common uses. Robert A. Heverly, *The Information Semicommons*, 18 BERKELEY TECH. L.J. 1127 (2003); *see also* Lydia Pallas Loren, *Building a Reliable Semicommons of Creative Works: Enforcement of Creative Commons Licenses and Limited Abandonment of Copyright*, 14 GEO. MASON L. REV. 271 (2007); Robert P. Merges, *A New Dynamism in the Public Domain*, 71 U. CHI. L. REV. 183 (2004) (describing Creative Commons as a "semicommons" in Heverly's sense).

142. *See generally* LAURA DENARDIS, PROTOCOL POLITICS: THE GLOBALIZATION OF INTERNET GOVERNANCE (2009) (discussing governance role of Internet standards).

143. *See* 1 DOUGLAS COMER, INTERNETWORKING WITH TCP/IP: PRINCIPLES, PROTOCOLS, AND ARCHITECTURE (5th ed. 2006) (describing IP datagram format and routing); INFO. SCIS. INST., RFC 791, INTERNET PROTOCOL: DARPA INTERNET PROGRAM PROTOCOL SPECIFICATION § 2.3 (1981), http://tools.ietf.org/html/rfc791 ("The function or purpose of Internet Protocol is to move datagrams through an interconnected set of networks. This is done by passing the datagrams from one internet module to another until the destination is reached.").

144. *See generally* DAVID GOURLEY & BRIAN TOTTY, HTTP: THE DEFINITIVE GUIDE (2002) (describing HTTP standard).

145. *See* JOHN RHOTON, PROGRAMMER'S GUIDE TO INTERNET MAIL: SMTP, POP, IMAP, AND LDAP (2000); JONATHAN B. POSTEL, RFC 821, SIMPLE MAIL TRANSFER PROTOCOL (1982), http://tools.ietf.org/html/rfc821 [hereinafter RFC 821] (detailing SMTP standard).

146. *See* POST, *supra* note 1, at 101–03; ZITTRAIN, *supra* note 2, at 26–35.

Tragic story warns us to restrict access.[147] Computers are rival: they can be stolen, hijacked, or crashed. Hardware remains expensive enough that people will try to get their hands on it (physically or virtually), and when they succeed, it creates real costs for others.[148] Private property empowers individual owners to protect against laptop thieves, virus writers, and botnet wranglers.[149]

Moreover, private use of computers aligns incentives well. Computers require their owners to invest time, effort, and money: buying the hardware, setting up the software, keeping the power and bandwidth flowing. An exclusion regime both allows and encourages computer owners to select the configuration that's value-maximizing for them. I use my laptop to write papers, check e-mail, and surf the Web wirelessly; you use your broadband-connected desktop to run regressions and play World of Warcraft. Our ideal computers are profoundly different; asking us to play sysadmin for each other would only pile up the agency costs. All of this pushes towards small-scale private ownership.

On the other hand, commons use makes sense when we look at the Internet as a communications platform. The Comedic story tells us that where information exchange is concerned, we should design for the widest participation possible. A communications network's value plummets if it's fragmented.[150] If you have something to say to even one other person, you may as well post it publicly, so that anyone else can take advantage of it. When you do, better to share with the world than with any smaller group.[151]

Further, this large-scale communications platform wouldn't work efficiently if it were private. Scholars have noted the immense transaction

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147. *Cf.* Henry E. Smith, *Governing the Tele-Semicommons*, 22 YALE J. ON REG. 289 (2005) (applying semicommons theory to argue against the use of common property treatment of individual physical network elements).

148. *See* Joris Evers, *Computer Crime Costs $67 Billion, FBI Says*, CNET NEWS, Jan. 19, 2006, http://news.cnet.com/Computer-crime-costs-67-billion,-FBI-says/2100-7349_3-6028946.html.

149. *See, e.g.*, ZITTRAIN, *supra* note 2, at 159 (advocating "a simple dashboard that lets the users of PCs make quick judgments about the nature and quality of the code they are about to run"). Such sentiments assume that users have the sort of autonomy over their PCs that a private property owner would, a principle Zittrain strongly endorses. *See id.* at 108–09.

150. *See* Andrew Odlyzko & Benjamin Tilly, A Refutation of Metcalfe's Law and a Better Estimate for the Value of Networks and Network Interconnections 4 (Mar. 2, 2005) (unpublished manuscript), *available at* http://www.dtc.umn.edu/~odlyzko/doc/metcalfe.pdf (arguing that the value of an *n*-user network grows as $n \log n$); *see also* Bob Briscoe et al., *Metcalfe's Law Is Wrong*, IEEE SPECTRUM, July 2006, at 35 (later version of Odlyzko & Tilly article).

151. Lauren Gelman observes that users often post sensitive information in publicly accessible ways online. Her point is that public accessibility allows you to reach others who share your interests, even when you couldn't identify them at the time of the posting. The value of reaching them can outweigh even significant privacy risks of being noticed by outsiders. *See* Lauren Gelman, *Privacy, Free Speech, and "Blurry-Edged" Social Networks*, 50 B.C. L. REV. 1315, 1334–35 (2009).

costs of negotiating individual permission from every system owner,[152] along with the potential anticommons holdup problems.[153] It's almost a mantra at this point that if you want to create a successful online service, you need to make it free and freely available.[154] And even as ISPs threaten to introduce stringent usage caps, they can barely manage to tell customers how much bandwidth they're actually using.[155] The commons has a powerful hold on the Internet as communications platform.

In other words, the Tragic story is right, for the individual computers and wires that constitute the Internet. It recommends private property, which is indeed how these physical resources are held. And the Comedic story is *also* right, for those computers and wires considered as the communications platform that is the Internet. It recommends an unmanaged commons, which is indeed how this virtual resource is held.

Not only are both stories right, they're right at wildly different scales. Remember how there are over a billion users and over two hundred million websites on the Internet?[156] That's a difference of *eight or nine orders of magnitude* between the scale of the individual computers on which private owners operate and the scale of the worldwide common platform. That divergence isn't a one-time anomaly; it's what the Internet does, every millisecond of every day, everywhere in the world.

Satisfying Smith's other condition, these two uses "impact . . . on each other"[157] profoundly and positively. You couldn't build a common global network without the private infrastructure to run it on, but most of the value of that infrastructure comes from the common global network dancing atop it. To see why it's the interaction that adds the value, remember that the private owners could disconnect their computers from the semicommons at any moment—and choose not to. Would you buy a computer incapable of being connected to the Internet? Neither would I. This is a semicommons that works.   Indeed, the Internet is probably the greatest, purest semicommons in history.

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152. Paul Ohm has pointed out that in many cases, just trying to meter or monitor these information flows—a necessary step in privatizing them—would in many circumstances be ruinously costly. *See* Paul Ohm, *The Rise and Fall of Invasive ISP Surveillance*, 2009 U. ILL. L. REV. 1417.

153. *See, e.g.*, Dan Hunter, *Cyberspace as Place and the Tragedy of the Digital Anticommons*, 91 CAL. L. REV. 439, 500–14 (2003).

154. *See* Chris Anderson, *Free! Why $0.00 Is the Future of Business*, WIRED, Mar. 2008, at 140.

155. *See, e.g.*, Jesse Kirdahy-Scalia, *One Year After Capping Bandwidth, Comcast Still Offers No Meter*, OPEN MEDIA BOSTON, Aug. 21, 2009, http://www.openmediaboston.org/node/860.

156. *See supra* notes 22–23 and accompanying text.

157. Smith, *supra* note 6, at 132.

C. *The Generative Semicommons*

In a moment, we'll complete this portrait of the Internet semicommons by looking at its characteristic forms of strategic behavior. But first, I'd like to point out how semicommons theory offers a fresh perspective on generativity. *The Future of the Internet* describes the generativity of both the personal computer (PC)[158] and the Internet,[159] which map neatly onto the private and common aspects of the Internet.

A generative PC is one that its owner fully controls. Not a tethered appliance that's physically yours but practically under someone else's governance.[160] Not a cloud service that you might be excluded from tomorrow.[161] And not an insecure box actually under the control of a shadowy Elbonian hacker syndicate. No, the generative PC is your private property, yours to do with exactly as you choose.

The generative Internet, on the other hand, is defined by its connectedness and commonality. Once you have a great new hack, the best thing to do is to send it out to others, so they can replicate its benefits for themselves and build their own improvements on it. That means the network ought to be as common as possible; you should be able to share your innovations with anyone, not subject to any third party's veto. Although Zittrain rejects a "categorical" end-to-end principle,[162] he treasures the way that the Internet's lack of control permits a "flexible, robust platform for innovation."[163]

The two stages of generativity—creating and sharing—thus map onto private and common, respectively. The cycle works best when the two are not just available, but conjoined. Generativity is the story of the Internet as innovating semicommons.

IV. CHALLENGES

As a semicommons, the Internet is valuable because it combines private and commons uses. Merely saying that it does, however, gives little guidance on how to make this coexistence work. Indeed, one of Smith's central points is that problems of strategic behavior are actually worse in a semicommons than in a pure commons.[164] His account of the open-field system doesn't just explain why it might make sense to treat the village fields as a semicommons; it also describes how villagers were able to solve these strategic behavior problems.[165] In so doing, he also provides a

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158. ZITTRAIN, *supra* note 2, at 11–18.
159. *Id.* at 19–35.
160. *Id.* at 101–04.
161. Jonathan Zittrain, Op-Ed., *Lost in the Cloud*, N.Y. TIMES, July 20, 2009, at A19.
162. ZITTRAIN, *supra* note 2, at 165.
163. Zittrain, *supra* note 33, at 1990.
164. Smith, *supra* note 6, at 138–39.
165. *See supra* Part II.A.

potentially more satisfying explanation of one of the characteristic features of the open fields: scattering.[166]

This part will do the same for the Internet: link the theoretical question of the mitigation of strategic behavior in a semicommons to well-known descriptive characteristics of the Internet. I'll argue that the success of many Internet technical features and online institutions can be cleanly explained in terms of their ability to overcome semicommons dilemmas. Part IV.A discusses "layering," one of the Internet's basic technical characteristics, in which one protocol provides a clean abstraction atop which another can run, and so on repeatedly. Layering helps mediate the private/common interface and helps prevent these uses from interfering with each other. Part IV.B takes up UGC sites, which exhibit a consistent correlation between a community and a particular piece of infrastructure. This linkage enables them to use governance rather than exclusion to detect and prevent misuse of their little corner of the Internet. And Part IV.C looks at some problems of boundary-setting, in particular how the Usenet system of distributed bulletin boards has failed to cope with strategic behavior. Its experience tells us much about the challenges of institution design on the Internet.

A. *Layering*

The term "layering" comes from computer science, where it describes the division of a system into components, each of which only interacts with the ones immediately "above" or "below" it.[167] Programmers and system designers use layered architectures because they enable modularity: each component can be designed without needing to know how the others work, which reduces the complexity of the programming task and simplifies debugging by reducing interactions between components.[168]

On the Internet, layering is prevalent. When one user writes another an e-mail, the actual exchange typically involves six or more layers. The e-mail ("content" layer) is sent from one e-mail program to another ("application" layer) using the Simple Mail Transport Protocol (another application, but one operating at the service of e-mail programs), which uses the Transmission Control Protocol to open a stable connection from one computer to the other ("transport" layer). That connection, in turn, is

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166. Smith, *supra* note 6, at 146–54 (arguing that border-setting semicommons explanation of scattering is superior to other economic explanations).

167. *See* 1 W. RICHARD STEVENS, TCP/IP ILLUSTRATED: THE PROTOCOLS 1–6 (1994); ANDREW S. TANENBAUM, COMPUTER NETWORKS 26 (4th ed. 2003); TELECOMM. STANDARDIZATION SECTOR, INT'L TELECOMM. UNION, ITU–T RECOMMENDATION X.200, INFORMATION TECHNOLOGY—OPEN SYSTEMS INTERCONNECTION—BASIC REFERENCE MODEL: THE BASIC MODEL § 5.2, at 6–8 (1994), http://www.itu.int/rec/dologin_pub.asp?lang=e&id=T-REC-X.200-199407-I!!PDF-E&type=items.

168. *See* STEVE MCCONNELL, CODE COMPLETE: A PRACTICAL HANDBOOK OF SOFTWARE CONSTRUCTION 94–108 (2d ed. 2004); HERBERT A. SIMON, THE SCIENCES OF THE ARTIFICIAL 195–200 (3d ed. 1996).

made up of a sequence of discrete IP datagrams ("network" layer), which in turn are moved from one computer to the other using a network protocol such as Ethernet ("link" layer) that is tailored to run well on specific hardware like a Category 5e twisted-pair copper cable ("physical" layer). The e-mail program doesn't need to know how Ethernet works, and vice-versa.[169]

For our purposes, one layer is more equal than the others: the network layer, where IP is universal.[170] Lower layers have a diversity of networking protocols and hardware; higher layers have a diversity of transports and applications. But there is only one network-layer protocol worthy of note on the Internet: IP.[171] Everyone uses it. The Internet itself can be defined as the global network of computers using IP to communicate with each other.[172]

As legal scholars have recognized, layering has policy implications.[173] In particular, it permits different resource allocation regimes at different layers. The same network may be fully private at the physical layer (only the company IT manager can enter the room with the server), a limited-access common-pool resource at the link layer (only employees in the building can connect to it, but they can do so freely), a governed open-to-the-world common-pool resource at the application layer (the company allows outside e-mail connections but filters them for spam), and mixed commons and private at the content layer (outside users send the employees both proprietary company documents and freely shared jokes). These different regimes coexist: the same physical network is simultaneously participating in all of them.[174] Any given electrical signal is meaningful at multiple layers.

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169. *See* TANENBAUM, *supra* note 167, at 37–71.

170. To be more precise, this claim would also include the ancillary routing protocols, such as the Border Gateway Protocol (BGP) and the Routing Information Protocol (RIP), that tell IP-implementing systems *which* other computers they should forward IP traffic through. *See* COMER, *supra* note 143, at 249–93 (describing BGP and RIP).

171. The current version of IP in broad use is version 4; there is a worldwide effort underway to upgrade to version 6. But IP's universality makes this upgrade both technically challenging and politically contentious: any widely adopted change to IP will change the nature of the Internet itself. *See* DENARDIS, *supra* note 142, at 4; LAWRENCE LESSIG, CODE: AND OTHER LAWS OF CYBERSPACE 207–09 (1999) ("[W]e again will have to decide whether this architecture of regulability is creating the cyberspace we want. A choice. A need to make a choice.").

172. *See* James Grimmelmann & Paul Ohm, *Dr. Generative—Or How I Learned To Stop Worrying and Love the iPhone*, 69 MD. L. REV. (forthcoming 2010) (book review).

173. *See, e.g.*, LAWRENCE LESSIG, THE FUTURE OF IDEAS: THE FATE OF THE COMMONS IN A CONNECTED WORLD 23–25 (2001); Lawrence B. Solum & Minn Chung, *The Layers Principle: Internet Architecture and the Law*, 79 NOTRE DAME L. REV. 815, 818–20 (2004); Kevin Werbach, *A Layered Model for Internet Policy*, 1 J. ON TELECOMM. & HIGH TECH. L. 37, 57–60 (2002); Timothy Wu, *Application-Centered Internet Analysis*, 85 VA. L. REV. 1163, 1188–93 (1999).

174. *See* Solum & Chung, *supra* note 173, at 838–44 (discussing coexistence of multiple layers).

IP plays a critical role in this system of overlapping regimes; it is the layer on which the Internet is most fully a commons. Beneath are privately owned hardware, managed networks, and (sometimes) proprietary protocols. Above it are specialized protocols that form direct connections between individual computers, tightly controlled applications, and copyrighted content. But IP itself is wide open: specify the IP address of a system you'd like your datagram to be delivered to, and dozens of computers along the way will voluntarily help get it there. Most of the time, no one asks for payment; no one inspects the contents; no one asks to see your signed authorization. This makes IP not just a universal layer sandwiched between more fragmented ones,[175] but also a commons layer sandwiched between more private ones.

It was an inspired design decision; IP has a lot of nice desiderata for a commons. A Comedic commons should be as large as possible, as easy as possible to join, as minimally demanding as possible on its participants, and as flexible as possible in the uses to which it can be put. IP checks every one of those boxes. Not only is it universal in the sense of being widely used, it's also universal in the sense of being able to run on any kind of network.[176] It's also a remarkably simple protocol; all it does is move datagrams from point A to point B.[177] That makes it easier to implement and reduces the need for explicit coordination, both factors that make it easier to participate in the IP commons.[178] Because IP's simplicity also precludes specialization for particular uses, it's suitable for almost every use.[179] It can be a jack of all trades by being a master of none.[180] The IP Internet is thus both easy for private infrastructure owners to join and easy for them to use profitably once they've joined.

This leaves, however, the problem of strategic behavior identified by Smith. That the Internet has a billion users is a sign of success, but that it has hundreds of millions of computers is a sign of challenge—that's a massive amount of resources to be devoting to the Internet semicommons. Every use of the IP commons imposes very real costs on the private infrastructure beneath it, and the natural question is why those costs don't

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175. *See* ZITTRAIN, *supra* note 2, at 67–71 (discussing "hourglass architecture" of IP).

176. *See* D. WAITZMAN, RFC 1149, A STANDARD FOR THE TRANSMISSION OF IP DATAGRAMS ON AVIAN CARRIERS (1990), http://tools.ietf.org/html/rfc1149 (explaining how to implement IP using carrier pigeons).

177. *See* POST, *supra* note 1, at 82–89 (discussing the simplicity of IP).

178. *See* M. MITCHELL WALDROP, THE DREAM MACHINE: J.C.R. LICKLIDER AND THE REVOLUTION THAT MADE COMPUTING PERSONAL 379–80 (2001) (discussing how IP's simplicity made it easier to connect networks and aided its adoption).

179. *See* David Isenberg, *Rise of the Stupid Network*, J. HYPERLINKED ORG., June 1997, http://www.hyperorg.com/misc/stupidnet.html ("The Stupid Network would let you send mixed data types at will . . . . You would not have to ask your Stupid Network provider for any special network modifications . . . . A rudimentary form of the Stupid Network—the Internet—is here today.").

180. *See* J.H. Saltzer et al., *End-to-End Arguments in System Design,* 2 ACM TRANSACTIONS ON COMPUTER SYS. 277, 278 (1984).

overwhelm it. Routers can become overwhelmed with heavy traffic and drop packets; network links can become saturated; servers can crash.

This isn't merely a theoretical concern. Strategic behavior is everywhere in the Internet semicommons. Network backbone operators routinely route packets in ways designed to dump as much of the cost as possible on each other.[181] Virus, worm, and malware authors use the commons to deliver their malicious software, hijack users' private computers, and send out spam—which in turn puts costs on private mail servers and actually degrades the content commons by polluting it with unwanted, distracting messages.[182] We also see the wasteful precautionary costs identified by Smith: spam filters,[183] CAPTCHAs,[184] firewalls,[185] and so on are the Internet equivalents of farmers sitting out in the rain watching to see where the sheep are driven.

This is all rather discouraging, but, as Galileo apocryphally said, *eppur si muove.*[186] The Internet does work, fortunes are made on it, and millions of afternoons are enjoyably frittered away reading *Twilight* fan fiction. The benefits from combining private and common uses online must outweigh the costs, notwithstanding all of these abuses, *or the Internet would not exist.*

Layering is one reason that the costs of strategic behavior and fencing are manageable. IP's simplicity creates a kind of forced sharing of

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181. For example, network A will hand off packets destined for network B's users as soon as possible, so that network B does the bulk of the work to deliver them. *See* JONATHAN E. NUECHTERLEIN & PHILIP J. WEISER, DIGITAL CROSSROADS: AMERICAN TELECOMMUNICATIONS POLICY IN THE INTERNET AGE 42–44 (2005).

182. *See* ZITTRAIN, *supra* note 2, at 36–51. Of course, we might classify these content-level costs as burdens on the private resources of users' attention, but saying that this is a cost imposed on the commons, even if less descriptively precise, is clearer in terms of pinpointing the problem.

183. *See* David Pogue, *On the Job, a Spam Fighter Is Learning*, N.Y. TIMES, Mar. 30, 2006, at C1 (describing the Spam Cube, a home device to filter spam). The Spam Cube, like other spam-fighting technologies, is costly in two different ways. It costs $150, and along with the spam it catches, it also blocks legitimate emails. *Id.*

184. *See* ReCAPTCHA, What Is a CAPTCHA?, http://recaptcha.net/captcha.html (last visited Apr. 10, 2010) ("A CAPTCHA is a program that can generate and grade tests that humans can pass but current computer programs cannot."). But CAPTCHAs are costly, too. *See* BaltTech, Towson U., National Federation of the Blind Re-Invent CAPTCHA, http://weblogs.baltimoresun.com/news/technology/2009/11/towson_u_national_federation_o.html (Nov. 18, 2009, 8:18 EST) (quoting computer science professor Jonathan Lazar as saying, "[b]asically, computer viruses are twice as successful as blind people on the old captchas.").

185. *See* WILLIAM R. CHESWICK ET AL., FIREWALLS AND INTERNET SECURITY: REPELLING THE WILY HACKER, at xviii (2d ed. 2003) (defining "firewall gateway" as a dedicated computer that is the only one on a network to communicate with the outside world); *id.* at 173–96 (describing how firewalls can provide specialized security). It's costly to add a dedicated computer to a network for no other purpose than security—to say nothing of the expense of configuring and monitoring it, or buying books like *Firewalls and Internet Security.*

186. "And yet it moves." STEPHEN HAWKING, ON THE SHOULDERS OF GIANTS: THE GREAT WORKS OF PHYSICS AND ASTRONOMY 393 (2002) (quoting Galileo Galilei). "[M]ost historians regard the story as a myth." *Id.*

infrastructure for users. A former housemate used to saturate our Internet connection running a peer-to-peer Gnutella node. It brought my Web surfing to a crawl—but it also brought his Web surfing to a crawl. There was no way for him to reach down further in the protocol stack and prioritize his physical computer over mine. It wasn't full internalization of the costs he was creating for the rest of us—but it was enough to convince him to moderate his file sharing once he figured out the connection.

Layering also has salutary boundary-setting effects.[187] Because the IP layer hides those beneath it, it functions like scattering in preventing commons users from strategically targeting specific private pieces of infrastructure. It's impossible to know with certainty the path that a packet will follow, and if one link fails under overload, the packets will flow along another route. You can graze your traffic across particular networks, but you can't easily park all of it in one spot. Conversely, John Gilmore's quip that "[t]he Internet interprets censorship as damage and routes around it"[188] captures the point that it's difficult to impinge on commons uses by targeting specific pieces of the private infrastructure. Take out one node and the Internet's overall flows will be largely unaffected.

Looking upwards in the protocol stack rather than down, as long as my ISP and other infrastructure providers implement IP without violating its layering abstractions—that is, as long as they don't "look inside" the IP packets—they have almost no choice but to provide a "neutral" network.[189] Layering becomes an architectural constraint that prevents them from selectively choosing to block, alter, or slow my communications. That limits the power of these private owners to engage in self-interested bargaining with commons users; they can't go to Google and demand a premium for allowing its traffic to pass, or slow down all video content, or otherwise start tinkering with commons uses.[190]

B. *User-Generated Content Sites*

Next, consider a large and important category of Internet activity: UGC sites. All of these sites face the Internet's semicommons problem in miniature. They typically run on private infrastructure supplied by a single entity, but anyone in the world can view and contribute to them.[191] Some

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187. Solum & Chung, *supra* note 173, discuss at length the policy virtues of respecting boundaries between layers.

188. Peter H. Lewis, *Limiting a Medium Without Boundaries*, N.Y. TIMES, Jan. 15, 1996, at D4.

189. Solum & Chung, *supra* note 173, at 829–31, 936–42.

190. This is not to enter the debates on network neutrality as a matter of policy. My point is merely that layering as a form of boundary-setting limits certain forms of self-interested behavior by private owners; evaluating whether this is a good thing or a bad thing would require more analysis than can fit in this margin.

191. This is another layered system, but note that the private/common division is different than the one discussed in the previous section. Here, the system is held in common at the content layer, but is essentially private at every lower layer.

are tiny, like my blog—laboratorium.net—which runs on a server operated by a group of my friends and has a few comments per day.[192] Others are gigantic, like YouTube, which runs on a massive Google server farm and serves up over a billion video views daily.[193]

Once more, we wouldn't observe the semicommons form unless it were worthwhile. If the juxtaposition of private and common uses weren't creating value, then either the private owners of the servers would turn them off or the common users would stop participating.[194] In view of Smith's analysis of semicommons incentives, we should therefore ask *how* these sites produce value and how they keep costs under control.

The first answer is that on the Web, normal commons use can often be a source of value for server owners rather than a net cost. Consider my blog, for which I pay about $250 a year. Each pageview and comment costs me something, true, but it gives me more in return. By allowing readers to access my blog, I spread my ideas to a larger audience. By allowing comments, I learn from them. Even server owners motivated only by money can reap value from free commons use. The secret, as the first commercial bloggers discovered, is advertising.[195] More users mean more ad revenue, so that users are like pooping sheep: well worth the bother.[196]

A site that is free to its users can take advantage of powerful Comedic effects. Any nonzero price requires some form of signup, login, and billing; in addition to being costly to implement, these exclusion mechanisms are

192. The Laboratorium, http://laboratorium.net/ (last visited Apr. 10, 2010).

193. *See* Posting of Chad Hurley to YouTube Blog, http://youtube-global.blogspot.com/2009/10/y000000000utube.html (Oct. 9, 2009).

194. In this respect, these particular Internet semicommons are more susceptible to Demsetzian explanations than many offline property systems and legal regimes, where the problem of collective action looms larger. *See* Harold Demsetz, *Toward a Theory of Property Rights*, 57 AM. ECON. REV. PROC. 347 (1967) (describing evolution of property rights as efficient response when value from more intensive use increases). Scholars, however, have raised difficult questions about the mechanism by which this evolution would take place. *See, e.g.*, Saul Levmore, *Two Stories About the Evolution of Property Rights*, 31 J. LEGAL STUD. S421, S425–33 (2002) (noting ambiguity between optimistic Demsetzian story of the evolution of efficient property regimes and pessimistic story about selfish interest groups capturing value for themselves). A UGC site, however, as a resource, doesn't preexist the semicommons form (so that its users can hardly be accused of appropriating a commons for their exclusive use), and its users make individual voluntary decisions to take part when the rewards outweigh the costs (thus providing a straightforward mechanism for the collective decision to use a particular governance regime). This isn't to say that UGC sites are free of interest-group dynamics, or that they don't face collective action dilemmas, only that their initial development of a property system may pose less of a puzzle than the development of property systems in purely tangible online resources.

195. *See* ROSENBERG, *supra* note 106, at 178–85.

196. Sometimes, as with Twitter, the ad revenue isn't there yet (and may not ever be, if the skeptics are to be believed), but the prospect of monetizing the eyeballs justifies the up-front expenses of building the community. *See* A & M Records, Inc. v. Napster, Inc., 114 F. Supp. 2d 896, 902, 921–22 (N.D. Cal. 2000) (basing a holding of vicarious copyright infringement on the argument that although Napster had no present revenue, a larger user base would give it greater future revenue potential), *aff'd in part, rev'd in part*, 239 F.3d 1004 (9th Cir. 2001).

surprisingly strong psychological impediments to participation.[197]   That means a huge, discontinuous jump in usage when access is truly open. On a site where users interact with each other in creative ways, this spike in usage has powerful feedback effects. My commenters don't just respond to me; they also riff on each others' thoughts. It is, in short, the Comedic story all over again: creating a community of sharers produces value for everyone involved.

The second piece of the puzzle is that the server owner doesn't disappear from the picture entirely. She retains residual exclusionary power.[198] She may not exercise it ex ante, at least in the first instance. But she can and regularly does exercise it ex post, to target specific instances of abuse. If YouTube users flag an inappropriate video, YouTube will yank it.[199] If I see a spam comment on my blog, I delete it. If the abuses are flagrant enough, the user is likely to be kicked off the site entirely—and eventually, to be blocked at the IP address level.[200]

In other words, YouTube and I are paying the monitoring costs to watch what commons users do on our private pieces of the Web. We're using governance to control behavior and self-help exclusion to enforce our decisions. The openness of our sites creates a classically Tragic scenario; we use our platform power to deter misuse.[201] We're willing to pay these costs because the overall benefits to us of common usage are larger still.

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197. *Cf.* Anderson, *supra* note 154, at 146.

198. Lest this seem unremarkable, keep in mind that it would be nearly inconceivable for an Internet backbone provider to decide sua sponte that it needed to block traffic from a particular IP address, and that when Comcast started blocking particular traffic, it drew an FCC investigation and injunctive relief. Formal Complaint of Free Press & Pub. Knowledge Against Comcast Corp. for Secretly Degrading Peer-to-Peer Applications, 23 F.C.C.R. 13,028 (2008).

199. *See* Google Help, YouTube Glossary: Flag as Inappropriate, http://www.google.com/support/youtube/bin/answer.py?hl=en&answer=95403 (last visited Apr. 10, 2010).

200. *See, e.g.*, Wikipedia: Blocking IP Addresses, http://en.wikipedia.org/wiki/Wikipedia:Blocking_IP_addresses (last visited Apr. 10, 2010).

201. *See* Jonathan Zittrain, *The Rise and Fall of Sysopdom*, 10 HARV. J.L. & TECH. 495, 501–06 (1997) (discussing role played by amateur "sysops" of online forums, newsgroups, and bulletin boards in fostering community). Zittrain's message in 1997 was pessimistic; he saw the sysop as a dying breed presiding over fragile communities. *The Future of the Internet* is far more optimistic about the potential of bottom-up collaboration and altruistic community creation in creating a healthy online society. One possible difference between then and now, I would submit, is that the benefits of linking these communities together on the Internet—putting the "commons" in "semicommons"—are much clearer today. Zittrain's invocation of the "sysop" also leads us off into the world of bulletin-board systems (or "BBSes"). Time and space constraints don't permit me to discuss them in detail as an additional example of an online organizational form. Their basic model, however—privately owned servers, connected to the telephone network, accessible to anyone who wished to dial in via modem—fits the basic semicommons pattern described in this essay, and their history also illustrates the applicability of Smith's model. For more on BBSes, see generally BBS: THE DOCUMENTARY (Bovine Ignition Systems 2005); Textfiles.com, History, http://www.textfiles.com/history/ (last visited Apr. 10, 2010).

The fact that we have this residual platform-based power and are willing to use it creates its own countervailing dangers of strategic behavior. I could delete comments from people who disagree with me. YouTube could make it impossible for users to get their videos off the site. These are private uses that impose costs on the common uses, and they're well studied in the literature (if not usually in these terms).[202] Abating these costs is itself a question in institution design. But note that within the semicommons framework we can still describe the problem as overall cost minimization across a number of different forms of strategic behavior and strategic behavior prevention.

A third critical point about these sites is that their success depends on their users. A coherent and motivated user can collectively exercise governance to prevent abuse. Some users guard the private infrastructure from commons overuse. Craigslist knows which posts are spam because its users tell it.[203] Other users defend the commons from its own enemies. Wikipedia's first line of defense against lies and propaganda is eagle-eyed users who look for self-interested or bad-faith edits and undo them.[204] A strong user community can even defend the commons from the private infrastructure owner, as Facebook discovered when it tried to introduce privacy-invading advertising technologies.[205]

Scale matters in this story. The Tragic story reminds us that smaller groups will be better at self-monitoring and enforcement. And that's exactly what we see on the Internet, after a fashion. "The Internet" as a whole doesn't have a generic "flag this content for removal" button. Instead, the pruning and weeding that help UGC sites flourish take place *on those sites*. The division of the Web into distinct "sites" makes it easier for close-knit communities to form.

These local communities, in turn, are coupled to each other in important ways.[206] Individual blogs are connected to each in a network of linking,

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202. *See, e.g.*, Jack M. Balkin, *Digital Speech and Democratic Culture: A Theory of Freedom of Expression for the Information Society*, 79 N.Y.U. L. REV. 1 (2004) (discussing censorship powers of platform owners); James Grimmelmann, *Saving Facebook*, 94 IOWA L. REV. 1137, 1192–95 (2009) (discussing platform lock-in). There's also the larger question of the proper division of value between private owner and commons users. One could argue that the platform owner who becomes rich off of user contributions is engaged in a form of digital exploitation. *See, e.g.*, Søren Mørk Petersen, *Loser Generated Content: From Participation to Exploitation*, FIRST MONDAY, Mar. 6, 2008, http://www.uic.edu/htbin/cgiwrap/bin/ojs/index.php/fm/article/view/2141/1948. As this is a normative question, not an analytic one, I put it aside for the time being.

203. Craigslist, Flags and Community Moderation, http://www.craigslist.org/about/help/flags_and_community_moderation (last visited Apr. 10, 2010).

204. *See* ZITTRAIN, *supra* note 2, at 131–42 (discussing Wikipedia).

205. Louise Story & Brad Stone, *Facebook Retreats on Online Tracking*, N.Y. TIMES, Nov. 30, 2007, at C1.

206. *See generally* DAVID WEINBERGER, SMALL PIECES LOOSELY JOINED: HOW THE WEB SHOWS US WHO WE REALLY ARE (2002) (describing the Internet's success in terms of this loose coupling of small components in multiple domains).

quotation, and conversation.[207] YouTube took off because it offered users the trivially easy capacity to embed videos in other Web pages—that is, to bridge the YouTube community and others.[208] This is a modular structure: tight community coupling within a site and looser coupling across sites.[209] This arrangement makes each site's Tragic internal governance problem more manageable while also facilitating Comedic conversations across sites.[210]

The same is also true within large sites. Wikipedia has many "WikiProjects": groups of pages on a similar topic.[211] They tend to have common groups of editors who focus on them. Bingo: a small and close-knit community, loosely coupled to others within Wikipedia. Similarly, social network sites divide the world into small networks centered around every user, forming overlapping communities. These Internet institutions bridge the optimal scales for private and common uses.

C. Usenet and Boundary-Setting

Semicommons theory explains the Internet's failures as well as its successes. Only those online institutions that can cost-effectively deter strategic behavior at the interface between private and common will prosper at the planetary scale of the Internet. Those that can't will stagnate rather than grow—or even collapse entirely under the strain of a worldwide semicommons.

As an example of a failed online semicommons, consider Usenet, a distributed set of message boards.[212] Its use of interconnected servers to

207. See ROSENBERG, supra note 106, at 205–06; Posting of James Grimmelmann to LawMeme, http://lawmeme.research.yale.edu/modules.php?name=News&file=print&sid=1155 (June 18, 2003, 4:03 EDT).

208. See Posting of Deepak Thomas and Vineet Buch to Startup Review, http://www.startup-review.com/blog/youtube-case-study-widget-marketing-comes-of-age.php (Mar. 18, 2007).

209. See SIMON, supra note 168, at 197–205 (describing common pattern of tightly coupled modules themselves loosely coupled to each other); Mark S. Granovetter, The Strength of Weak Ties, 78 AM. J. SOC. 1360 (1973) (describing power of loose links to bridge different social groups).

210. This point may have implications for Zittrain's goal of stopping malware through "suasion" and "experimentation." ZITTRAIN, supra note 2, at 173. Zittrain's discussion of the challenges and goals of the StopBadware project clearly recognizes the dangers of both too much and not enough private control, at multiple scales. Id. at 168–73. Sites experimenting with security policies in an informed way are private and Tragic. Internet-wide monitoring and information-sharing are common and Comedic. See id.

211. See Wikipedia: WikiProject, http://en.wikipedia.org/wiki/WikiProject (last visited Apr. 10, 2010) ("A WikiProject is a collection of pages devoted to the management of a specific topic or family of topics within Wikipedia; and, simultaneously, a group of editors who use those pages to collaborate on encyclopedic work.").

212. On the technology and operation of Usenet (sometimes also written as "USENET"), see generally JENNY A. FRISTUP, USENET: NETNEWS FOR EVERYONE (1994); MARK HARRISON, THE USENET HANDBOOK: A USER'S GUIDE TO NETNEWS (1995); ED KROL, THE WHOLE INTERNET: USER'S GUIDE & CATALOG (2d ed. 1994); TIM O'REILLY & GRACE TODINO, MANAGING UUCP AND USENET (10th ed. 1992); and BRYAN PFAFFENBERGER, THE

create shared worldwide "newsgroups" made it a thriving semicommons through the 1980s.[213]   But this same structure couldn't cope with the abuses caused by the Internet's exponential takeoff in the 1990s.[214]   A comparison of Usenet with e-mail and UGC sites shows that they did a better job of boundary-setting.[215]   Semicommons theory explains how different design choices can help one online institution succeed where another fails.

1. How Usenet Works

Individual Usenet users post and read messages on a local server on which they have an account; these servers then exchange new messages

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USENET BOOK: FINDING, USING, AND SURVIVING NEWSGROUPS ON THE INTERNET (1994). For discussion of its culture and sociology, see generally MICHAEL HAUBEN & RHONDA HAUBEN, NETIZENS: ON THE HISTORY AND IMPACT OF USENET AND THE INTERNET (1997); HOWARD RHEINGOLD, THE VIRTUAL COMMUNITY: HOMESTEADING ON THE ELECTRONIC FRONTIER 117–31 (1993); and CLAY SHIRKY, VOICES FROM THE NET 80–89 (1995). Within the law review literature, see generally A. Michael Froomkin, *Habermas@Discourse.net: Toward a Critical Theory of Cyberspace*, 116 HARV. L. REV. 749, 821–31 (2003); Paul K. Ohm, *On Regulating the Internet: Usenet, a Case Study*, 46 UCLA L. REV. 1941 (1999); David G. Post, *Pooling Intellectual Capital: Thoughts on Anonymity, Pseudonymity, and Limited Liability in Cyberspace*, 1996 U. CHI. LEGAL F. 139, 163 n.54; and Charles D. Siegal, *Rule Formation in Non-hierarchical Systems*, 16 TEMP. ENVTL. L. & TECH. J. 173, 181–83, 190–99 (1997). *See also* Eric Schlachter, War of the Cancelbots!, http://eric_goldman.tripod.com/articles/cancelbotarticle.htm (last visited Apr. 10, 2010). Usenet has made sporadic appearances in the case reports. Highlights with significant factual discussion of Usenet include Arista Records LLC v. USENET.com, Inc., 633 F. Supp. 2d 124, 129–31 (S.D.N.Y. 2009); Ellison v. Robertson, 189 F. Supp. 2d 1051, 1053–54 (C.D. Cal. 2002), *rev'd*, 357 F.3d 1072 (9th Cir. 2004); ACLU v. Reno, 929 F. Supp. 824, 834–35 (E.D. Pa. 1996), *aff'd*, 521 U.S. 844 (1997); and Religious Tech. Ctr. v. Netcom On-Line Commc'n Servs., Inc., 907 F. Supp. 1361, 1366 n.4, 1367–68 (N.D. Cal. 1995). Purists may insist that "Usenet" refers only to one particular set of newsgroups, and that "Network News" is the correct umbrella term that also includes local newsgroups and even a few alternative hierarchies. *See, e.g.*, KROL, *supra*, at 151–57. In practice, though, users often also referred to these other hierarchies as "Usenet." *See id.* at 452. Similarly, one could technically distinguish between the higher-level protocol governing Usenet's messages and newsgroups, *see* M. HORTON & R. ADAMS, RFC 1036 STANDARD FOR INTERCHANGE OF USENET MESSAGES (1987), http://tools.ietf.org/html/rfc1036 [hereinafter RFC 1036], and the lower-level protocols governing how those messages are transferred from one computer to another. *See* MARK R. HORTON, RFC 976, UUCP MAIL INTERCHANGE FORMAT STANDARD (1986), http://tools.ietf.org/html/rfc976; BRIAN KANTOR & PHIL LAPSLEY, RFC 977, NETWORK NEWS TRANSFER PROTOCOL (1986), http://tools.ietf.org/html/rfc1036.   But in practice, the same social conventions causing users and administrators to standardize on the one protocol also led them to standardize on the other. As Paul Ohm puts it, "Just as you can get from downtown to Westwood without a car, you can communicate via Usenet without NNTP [Network News Transfer Protocol]. But most people would not take this trip without a car, just as most people do not use USENET except over NNTP." Ohm, *supra*, 1949–50 n.28 (citing RFC 1036, *supra*, § 4).

    213. *See infra* Part IV.C.1.
    214. *See infra* Part IV.C.2.
    215. *See infra* Part IV.C.3.

with each other via a peer-to-peer protocol.[216] Each server talks only to a few others, but most Usenet servers are linked together so that any given message will eventually be propagated to all servers in the network.[217]

This technical structure coexists with Usenet's semantic structure: a hierarchy of topical "newsgroups."[218] That hierarchy, established in 1987 in a coordinated event known as the "Great Renaming," divides the Usenet universe into "newsgroups" such as soc.culture.welsh (on Welsh culture) and sci.math (on mathematics).[219] Individual messages are typically posted to a single newsgroup, but replicated across the whole network of servers.[220]   The administrators of individual servers decide which newsgroups to carry on their servers.[221]

Usenet also sported a higher level of governance (of the sort detailed by Ostrom)[222] in its institutions for collective decision making about which newsgroups to support.[223] A centralized board coordinated the process: a proposed new newsgroup (or proposed deletion of an old one) would be publicly announced, discussed, and put to a vote. The certified results of this process were generally accepted as legitimate by server operators: a proposed newsgroup that won its vote would typically be added by enough servers that it would achieve critical density in the network and connect those users who wanted to join it.[224]

Once again, the semicommons structure is evident. Each server is a private use; each newsgroup is a common use. The two are inextricably intertwined. The worldwide network of servers gives each newsgroup a

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216. This exchange originally took place through direct telephone-line connections between Usenet servers; as the Internet became more widely available, the exchanges gradually switched over to using the Internet for their transport. *See* HAUBEN & HAUBEN, *supra* note 212, 39–40, 44; RHEINGOLD, *supra* note 212, at 120–21.

217. *See* RFC 1036, *supra* note 212, § 5 (describing algorithm for propagation of Usenet messages through network).

218. *See* KROL, *supra* note 212, at 153–54.

219. *See* Henry Edward Hardy, The History of the Net (Sept. 20, 1993) (unpublished master's thesis, Grand Valley State University), *available at* http://w2.eff.org/Net_culture/ net.history.txt. On the topical nature of particular newsgroups, see generally the archive of Usenet Frequently Asked Question (FAQ) files at www.faqs.org, which are organized by newsgroup.

220. *See* Ohm, *supra* note 212, at 1945–47 (describing posting to newsgroups); *id.* at 1949–50 (describing replication). On server operation, see generally O'REILLY & TODINO, *supra* note 212.

221. *See* KROL, *supra* note 212, at 157 ("Last, we must deal with (how can I write this delicately?) censorship. Some administrators decide that some groups (especially in the *alt* category) are not for consumption by the server's clientele. So they choose not to carry them."). Since, by 2002, Usenet carried 1000 gigabytes of data per day, *see* Froomkin, *supra* note 212, at 822, some prioritization of which groups to carry was a technical necessity. *See* KROL, *supra* note 212, at 156 ("A server administrator may choose not to accept a certain group because it is very active and eats up too much disk space.").

222. OSTROM, *supra* note 62, at 101–02 (discussing importance of "nested enterprises").

223. *See* Froomkin, *supra* note 212, at 823–24.

224. *Id.* at 824–25.

global reach,[225] but each server remains locally owned and operated. By 2002, Usenet was carrying over 1000 gigabytes of messages a day.[226] That's both a remarkable volume of shared content and a tremendous technical burden on each server.

Through the 1980s and into the mid-1990s, Usenet was a highly successful semicommons, reaching more than 2.5 million people by 1992.[227] Both boundary-setting devices—between servers and between newsgroups—played a role. Dividing Usenet across servers (rather than centralizing it) made it technically feasible and enabled it to grow by accretion as individual server operators connected and joined the semicommons.[228] Meanwhile, dividing Usenet into newsgroups supported the formation of smaller communities capable of exercising good internal governance. Strong social norms of netiquette discouraged off-topic posts, for example: a post about football in sci.math would draw a scolding.[229] The norms of sci.math and the norms of soc.culture.welsh could be different, making both stronger.

2. How Usenet Failed

But past performance is no guarantee of future results, and Usenet didn't deal well with the Internet's massive surge in popularity during the 1990s. As the number of new Internet users increased exponentially year after year, so did the technical and social strains on the Usenet semicommons.[230] The most visible form of abuse was spam: messages (usually, but not exclusively, commercial) posted to thousands of newsgroups at once. It placed enormous technical burdens on the private infrastructure and substantially degraded the readability of the common newsgroups.[231] Both

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225. *See* RHEINGOLD, *supra* note 212, at 130 ("Usenet is a place for conversation or publication, like a giant coffeehouse with a thousand rooms; it is also a worldwide digital version of the Speaker's Corner in London's Hyde Park, an unedited collection of letters to the editor, a floating flea market, a huge vanity publisher, and a coalition of every odd special-interest group in the world.").

226. Froomkin, *supra* note 212, at 822.

227. *See* RHEINGOLD, *supra* note 212, at 120. The years of publication of the books on Usenet cited in footnote 212 are telling: 1992, 1993, 1994, 1994, 1994, 1995, 1995, and 1997. *See supra* note 212.

228. *See* RHEINGOLD, *supra* note 212, at 119 ("All you had to do to join Usenet was to obtain the free software, find a site to feed you News and take your postings, and you were in action.").

229. *See* S. HAMBRIDGE, RFC 1855, NETIQUETTE GUIDELINES (1995), http://tools.ietf.org/html/rfc1855.

230. In Internet folklore, at least, the tide turned in 1993, as commercial services like Delphi and AOL began offering their millions of subscribers access to Usenet newsgroups, an event known as the "Eternal September"—a never-ending stream of new users as unfamiliar with Usenet's norms as the annual crop of college first-years had been. *See* WENDY M. GROSSMAN, NET.WARS 9–11 (1997).

231. *See* Froomkin, *supra* note 212, at 825–29.

Usenet's property boundaries and its institutions proved incapable of dealing with this influx.

Architecturally, Usenet got the property boundaries wrong. Each meaningful community—a newsgroup—was split across many pieces of private infrastructure—servers—and vice-versa. This form of scattering inhibited opportunism by censorious private server operators: other servers could exchange a message even if one server deleted it,[232] and its own users could switch Usenet providers.[233] But it also meant that neither private server operators nor commons newsgroup communities were in a position to deal effectively with spam. The private infrastructure owners couldn't individually take effective action against heavily cross-posted spam and garbage; they each had to monitor all of Usenet, and a message deleted on one server would still crop up on the others.

Meanwhile, the community of readers of a particular newsgroup being overrun also had no good tools to stop the flood. Social norms collapsed under the first sustained assault from outsiders. In 1994, a pair of immigration lawyers advertised their services on over 6000 newsgroups.[234] The outcry was remarkable: not just online condemnation, but also self-help denial-of-service e-mail attacks, threats to the lawyers' ISP, and "huge numbers of magazine[] subscriptions in [the lawyers'] names."[235] Legal scholars have discussed the remarkable vehemence of this response,[236] but it's more a sign of weakness than of strength. Effective social norms don't require such extensive enforcement, precisely because they're effective. The immigration lawyers were outsiders to the newsgroup communities they spammed, afraid of no threats the newsgroups could wield.[237]

In any event, later events established that social norms were essentially ineffective against spam. Other spammers soon followed, in large numbers.[238] The green-card lottery spam was the proof of concept—the lawyers behind it even published a book of advice for other would-be

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232. *See* Giganews, Usenet Interview with John Gilmore, http://www.giganews.com/ usenet-history/gilmore.html (last visited Apr. 10, 2010) ("For example, the quote I seem to be most famous for, 'The net treats censorship as damage and routes around it', came directly out of my Usenet experience. I was actually talking about the Usenet when I first said it. And that's how the Usenet works—if you have three news feeds coming in, and one of those feeds censors the material it handles, the censored info automatically comes in from the other two.").

233. *See* KROL, *supra* note 212, at 132 ("If you are offended [by your server administrator's refusal to carry a newsgroup], you have two choices: find another server or beat up on your administrator.").

234. Siegal, *supra* note 212, at 192.

235. *Id.*

236. Froomkin, *supra* note 212, at 827–28 ("[M]ass self-defense . . . ."); Siegal, *supra* note 212, at 192–93 ("[E]xtreme self-help . . . .").

237. *See* Siegal, *supra* note 212, at 193 ("Moreover, Canter and Seigel, unbowed by their role as outcasts on the Internet, published a book telling other would be cyber-entrepreneurs how to profit by following their example . . . .").

238. *See id.* ("[S]pamming is common . . . .").

Usenet spammers, claiming they'd made over $100,000 at it.[239] Efforts at educating new users also proved futile.[240] Without clear boundaries to exclude outsiders and effective enforcement mechanisms, norm-based self-governance runs into exactly the barriers described by Ostrom.

In the late 1990s, as these failures were becoming obvious, Usenet citizens (and a few legal scholars[241]) celebrated instead the possibility of technical self-defense. One older technique was moderation: as on a moderated listserv, messages would be sent to a newsgroup administrator, and only posted after he or she approved them.[242] While effective in dealing with spam, moderation imposes substantial costs on the Comedic potential of a group: it slows down messages as they wait for the moderator's approval, inhibiting conversation;[243] it depends on the volunteer labor of a moderator willing to perform this round-the-clock job;[244] and it allows the moderator to behave opportunistically, shaping or censoring the flow of dialogue.[245] Most Usenet groups were unmoderated,[246] and it's not hard to think of a reason. Moderation doesn't scale.

Newer techniques of technological self-defense fared little better. Consider the killfile: a personal list of users whose messages you don't want to see.[247] Your personal newsreading program hides those messages; they remain on the server for others to read.[248] The killfile sounds like a

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239. *Id.*

240. *Id.* ("But these guidelines obviously do not deter those who seek either financial gain or perverse pleasure from spamming.").

241. *See* Ohm, *supra* note 212, at 1941 ("[S]till too early for a legislature to intervene . . . ."); Siegal, *supra* note 212, at 193–95.

242. *See* FRISTUP, *supra* note 212, at 25; Ohm, *supra* note 212, at 1976–77.

243. *See* Internet FAQ Archives, Moderated Newsgroups FAQ, http://www.faqs.org/faqs/usenet/moderated-ng-faq/ (last visited Apr. 10, 2010) ("In general, hand-moderated newsgroups often have some unavoidable delay . . . .").

244. *See id.* ("[A] typical setup for doing moderation would include . . . several hours of spare time per week for at least a year . . . .").

245. *See id.* ("The discussion of differences between moderation and censorship has been erupting several times a year in news.groups for about 15 years.").

246. *See id.* (noting a total of about 300 moderated Usenet newsgroups); *cf.* Froomkin, *supra* note 212, at 822 (counting "thousands" of newsgroups overall).

247. PFAFFENBERGER, *supra* note 212, at 193 ("The (Unfortunately Necessary) Art of the Kill File . . . . The proper remedy for all the above-mentioned forms of net.abuse is the kill file."). Items could also be killed based on other criteria, such as the use of a particular phrase. *See* KROL, *supra* note 212, at 166–69 (explaining use of keyword-based tagging and killing to help newsgroup readers quickly browse topics). But the term "kill file" is most colorfully used to describe user-based filtering. *See* ERIC S. RAYMOND, THE NEW HACKER'S DICTIONARY 269 (3d ed. 1996) ("Thus to add a person (or subject) to one's kill file is to arrange for that person to be ignored by one's newsreader in future. By extension, it may be used for a decision to ignore the person or subject in other media.").

248. *See* Internet FAQ Archivers, rn KILL file FAQ § 1, http://www.faqs.org/faqs/killfile-faq/ (last visited Apr. 10, 2010) (noting in passing that there is a killfile "for each user"). The killfile works a bit like a personal filter that sends all messages from your crazy cousin straight to an archive folder. Compare the nearly identical interfaces for "Rules"

perfectly speech-friendly system: the killfiler's freedom not to read is respected, and so is the killfilee's freedom to speak and other users' freedom to hear from her.[249] And it does work well enough in small communities for dealing with specific annoying users: a kind of virtual silent treatment.[250] But it fails in a larger commons. Most of the spammers and trolls are new users you've never heard of (and will never hear from again).[251] Nor does killfiling reduce the technical burdens felt by server operators—the servers still need to carry the messages, even though users ignore them.

Cancelbots failed, too. They take their name from the fact that a Usenet post author can send a follow-up message to "cancel" her original post, thereby deleting it.[252] These messages are easily forged, leading to a self-help mechanism for dealing with spam and abuse: just forge a cancel message for the offending post.[253] As the spam problem grew, vigilante Usenet users started automating the cancels, using programs called "cancelbots."[254] In practice, though, cancelbots didn't so much end the Usenet spam wars as escalate them.[255] Spammers vied to send out ads faster than the vigilantes could cancel them; this competition was a wasteful arms race.[256] Worse, spammers themselves could use cancels against their

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(including killing, marking as read, and sorting messages) in Unison (a newsreader) and Mail.app (an e-mail client) for Mac OS X.

249. *See* SHIRKY, *supra* note 212, at 82 ("Kill files perfectly illustrate the burden placed on the reader on Usenet where freedom of speech is as absolute as its gets anywhere. For all intents and purposes, anyone can say anything to anyone. If a certain kind of speech causes upset, it is usually up to the reader not to read posts about those subjects or mail from those people.").

250. This observation is based on the personal experience of the author. I would rather not, for reasons that should be obvious, name the specific newsgroups and mailing lists on which I have resorted to using a killfile.

251. *See, e.g.*, James "Kibo" Parry, Killfiles and You, http://www.kibo.com/kibokill/ (last visited Apr. 10, 2010) (providing detailed suggestions for efficient use of a killfile). Note the assumption that filtering out specific unwanted users will not suffice to make a newsgroup readable; more detailed filtering is required.

252. *See* Siegal, *supra* note 212, at 194; RFC 1036, *supra* note 212, § 3.1; Internet FAQ Archives, Cancel Messages: Frequently Asked Questions, Part 2/4 (v1.75), http://www.faqs.org/faqs/usenet/cancel-faq/part2/ (last visited Apr. 10, 2010) [hereinafter Cancel FAQ, Part 2/4].

253. *See* Siegal, *supra* note 212, at 194; Internet FAQ Archives, Cancel Messages: Frequently Asked Questions, Part 1/4 (v1.75), at I–II, http://www.faqs.org/faqs/usenet/cancel-faq/part1/ (last visited Apr. 10, 2010) (discussing "third-party" cancels, including "forged" cancels).

254. Cancel FAQ, Part 2/4, *supra* note 252, at IV.C. ("A cancelbot is a program that searches for messages matching a certain pattern and sends out cancels for them; it's basically an automated cancel program, run by a human operator.").

255. *See* GROSSMAN, *supra* note 230, at 75–78 (discussing technical back-and-forth between message posters and message cancelers).

256. *See* Froomkin, *supra* note 212, at 829–31 (discussing "Usenet Death Penalty" in which a site considered to be too lax in stopping spam "has every single Usenet post originating from it immediately canceled or at least not forwarded. Thus, every person using that ISP loses the ability to post to Usenet regardless of his or her guilt or, in most cases,

enemies[257] (leading to the use of pseudonymous anti-spam entities like the Cancelmoose[tm]).[258]   Worse still, griefers[259] could use cancels against completely innocent Usenet posters[260]—so that many server administrators simply ignored cancels entirely.[261]

Perhaps some larger institution could have developed coherent cancelation policies and consistently applied those policies across Usenet's mishmash of servers and newsgroups.[262] But Usenet's existing institutions were too weak and too distrusted to develop and enforce such policies on the diverse and dispersed Usenet community.[263] Different newsgroups had different norms; different server operators had different appetites for ongoing governance work.[264] It was a classic collective action problem:

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innocence"); Cancel FAQ, Part 2/4, *supra* note 252, at IV.E ("Giving out a cancelbot is like handing out loaded guns with no safeties.").

257. *See* Cancel FAQ, Part 2/4, *supra* note 252, at V.D (discussing spammers who used cancels as an offensive weapon, such as "Krazy Kevin," who "cancelled many posts on news.admin.net-abuse.misc concerning his spams" and "Crusader," who tried to prevent investigation of a neo-Nazi mass email by cancelling Usenet messages discussing it).

258. *See* Post, *supra* note 212, at 163 n.54, 166 (discussing pseudonymity of Cancelmoose[tm]); Internet FAQ Archives, Net Abuse FAQ, § 2.9, http://www.faqs.org/faqs/net-abuse-faq/part1/ (last visited Apr. 10, 2010)) ("Cancelmoose[tm] is, to misquote some wise poster, 'the greatest public servant the net has seen in quite some time.' Once upon a time, the 'Moose would send out spam-cancels and then post notice anonymously to news.admin.policy, news.admin.misc, and alt.current-events.net-abuse. The 'Moose stepped to the fore on its own initiative, at a time (mid 1994) when spam-cancels were irregular and disorganized, and behaved altogether admirably—fair, even-handed, and quick to respond to comments and criticism, all without self-aggrandizement or martyrdom. . . . Nobody knows who Cancelmoose[tm] really is, and there aren't even any good rumors.").

259. *See* Julian Dibbell, *Griefer Madness*, WIRED, Feb. 2008, at 90, 92 (defining "griefer" as "an online version of the spoilsport—someone who takes pleasure in shattering the world of play itself").

260. *See* Cancel FAQ, Part 2/4, *supra* note 252, at V.D (listing "rogue cancellers of various skill, competence, and intelligence"). Notable examples include Ellisd, who tried on moral grounds to cancel all messages posted to alt.sex, and the so-called CancelBunny, which tried to cancel posts containing the scriptures of Scientology. *Id.*

261. Froomkin, *supra* note 212, at 829.

262. *See id.* at 828–31 (discussing attempt by "Internet vigilantes" to coordinate their efforts through the news.admin.net-abuse newsgroup and impose collective punishments on servers deemed to be excessively spam-friendly and discussing debates over legitimacy and existence of consensus to act against particular spammers).

263. *See id.* at 823–25 (discussing difficulty of coordinating process of selecting which newsgroups to carry); Hardy, *supra* note 219 (discussing how dissatisfaction with decisions by administrators of "backbone cabal" systems not to carry newsgroups discussing sex or drugs, leading to creation of alternative hierarchy for distribution of news and abdication of previous coordinators of newsgroup-creation process); Lee S. Bumgarner, The Great Renaming FAQ: Part 4, http://www.linux.it/~md/usenet/gr4.htm (last visited Apr. 10, 2010) (discussing near "constitutional crisis" on Usenet, including forged votes, over whether to create a newsgroup devoted to discussion of aquaria); Giganews, 1987:   The Great Renaming—Page 2, http://www.giganews.com/usenet-history/renaming-2.html (last visited Apr. 10, 2010) (discussing controversy over Great Renaming and suspicion of the administrators who pushed it through).

264. *See* Froomkin, *supra* note 212, at 823 (noting that "backbone cabal" systems carried disproportionate share of Usenet traffic); *id.* at 824–25 (observing that "a large number, perhaps a majority, of sites had effectively delegated administration of the newsgroup

redesigning Usenet's technical protocols would have required widespread user and server-owner agreement—but that would also have meant giving up some of the private control and commons freedom that these groups prized about Usenet.

In the end, Usenet's distributed openness left it vulnerable to exactly the pressures Smith identifies: griefers used the commons to strategically target private users, and spammers used the commons without heeding the effects on private infrastructure.[265] Usenet itself is not dead. One can still go to Google Groups or Giganews and participate in ongoing conversations in groups with strong norms that allowed them to weather the storm. But it has nowhere near the relative importance that it once did to the life of the Internet.   ISPs   are   gradually   dropping   their   support   for   Usenet newsgroups,[266] and it seems unlikely that the system will ever meaningfully rise again.[267]

3. Why E-mail Succeeded Where Usenet Failed

This diagnosis—bad boundary-setting—is specific to Usenet. The entire Internet suffers from spam[268]—any sufficiently advanced technology is indistinguishable from a spam vector.[269] Spam is *the* most characteristic form of strategic behavior in the Internet semicommons; a commons use that imposes serious costs both on commons and private use.[270] But other applications have managed to cope with the spam problem—because their boundaries are drawn in ways that permit more effective monitoring and enforcement.

Contrast Usenet, for example, with the UGC sites described in the previous section. As detailed above, these sites align commons community with private server infrastructure, giving them governance and exclusion

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creation process to one person" who was willing to "take the time to figure out what is a legitimate group . . . and what is a practical joke").

265. *See, e.g.*, Sascha Segan, *R.I.P. Usenet*, PC MAG.COM, July 31, 2008, http://www.pcmag.com/article2/0,2817,2326849,00.asp   ("[S]ervice   providers   sensibly started to wonder why they should be reserving big chunks of their own disk space for pirated movies and repetitive porn.").

266. *See, e.g.*, Declan McCullagh, *N.Y. Attorney General Forces ISPs To Curb Usenet Access*, CNET NEWS, June 10, 2008, http://news.cnet.com/8301-13578_3-9964895-38.html.

267. *See* Posting of Kevin Poulsen to Epicenter, http://www.wired.com/epicenter/2009/10/usenet/ (Oct. 7, 2009, 12:34 PST).

268. Clay Shirky has written that "[s]ocial software is stuff that gets spammed." Posting of   Clay   Shirky   to   Many2Many,   http://many.corante.com/archives/2005/02/01/tags_run_amok.php (Feb. 1, 2005).

269. As of this writing, Wikipedia discusses "e-mail spam . . . instant messaging spam, Usenet newsgroup spam, Web search engine spam, spam in blogs, wiki spam, online classified ads spam, mobile phone messaging spam, Internet forum spam, junk fax transmissions, social networking spam, and file sharing network spam." Spam (electronic), Wikipedia, http://en.wikipedia.org/wiki/Spamming (last visited Apr. 10, 2010). Just about anything worth using online is spammed.

270. *See* Chris Kanich et al., *Spamalytics: An Empirical Analysis of Spam Marketing Conversion*, 52 COMM. ACM 99 (2009).

advantages that newsgroups lacked.[271] But a UGC site configured as a discussion board behaves—from a user perspective—almost exactly like a newsgroup.[272] Together with blogs and other similar social software, these Web-based discussion boards have taken over many of the community-forum roles that Usenet newsgroups previously played. Now that dispersed servers are no longer technically necessary—as they were in the days before the Internet[273]—the dedicated website is a superior institutional form from a semicommons perspective.

Or contrast Usenet with e-mail. While e-mail spam is certainly a serious and costly problem, e-mail has nonetheless been one of the Internet's great success stories. This success is all the more remarkable, given that a decade and a half ago, e-mail and Usenet looked very similar.[274] They were started within a few years of each other, and they're both text-based, Internet-wide communications systems that allow users to communicate with each other through a peer-to-peer process of message exchange.[275] And yet the e-mail of 2010 is essential to the Internet as we know it and is used by almost everyone; the Usenet of 2010 is an archaic survival used by small groups of enthusiasts.

What happened? E-mail got its property boundaries right. Usenet was created with the expectation that users throughout the network would share the same newsgroups; its design works to coordinate everyone's experiences.[276] By contrast, e-mail cares only about delivery: getting a particular message to a particular recipient.[277] There are no e-mail equivalents to newsgroups—coordinated entities that all users see in a substantially identical form. Each e-mail server is a dedicated piece of infrastructure designed to enable incoming and outgoing e-mail for its own

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271. *See supra* Part IV.B.

272. *See* Usenet, Wikipedia, http://en.wikipedia.org/wiki/Usenet (last visited Apr. 10, 2010) ("Usenet . . . is the precursor to the various Internet forums that are widely used today . . . .").

273. *See* Giganews, Usenet Newsgroups History, http://www.giganews.com/usenet-history/index.html (last visited Apr. 10, 2010) (describing switch from UUCP to NNTP as being designed to take advantage of "cutting-edge networking concepts" including the "always-on" Internet). Without the always-on Internet, unless most users are willing to pay long-distance phone charges to connect, they need to have servers located near them.

274. Krol, writing in 1994, thought that e-mail and Usenet each deserved a chapter. Indeed, he gave the Web roughly the same amount of space he gave to Usenet. KROL, *supra* note 212, at 101–48 (e-mail); *id.* at 151–87 (Usenet); *id.* at 287–322 (Web).

275. Usenet was born in 1979, WALDROP, *supra* note 178, at 427–28, modern SMTP-based e-mail in 1983, *id.* at 465.

276. *See, e.g.*, MARK R. HORTON, RFC 850, STANDARD FOR INTERCHANGE OF USENET MESSAGES § 3.4 (1983), http://tools.ietf.org/html/rfc850 ("This message removes a newsgroup with the given name. . . . [T]he newsgroup is removed from every site on the network . . . .").

277. *See, e.g.*, RFC 821, *supra* note 145, § 3.2 (discussing forwarding of message by intermediate relays, with no expectation that they will retain copies for themselves or transmit to other, unspecified recipients).

users.[278] This difference means that e-mail servers have defensible borders. I can install a spam filter without disrupting any e-mail except that to and from users on my piece of the network.[279] That lets me experiment with local anti-spam policies without needing anyone else's permission or cooperation.[280] Users, in turn, can choose e-mail providers based on the quality of their spam filtering.[281]

In a very important sense, e-mail is less ambitious than Usenet. E-mail may be a common protocol open to everyone, and most e-mail servers may be "common" in the sense that anyone can send a mail to users on them, but e-mail itself is deeply nonpublic. A great e-mail message can only be widely shared through successive forwarding. Some people who might have benefited from it won't ever be on the cc: lists. That's a loss to the commons, and it's a reason that e-mail coexists with all sorts of systems designed to offer more community, like mailing lists and the discussion boards we've already met. But the price we pay for needing to turn elsewhere for a fuller commons is that e-mail actually *works*.

V. CONCLUSION

In the scholarly debates over the significance of the Internet, the private-versus-common dichotomy looms large. Triumphalists proclaim that the Internet creates new forms of collaboration and that the commons is the way of the future. Skeptics respond that the stability and sustainability of the Internet depend on private ownership. These are the Comedic and Tragic stories, and they animate scholarly controversies in telecommunications, intellectual property, privacy, intermediary regulation, virtual worlds, and almost every other corner of Internet law.

In addition to its analytical virtues in explaining why some Internet systems thrive and others fail, semicommons theory also speaks to these debates. It reminds us not to take the seeming schism between "private" and "common" too seriously. The greatest commons the world has ever seen is built out of private property; the highest, best, and most profitable

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278. *See generally* BRYAN COSTALES & ERIC ALLMAN, SENDMAIL (3d ed. 2002) (describing configuration of e-mail servers).

279. *See* Froomkin, *supra* note 212, at 833 ("[W]e are exercising our right to refuse traffic from anyone we choose. We choose not to accept any traffic at all from networks who are friendly in any way to spammers. This is our right as it would be within anyone's rights to make the same choice (or a different one, *so long as only their own resources were affected by their choice*)." (emphasis added) (quoting Paul Vixie, What Is an Open Relay?, http://www.mail-archive.com/imail_forum@list.ipswitch.com/msg11527.html (last visited Apr. 10, 2010))).

280. *See, e.g.,* PAUL GRAHAM, HACKERS AND PAINTERS: BIG IDEAS FROM THE COMPUTER AGE 121–29 (2004) (proposing Bayesian filtering and explaining that the author had already implemented such a system on his own).

281. *See* Gmail Uses Google's Innovative Technology To Keep Spam Out of Your Inbox, http://mail.google.com/mail/help/fightspam/spamexplained.html (last visited Apr. 10, 2010) (using high-quality spam filtering as advertisement for Gmail).

use of that property is to create a commons. Private and common need each other, and we need them both on the Internet. Our task is not to choose between them but to find ways to make them work well together.[282]

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282. *Cf.* LAWRENCE LESSIG, REMIX: MAKING ART AND COMMERCE THRIVE IN THE HYBRID ECONOMY (2008) (arguing for coexistence of and collaboration between private and common forms in the law of intellectual property); Heverly, *supra* note 141, at 1184–85.