12-1-2008

Toward a Unified Theory of Access to Local Telephone Systems

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I. INTRODUCTION

The breakup of AT&T represents perhaps the most dramatic landmark of a fundamental shift in U.S. telecommunications policy.[1] Until the 1960s, policymakers generally regarded the entire telephone network as being inherently monopolistic.[2] Over time, technological developments made competition possible in complementary products and services offered through the local telephone network, such as the telephone equipment located in residences and business offices (known as "customer premises equipment" or "CPE"),[3] long-distance service, and the new set of services that combined computing power with transmission to provide innovative new services that went far beyond traditional voice communications (originally called "enhanced services" and later called "information services"). The order mandating the breakup of AT&T, commonly known as the Modification of Final Judgment (MFJ), attempted to promote competition in those services by mandating that the newly created Bell Operating Companies provide rival providers with equal access to their local telephone networks.[4]

The MFJ only provided for access to providers of complementary services. It did not envision direct competition in the local telephone

1. *See* United States v. AT&T Co., 552 F. Supp. 131 (D.D.C. 1982), *aff'd mem. sub nom.* Maryland v. United States, 460 U.S. 1001 (1983). Some commentators have observed that regulators had already begun to impose many of the access requirements imposed by the decision long before the federal government brought its antitrust suit against AT&T. *See, e.g.*, Glen O. Robinson, *The Titanic Remembered: AT&T and the Changing World of Telecommunications*, 5 YALE J. ON REG. 517 (1988) (book review). The decision nonetheless remains the most salient example of this fundamental change in regulatory approach.

2. *See, e.g.*, GERALD R. FAULHABER, TELECOMMUNICATIONS IN TURMOIL 107 (1987); PETER W. HUBER, MICHAEL K. KELLOGG, & JOHN THORNE, FEDERAL TELECOMMUNICATIONS LAW § 2.1.1 (2d ed. 1999).

3. This is in contrast to "telecommunications equipment," which refers to the wires and switches located outside end-users' premises that connected those premises together.

4. *United States v. AT&T Co.*, 552 F. Supp. at 161-62.

network.[5] Technology would soon transform that portion of the network, as new fiber-optic and wireless-based technologies allowed competition in local telephone service to emerge as well. As a result, Congress enacted the Telecommunications Act of 1996[6] (1996 Act) and included in it a range of access requirements that went far beyond those required by the MFJ.[7] The FCC implemented these new requirements through a regime known as Total Element Long Run Incremental Cost (TELRIC), which based access prices on the long-run, forward-looking cost of elements to which the requesting company sought access.[8]

This approach taken by Congress and the FCC suffers from several conceptual shortcomings. It overlooks the fact that the emergence of competition undermines many of the basic rationales for regulation. In addition, a cost-based approach to access pricing, in effect, treats each network element as if it existed in a vacuum. In so doing, it fails to capture the interactions between different network components that allow networks to compensate for limitations in capacity and unexpected changes in network flows by routing traffic along different pathways. It is quality that causes networks to behave as complex systems in ways that can be discontinuous and quite unpredictable. Finally, using the same methodology to implement many of the access requirements currently embodied in U.S. telecommunications policy in effect treats them as if they were conceptually the same. The lack of an overarching theory of network design ignores the fact that different forms of access have different implications for network configuration, capacity, reliability, and cost.

This Article seeks to rectify these shortcomings. Part II describes the early state and federal efforts to regulate local telephone networks and traces the emergence of competition and the ways in which the regulatory regime adapted in response. Part III reviews the basic rationales for regulating local telephone networks and critiques their continued applicability. Part IV analyzes access through an approach we have

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5. *See* Verizon Comm., Inc. v. FCC, 535 U.S. 467, 475-76 (2001) (noting that at the time of the breakup of AT&T, local telephone service was "thought to be the root of natural monopoly in the telecommunications industry"); United States v. W. Elec. Co., 673 F. Supp. 525, 537-38 (D.D.C. 1987), *aff'd*, 894 F.2d 1387 (D.C. Cir. 1990) (concluding that local telephone service "is characterized by very substantial economies of scale and scope" and that "[t]he exchange monopoly of the Regional Companies has continued because it is a natural monopoly"); STEPHEN BREYER, REGULATION AND ITS REFORM 291 (1982) ("Local telephone service seems to be generally accepted as a natural monopoly."); 2 ALFRED E. KAHN, THE ECONOMICS OF REGULATION: PRINCIPLES AND INSTITUTIONS 127 (1971) ("That the provision of local telephone service is a natural monopoly is generally conceded.").

6. Telecommunications Act of 1996, Pub. L. No. 104-104, 110 Stat. 56 (1996) (codified as amended in scattered sections of 47 U.S.C. (2000)).

7. *See infra* notes 49-61 and accompanying text.

8. *See infra* notes 56-59 and accompanying text.

developed based on the branch of mathematics known as graph theory that captures the interactions between network components that are one of the most distinctive qualities of networks.[9] In so doing, we apply a five-part system that we have developed for classifying different forms of access[10] to gain insight into the problems and distortions caused by the existing regulatory regime.

II. THE HISTORY OF THE REGULATION OF LOCAL TELEPHONY

A. Early State and Federal Regulation

Under the system of federalism enshrined in the U.S. Constitution, the authority of the federal government is limited to *inter*state commercial activities. The regulation of *intra*state telephone rates fell within the jurisdiction of the states.[11] Although early legislation in five states had authorized some degree of regulation over local telephone companies, state regulation of local telephone service did not begin in earnest until 1907 when states began authorizing their public utility commissions to oversee the reasonableness of local telephone rates. By 1921, all but three states had instituted some form of regulation of local telephone rates.[12]

Federal regulation of interstate telephone service began in 1910 with the enactment of the Mann-Elkins Act,[13] which declared interstate telephone and telegraph companies to be common carriers subject to the duty to provide service upon any reasonable request at "just and reasonable

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9. *See* Daniel F. Spulber & Christopher S. Yoo, *On the Regulation of Networks as Complex Systems: A Graph Theory Approach*, 99 NW. U. L. REV. 1687, 1693-1707 (2005).

10. *See* Daniel F. Spulber & Christopher S. Yoo, *Network Regulation: The Many Faces of Access*, 1 J. COMPETITION L. & ECON. 635 (2005).

11. *See, e.g.*, Smith v. Ill. Bell Tel. Co., 282 U.S. 133, 148-49 (1930). Such a vision of dual federalism can be hard to maintain with respect to network industries such as telephony, in which the same capital assets are used for both intrastate and interstate service. With respect to other network industries, such as the railroads, the Supreme Court has acknowledged that intrastate and interstate rates "are so related that the government of the one involves the control of the other" and has recognized that the federal government cannot create a coherent regulatory system without authority over both. Houston & Tex. Ry. v. United States (Shreveport Rate Case), 234 U.S. 342, 351 (1914); *accord* Wickard v. Filburn, 317 U.S. 111, 125 (1942) (recognizing that purely intrastate activities can have a tangential impact on interstate commerce sufficient to bring those activities within federal jurisdiction). This reasoning has not been extended to telephony prior to 1996. *See, e.g.*, La. Pub. Serv. Comm'n v. FCC, 476 U.S. 355 (1986); *Smith*, 282 U.S. at 148-49.

12. H.R. REP. NO. 67-109, at 3 (1921); *Consolidation of Competing Telephone Companies: Joint Hearings on S. 1313 Before the Comm. on Interstate Commerce*, 67th Cong. 4, 5 (1921) (statement of F.B. MacKinnon, President, U.S. Indep. Tel. Ass'n); J. WARREN STEHMAN, THE FINANCIAL HISTORY OF THE AMERICAN TELEPHONE AND TELEGRAPH COMPANY 164-67 (Augustus M. Kelley 1967) (1925).

13. Mann-Elkins Act, Pub. L. No. 61-218, ch. 309, §§ 7, 12, 36 Stat. 539, 544-46, 551 (1910).

rates."[14] The Act also gave the Interstate Commerce Commission (ICC) the power to overturn rates that it found to be "unjust or unreasonable or unjustly discriminatory or unduly preferential or prejudicial,"[15] but it did not give the ICC the authority to require the filing of tariffs or mandate interconnection ex ante, which had the effect of limiting it to ex post review of rates.[16] In addition, during this period the ICC focused its attention primarily on the railroads. As a result, the ICC did little to exercise the scant regulatory jurisdiction over telephone service that it did possess, undertaking only four telephone rate cases during the twenty-four years during which it had jurisdiction over the telephone industry.[17]

Congress addressed many of the deficiencies of the Mann-Elkins Act when enacting the Communications Act of 1934.[18] In addition to giving the newly created FCC the authority to ensure that interstate telephone rates were just, reasonable, and nondiscriminatory, the Act also addressed the ICC's lack of authority to require tariffs by requiring all interstate carriers to file schedules of charges.[19] At the same time, the Act preserved the preexisting division between federal and state authority by including language providing that "nothing in this chapter shall be construed to apply or to give the Commission jurisdiction with respect to . . . charges, classifications, practices, services, facilities, or regulations for or in connection with intrastate communication service . . . of any carrier."[20] The Act also gave the FCC the authority to oversee what became known as the "separations" process, through which the agency would determine what

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14. *Id.* at ch. 309, § 7, 36 Stat. at 545.

15. *Id.* at ch. 309 § 12, 36 Stat. at 551.

16. *Id.* at § 7, 12. *See also*, W. Union Tel. Co. v. Esteve Bros., 256 U.S. 566, 573 (1921); Unrepeated Message Case, 44 I.C.C. 670, 673-74 (1917).

17. Whittaker, 59 I.C.C. 286 (1920); Commercial Cable Co., 45 I.C.C. 33 (1917); Malone, 40 I.C.C. 185 (1916); W. N. White & Co., 33 I.C.C. 500 (1915). *See generally FCC: Hearings on H.R. 8301 Before the House Comm. on Interstate and Foreign Commerce*, 73d Cong. 69 (1934) [hereinafter *1934 House Hearings*] (statement of Paul Walker) (observing that "it is known to everyone that the Interstate Commerce Commission has never found it practical to do anything toward the regulation of telephone rates"), *reprinted in* A LEGISLATIVE HISTORY OF THE COMMUNICATIONS ACT OF 1934, at 343, 415 (Max D. Paglin ed., 1989); I.L. SHARFMAN, THE INTERSTATE COMMERCE COMMISSION: A STUDY IN ADMINISTRATIVE LAW AND PROCEDURE part 2, 110 (1931) (observing that "[i]n practice, . . . there has been no extensive exercise of these broad powers" over interstate communications by the ICC); Glen O. Robinson, *Title I: The Federal Communications Act: An Essay on Origins and Regulatory Purpose, in* LEGISLATIVE HISTORY, *supra* at 7 (noting "a general consensus that the ICC did not aggressively implement its new mandate").

18. Communication Act of 1934, Pub. L. No. 73-416, chap. 652, 48 Stat. 1064 (current version at 47 U.S.C. § 151 et seq (2000)).

19. *See* 47 U.S.C. §§ 201(b), 202(a), 203.

20. *Id.* §152(b).

proportion of the costs of capital equipment used for both local and long distance would be allocated to each service.[21]

B. The Emergence of Competition in Complementary Services

From the time of the enactment of the 1934 Act until the mid-1960s, regulators and the Bell System entered into a symbiotic relationship. The regulatory authorities condoned the Bell System's monopolization of all aspects of the telephone network. Monopoly control allowed regulators to authorize charging above cost for certain services and to use the excess returns to cross-subsidize other services that were more popular with regulatory constituencies. For example, the FCC used its control over the separations process to allocate to long-distance rates an ever-increasing proportion of the costs of the capital equipment used to provide both local and long-distance service—such as CPE, the wires connecting individual customers' premises to central offices (commonly known as "local loops"), and the switching equipment located in central offices.[22] The higher long-distance charges were thus used to keep monthly charges for local telephone service low. Similarly, state regulatory authorities used higher charges on business users to cross-subsidize the rates paid by residential users. Finally, regulatory authorities used a system known as "rate averaging" to mandate that all telephone subscribers in the state pay the same rates for service. The effect was to require lower-cost urban users to cross-subsidize the service for higher-cost rural users. The Bell System, which by this time had established a pattern of cooperating with regulatory authorities, acceded. So long as the resulting rates protected its aggregate rate of return, it had little concern over the allocation of that revenue across different customers and services.[23]

Over time, outside forces began to undercut this cozy arrangement. First, after a long period of rate decreases during the 1940s and 1950s, the Bell System began to seek increases in long-distance rates. Complaints from members of Congress and the General Services Administration prompted the FCC to initiate its first systematic analysis of the Bell System's costs, which revealed wide disparities in rates of return across seven different classes of interstate service. As a result, the FCC abandoned its system of "continuing surveillance," in which long-distance rates were established through informal negotiations between AT&T and the FCC, in

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21. *Id.* § 221(c).

22. PETER TEMIN, THE FALL OF THE BELL SYSTEM 25-27 (1987).

23. *See* David L. Kaserman & John W. Mayo, *Cross-Subsidies in Telecommunications: Roadblocks on the Road to More Intelligent Telephone Pricing*, 11 YALE J. ON REG. 119, 131, 142-46 (1994); Howard A. Shelanski, *Adjusting Regulation to Competition: Toward a New Model for U.S. Telecommunications Policy*, 24 YALE J. ON REG. 55, 59-60 (2007).

favor of a more formal regulatory regime based on cost-of-service ratemaking.[24]

In addition, competition began to emerge from providers of complementary services. For example, producers of CPE began to seek access to the Bell System's local telephone networks. "Foreign attachments" provisions contained in the Bell System's tariffs prohibited the interconnection of any CPE not manufactured by the Bell System's manufacturing subsidiary, Western Electric. After some prodding by the courts,[25] the FCC issued its landmark *Carterfone* decision,[26] which eventually led to the adoption of the Part 68 rules requiring the Bell System to open its network to any CPE that met specified requirements.[27]

The emergence of microwave as a means of transmission allowed competition to emerge in long distance as well. A new company called Microwave Communications, Inc. (later better known as MCI) realized that it could expand its private line services—which were designed to serve companies with multiple offices in distant locations, both by connecting those offices together and by providing connections to the local telephone networks surrounding each location—to provide long-distance service as well. Again, after some prodding by the courts,[28] the FCC acceded and allowed competition in long-distance service to emerge.[29]

In addition, a new set of services, originally called "enhanced services" and later called "information services," began to emerge, which combined computing power with transmission to provide innovative new services that went far beyond traditional voice communications.[30] Some of

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24. Charges for Interstate & Foreign Comm., *Memorandum Opinion and Order*, 2 F.C.C.2d 871, 871-72 paras. 1-2 (1965).

25. *See* Hush-a-Phone Corp. v. United States, 238 F.2d 266, 269 (D.C. Cir. 1956) (recognizing every subscriber's right "to use his telephone in ways which are privately beneficial without being publicly detrimental").

26. Use of the Carterfone Device in Message Toll Telephone Service, *Decision*, 13 F.C.C.2d 420, 13 Rad. Reg. 2d (P & F) 597 (1968).

27. Proposals for New or Revised Classes of Interstate & Foreign Message Toll Tel. Ser. (MTS) & Wide Area Tel. Serv. (WATS), *First Report and Order*, 56 F.C.C.2d 593 (1975) (codified at 47 C.F.R. pt. 68 (2008)).

28. *See* MCI Telecomm. Corp. v. FCC, 561 F.2d 365 (D.C. Cir. 1977); MCI Telecomm. Corp. v. FCC, 580 F.2d 590 (D.C. Cir. 1978).

29. MTS and WATS Market Structure, *Report and Third Supplemental Notice of Inquiry and Proposed Rulemaking*, 81 F.C.C.2d 177, 48 Rad. Reg. 2d (P & F) 67 (1980).

30. The FCC defined enhanced services as "services, offered over common carrier transmission facilities used in interstate communications, which employ computer processing applications that act on the format, content, code, protocol or similar aspects of the subscriber's transmitted information; provide the subscriber additional, different, or restructured information; or involve subscriber interaction with stored information." Amendment of Section 64.702 of the Comm'n's Rules & Regs. (Second Computer Inquiry), *Order*, 77 F.C.C.2d 384, 498 paras. 233-60 (1980) [hereinafter *Computer Inquiry II*] (codified at 47 C.F.R. § 64.702(a) (2008)), *aff'd sub nom.* Computer & Comm. Indus. Ass'n

these services were dial-up services, the predecessors to the modern Internet, which used analog modems to make it possible for the first time to connect computers to the network. Other services harnessed computing power in the network itself, typically in the newly digitized switches, to provide new services, such as voicemail, call waiting, and caller ID. Because these functions were most efficiently provided through the switch itself, they became known as "vertical switching services."

Policymakers soon became concerned that the incumbent local telephone companies would be able to use their monopoly control over the local telephone network to favor their own proprietary enhanced and information service offerings. As a result, the FCC initiated its first and second *Computer Inquiries*,[31] which required that any leading local telephone companies wishing to provide data processing or enhanced services do so through a separate corporate subsidiary and required that those companies serve all enhanced service providers on a nondiscriminatory basis.

The FCC later concluded in *Computer Inquiry III*,[32] that the costs of the separate subsidiary requirement outweighed the benefits and that nonstructural safeguards could protect against anticompetitive activity just as effectively. Consequently, it allowed local telephone companies to avoid the separate subsidiary requirement so long as they adhered to a two-phase system of alternative regulatory requirements. The first phase was in essence a nondiscriminatory access mandate known as comparably efficient interconnection (CEI), which required local telephone providers to provide unaffiliated enhanced service providers with access to the same facilities on the same terms and conditions provided to their own proprietary enhanced and information service offerings.[33] The second

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v. FCC, 693 F.2d 198 (D.C. Cir. 1982). The FCC later ruled that the term "enhanced services" should be interpreted as extending to the same functions as the term "information services" established by the MFJ and codified by the Telecommunications Act of 1996. Implementation of the Non-Accounting Safeguards of Secs. 271 & 272 of the Comm. Act of 1934, as amended, *First Report and Order and Further Notice of Proposed Rulemaking*, 11 F.C.C.R. 21905, 21955-56 para. 102 (1996). *See generally* Daniel F. Spulber & Christopher S. Yoo, *Access to Networks: Economic and Constitutional Connections*, 88 CORNELL L. REV. 885, 1007 (2003).

31. Reg. & Policy Problems Presented by the Interdependence of Computer and Comm. Serv. & Facilities (*Computer Inquiry I*), *Final Decision and Order*, 28 F.C.C.2d 267, 270-74 paras. 11-22 (1970), *aff'd sub nom.* GTE Serv. Corp. v. FCC, 474 F.2d 724 (2d Cir. 1973); *Computer Inquiry II*, *supra* note 30, at 475-86 paras. 233-60 (1980).

32. Amendment of Sections 64.702 of the Commission's Rules and Regulations (Third Computer Inquiry), *Report and Order*, 104 F.C.C.2d 958, 1002-11 paras. 79-97, 1035-42 paras. 147-66, 1064-66 paras. 214-17 (1986) [hereinafter *Computer III Phase I Order*], *on reconsideration*, 2 F.C.C.R. 3035 (1987), *vacated and remanded sub nom.* California v. FCC (*California I*), 905 F.2d 1217 (9th Cir. 1990).

33. *Id.* at 1021-25 paras. 117-35.

phase, known as open network architecture, in essence required unbundled access to all of the incumbent's network elements.[34] A series of judicial challenges prevented the alternative regime created by the *Computer Inquiry III* from ever being fully implemented.[35]

The consent decree ordering the breakup of AT&T also required the local telephone companies to provide equal access to all long-distance and information service providers.[36] This regime was later extended to mandate equal access to CPE as well.[37] These measures made no attempt to introduce competition into local telephony. Instead, they conceded that local telephone service remained a natural monopoly and instead attempted to foster competition in complementary services.[38]

C. The Emergence of Competition in Local Telephony

Eventually, competition began to emerge, not just in services that were complementary to local telephony, but also with respect to local telephone service itself. The arrival of fiber optics fostered the emergence of a new type of company known as competitive access providers (CAPs).[39] CAPs initially focused on offering long-distance bypass services, which allowed corporate customers to place long-distance telephone calls without having to access the Bell System's local telephone facilities. The eventual expansion of CAP networks to cover the entire core business districts of major metropolitan areas made it possible for CAPs to begin to offer local telephone service in direct competition with the incumbents.[40]

CAP-provided services possessed certain advantages. CAPs employed fiber-optic technologies, which allowed them to offer more features and a

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34. *Id.* at 1002-11 paras. 79-97, 1035-42 paras.147-66, 1064-66 paras. 214-17.

35. The Ninth Circuit initially overturned the *Computer Inquiry III* regime as arbitrary and capricious on the grounds that the FCC had not adequately justified its decision to rely on nonstructural safeguards. *California I*, 905 F.2d at 1230-39. A subsequent attempt to reinstate the *Computer III* regime also failed to pass judicial muster. *Computer III* Remand Proceedings: Bell Operating Co. Safeguards & Tier 1 Local Exch. Co. Safeguards, *Report and Order*, 6 F.C.C.R. 7571, 7578-88 paras. 14-41, 7617-25 paras. 98-109 (1991), *vacated and remanded in part sub nom.* California v. FCC, 39 F.3d 919 (9th Cir. 1994).

36. United States v. AT&T Co., 552 F. Supp. 131, 195-97 (D.D.C. 1982), *aff'd mem. sub nom.* Maryland v. United States, 460 U.S. 1001 (1983).

37. *See* HUBER, KELLOGG & THORNE, *supra* note 2, § 5.2.1.2.

38. *See supra* note 5 and accompanying text; Implementation of the Local Competition Provisions in the Telecomm. Act of 1996, *Notice of Proposed Rulemaking*, 11 F.C.C.R. 14171, para. 4 (1996).

39. The discussion that follows is adapted from Spulber & Yoo, *Access to Networks*, *supra* note 30, at 961-63.

40. David J. Teece, *Telecommunications in Transition: Unbundling, Reintegration, and Competition*, 1 MICH. TELECOMM. & TECH. L. REV. 47, 66, 78 (1994-1995) (describing CAP entry into local telephone service in New York, Chicago, and Grand Rapids).

cheaper price structure than the incumbents.[41] Moreover, regulators did not require CAPs to submit tariffs. The more relaxed regulatory environment allowed CAPs to respond more quickly to changes in technology and market demand and to customize pricing and terms of service to each customer's needs. The untariffed nature of CAP services also allowed them to evade the system of cross-subsidies embedded in current regulatory policy.

The emergence of competition in local telephone networks meant that some calls would originate on one local telephone company's network and terminate on another's. The FCC became concerned that incumbent local telephone companies would attempt to forestall the emergence of competition either by refusing to interconnect with CAPs or by only agreeing to do so on economically unattractive terms. The FCC thus ordered the incumbent local telephone companies to give CAPs the right to interconnect with their local telephone networks on the same terms and conditions that the incumbent provided for their own circuits. In order to make this interconnection mandate effective, the FCC gave CAPs the right to place any equipment needed to terminate calls in the incumbent's central offices, which the FCC termed "physical collocation." If the incumbent's central office lacked sufficient physical space to accommodate the CAP, the FCC ordered the incumbent to provide "virtual collocation," which allowed the CAP to interconnect with the incumbent's network through a location outside of the incumbent's central office. The price of both physical and virtual collocation would be governed by price caps. As with other price cap regimes, initial rates would be based on historical cost.[42] State authorities issued similar orders to facilitate CAP entry into local telephone service.

The FCC's collocation rules were struck down on judicial review on the grounds that they exceeded the FCC's statutory authority.[43] The reviewing court reasoned that the right to place equipment on the incumbent's property constituted precisely the type of permanent physical

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41. Specifically, the use of fiber optics provided dramatic improvements in the amount of bandwidth available. It also decreased service costs in general and made them much less distance sensitive. Fiber optics also allowed CAPs to take advantage of the efficiencies made possible by computer processing, such as improved switching and digital compression.

42. Expanded Interconnection with Local Tel. Co. Facilities, *Report and Order and Notice of Proposed Rulemaking*, 7 F.C.C.R. 7369, 7374-75 para. 7 & nn.10-12, 7389-90 para. 39, 7390-91 paras. 41-42, 7392-94 paras. 44-46, 7424-25 para. 120, 7428-29 para. 127, 7476-83 paras. 230-40 (1992) [hereinafter *Special Access Order*]; Expanded Interconnection with Local Tel. Co. Facilities, *Second Report and Order and Third Notice of Proposed Rulemaking*, 8 F.C.C.R. 7374, 7391-404 para. 29-31, 7418 para. 75, 7419 para. 79, 7475 para. 144 (1993).

43. Bell Atl. Tel. Co. v. FCC, 24 F.3d 1441 (D.C. Cir. 1994).

occupation that *Loretto*[44] held to be a per se taking. The principle that statutes should not be construed so as to create "'an identifiable class of cases in which application of a statute will necessarily constitute a taking'" thus dictated that mandating physical collocation exceeded the FCC's statutory authority.[45] The FCC responded to this decision by giving the incumbent local telephone companies the option of providing virtual collocation instead of physical collocation. The FCC continued to maintain that mandatory physical collocation did not constitute a per se taking, but argued that, regardless of whether that was true, offering virtual collocation as an option eliminated any such constitutional problems.[46] Before the courts could address the validity of these revised regulations, the entire scheme was rendered moot by the enactment of the Telecommunications Act of 1996.[47]

D. The Telecommunications Act of 1996

The Telecommunications Act of 1996[48] was designed to "open[] all communications services to competition," including local telephone service.[49] Policymakers envisioned that competition in local telephone markets might emerge through one of three paths.[50] First, an entrant might simply obtain access to *all* of the elements needed to provide local telephone service from the incumbent and resell them. Resale rates would be based on retail rates less "any marketing, billing, collection, and other costs that will be avoided" when local telephone services are provided by another carrier.[51]

Second, an entrant might build an entirely new network. Because any new entrant would need to be able to place calls to and receive calls from the incumbent local telephone companies' customers, the 1996 Act requires that incumbents allow any requesting telecommunications carrier to

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44. Loretto v. Teleprompter Manhattan CATV Corp., 458 U.S. 419 (1982).

45. *Bell Atl. Tel. Co.* 24 F.3d at 1445 (quoting United States v. Riverside Bayview Homes, Inc., 474 U.S. 121, 128 n.5 (1985)).

46. Expanded Interconnection with Local Tel. Co. Facilities, *Memorandum Opinion and Order*, 9 F.C.C.R. 5154, 5163 paras. 22-23 (1994).

47. *See* Pac. Bell Co. v. FCC, Nos. 94-1547, 94-1548 & 94-1612, 1996 WL 175198 (D.C. Cir. Mar. 22, 1996).

48. Telecommunications Act of 1996, Pub. L. No. 104-104, § 601(b)(1), 110 Stat. 56, 143 (1996) (codified as amended at 47 U.S.C. § 152 note (2000)).

49. H.R. REP. NO. 104-204, pt. 1, at 48-49, *reprinted in* 1996 U.S.C.C.A.N. 1, 11-13. The discussion that follows is adapted in part from Spulber & Yoo, *Access to Networks*, *supra* note 30, at 965-70.

50. Verizon Comm. Inc. v. FCC, 535 U.S. 467, 491-92 (2002). *See also*, Implementation of the Local Competition Provisions in the Telecomm. Act of 1996, *First Report and Order*, 11 F.C.C.R. 15499, 15509 para. 12 (1996) [hereinafter *Local Competition Order*].

51. 47 U.S.C. §252(d)(3) (2000). *See also id.* § 251(c)(4).

interconnect with their networks at any technically feasible point on terms that are equal in quality to those that the incumbent provides for its own circuits and that are "just, reasonable, and nondiscriminatory."[52]

Third, an entrant may provide some of the elements needed to offer local telephone service and obtain the rest from the incumbent. To allow this to occur, Congress required every incumbent local telephone company to provide all other carriers with access to any of its network elements on an unbundled basis (called "unbundled network element" or "UNE" access). This would obviate the need for an entrant to have its entire network in place at the time it began to offer local service.[53] Such access must be provided at any technically feasible point under rates, terms, and conditions that are "just, reasonable, and nondiscriminatory."[54] In determining which network elements would be subject to the unbundled access requirement, the statute required the FCC to consider whether "access to such network elements as are proprietary in nature is *necessary*" and whether "the failure to provide access to such network elements would *impair* the ability of the telecommunications carrier seeking access to provide the services that it seeks to offer."[55]

The statute requires that the parties first attempt to determine the prices for interconnection and access to unbundled network elements through voluntary negotiations, at times aided by mediation by a state public utility commission. If voluntary negotiations fail, Congress gave state public utility commissions the power to set rates through binding arbitration, which would be governed by one of two statutory mandates. First, arbitrated rates for interconnection and UNE access shall be "based on the cost . . . of providing the interconnection or network element," provided that cost is "determined without reference to a rate-of-return or other rate-based proceeding."[56] Second, access rates for terminating traffic originating on another network shall be governed by "reciprocal compensation," which "provide[s] for the mutual and reciprocal recovery by each carrier of costs associated with the transport and termination on each carrier's network facilities of calls that originate on the network facilities of the other carrier."[57] Such costs must be determined "on the basis of a reasonable approximation of the additional costs of terminating such calls," although carriers may waive mutual recovery in favor of other

52. *Id.* § 251(c)(2)(B)-(D).
53. S. REP. NO. 104-230, at 147 (1996) (Conf. Rep.).
54. 47 U.S.C. § 251(c)(3).
55. *Id.* § 251(d)(2)(A)-(B) (emphasis added).
56. *Id.* § 252(d)(1)(A)(i).
57. *Id.* § 252(d)(2)(A)(i).

arrangements, such as bill and keep systems.[58] The result was a wide-scale federalization of local telephony, including many areas of regulation that had previously fallen within the jurisdiction of the states.[59]

Because both interconnection and access to UNEs almost inevitably require allowing the requesting carrier to place some of its equipment on the incumbent local telephone company's property, the statute requires incumbents to permit physical collocation so that entrants can establish physical connections between their equipment and the incumbent's network. Specifically, the statute requires incumbents to permit "physical collocation of equipment necessary for interconnection or access to unbundled network elements" on "rates, terms, and conditions that are just, reasonable, and nondiscriminatory."[60] If "physical collocation is not practical for technical reasons or because of space limitations," the statute gives incumbents the option of providing virtual collocation instead.[61]

As noted earlier, the FCC employed a methodology known as TELRIC to implement the provisions governing interconnection and UNE access rates. Under TELRIC, UNE rates are based on the element's "economic costs," which the FCC defined as the incremental costs directly attributable to the specified element plus a reasonable allocation of the joint and common costs.[62] TELRIC resolved a longstanding dispute in regulatory policy[63] by assessing both the incremental and common costs on a forward-looking basis that focuses on the cost of replacing a particular network element rather than the amount actually paid for it. TELRIC eludes the problems caused by the distinction between fixed and variable costs by measuring incremental costs from a "long run" perspective, which is defined as a period that is long enough for all of a firm's costs to become variable or avoidable. The FCC believed that basing rates on forward-looking incremental cost represented the best way to replicate, to the greatest extent possible, the conditions of a competitive market.[64] In addition, TELRIC further accommodates technological change by requiring that costs be determined on the basis of the most efficient technology available and the lowest cost network configuration given the existing

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58. *Id.* § 252(d)(2)(A)(ii).

59. As the Supreme Court noted in *Iowa Utilities Board*, "[T]he question in these cases is not whether the Federal Government has taken the regulation of local telecommunications competition away from the States. With regard to the matters addressed by the 1996 Act, it unquestionably has." AT&T Corp. v. Iowa Utils. Bd., 525 U.S. 366, 378 n.6 (1999).

60. 47 U.S.C. § 251(c)(6).

61. *Id.*

62. *Local Competition Order*, *supra* note 50, 15845 para. 675, 15847 para. 682.

63. *See* Spulber & Yoo, *Access to Networks*, *supra* note 30, at 902-03, 908-10 (describing the longstanding debate over whether regulated rates should be based on historical or replacement cost).

64. *Local Competition Order*, *supra* note 50, at 15813 para. 620, 15846 para. 679.

location of the incumbent's current wire centers.[65] The FCC declined to incorporate an element to reflect the opportunity cost borne by the network owner.[66] Although the statutory mandate underlying TELRIC applied only to interconnection and UNE access, the FCC ruled that TELRIC should also govern physical collocation.[67] In addition, the FCC determined that TELRIC represented the appropriate interpretation of the "the additional costs of terminating such calls" that govern reciprocal compensation, although the statute explicitly reserves the possibility of bill and keep.[68]

Initially, the FCC interpreted the "necessary" and "impair" requirements broadly to encompass essentially all of the elements needed to provide local telephone service.[69] This allowed entrants to avoid resale pricing altogether simply by using UNE access to obtain access to the same network elements, a practice known as the UNE-Platform or UNE-P. Over time, the FCC began to cut back on the number of elements subject to the 1996 Act's UNE access requirements. The precipitous drop in the cost of switching caused by the advent of digital technologies led the FCC to rethink the extent to which switching should remain subject to UNE access. In 2003, the FCC removed switches serving large business customers (called "enterprise market switching") from the list of elements to which new entrants could obtain UNE access.[70] At the same time, it continued to allow UNE access to switches serving residences and small businesses (called "mass market switching"), not because of high fixed costs, but rather because of operational problems associated with "hot cuts," during which the line serving a particular customer is disconnected from the

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65. 47 C.F.R. § 51.505(b)(1) (2008).

66. *Local Competition Order*, *supra* note 50, at 15859-60 paras. 708-11.

67. *Id.* at 15816 para. 629.

68. *Id.* at 16023 para. 1054 (quoting 47 U.S.C. § 252(d)(2)(A)(ii)); *accord* 47 C.F.R. § 51.705(a)(1) (2008) (requiring that reciprocal compensation be determined on the basis of forward-looking economic costs pursuant to the methodology governing pricing for interconnection and access for unbundled network elements). The FCC allowed for three alternatives. One option was for state PUCs to adopt a proxy range set by the FCC (at 0.2 and 0.4 cents per minute for termination). *Id.* at 16024 para. 1055, 16026-28 para. 1060-62. The Eighth Circuit struck down the use of proxy prices. *See* Iowa Utils. Bd. v. FCC, 219 F.3d 744, 756-57 (8th Cir. 2000), *rev'd on other grounds sub nom.* Verizon Comm. Inc. v. FCC, 535 U.S. 467 (2002). This portion of the Eighth Circuit's decision does not appear to have been challenged before the Supreme Court.

69. *See Local Competition Order*, *supra* note 50, at 15683-714 paras. 360-426; 15714-69 paras. 428-528; Implementation of the Local Competition Provisions of the Telecomm. Act of 1996, *Third Report and Order*, 15 F.C.C.R. 3696, 3778-832 paras. 181-299, 3840-90 paras. 318-437 (1999) [hereinafter *UNE Remand Order*].

70. *See* Review of the Sec. 251 Unbundled Obligations of Incumbent Local Exch. Carriers, *Report and Order and Order on Remand and Further Notice of Proposed Rulemaking*, 18 F.C.C.R. 16978, 17237 para. 419, 17238-39 para. 421, 17258-60, paras. 451-53 (2003) [hereinafter *Triennial Review Order*], *modified*, 18 F.C.C.R. 19020 (2003), *vacated in part sub nom.* U.S. Telecom Ass'n v. FCC, 359 F.3d 554 (D.C. Cir. 2004).

incumbent's switch and reattached to the new entrant's.[71] Both findings could be rebutted on a case-by-case basis.[72]

The D.C. Circuit upheld the FCC's decision with respect to enterprise market switching, observing that "[t]here appears to be no suggestion that mass market switches exhibit declining average costs in the relevant markets, or even that switches entail large sunk costs" and deployment of duplicate switches did not appear to be either "uneconomic" or "wasteful."[73] The absence of any evidence that denying access to incumbents' mass market switches would impair competitors' ability to compete led the court to overturn the FCC's refusal to deregulate mass market switching.[74] On remand, the FCC harmonized both findings by ruling that mass market switching was no longer subject to UNE access requirements, largely because of the wide-scale deployment of competitive circuit switches and the investment disincentives created by sharing requirements, a conclusion that was upheld on judicial review.[75]

III. THE RATIONALES FOR REGULATING LOCAL TELEPHONE NETWORKS

The regulation of local telephone networks has traditionally been based on four primary rationales: the belief that local telephone service is a natural monopoly, the concern that network economic effects will give incumbents decisive advantages, the dangers that the incumbent will engage in vertical exclusion to deny access to providers of complementary services, and the purported dangers of "ruinous" competition. The impact of these regulatory efforts—and the challenges that state and federal regulators have confronted—illustrate the difficulty of attempting to impose regulation on such a technologically complex and dynamic industry, as well as how the emergence of competition is undermining each of these rationales.

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71. *Id.* at 17237-38 para. 419, 17239 para. 422, 17263-64 para. 459, 17265-86 paras. 464-485.

72. *Id.* at 17237 para. 419, 17238-39 para. 421, 17239-40 para. 424, 17260-63 paras. 454-58, 17264-65 paras. 460-463, 17290-312 paras. 493-524.

73. *U.S. Telecom Ass'n*, 359 F.3d at 569, 572-73.

74. *Id.* at 586-87.

75. *See* Unbundled Access to Network Elements, *Order on Remand*, 20 F.C.C.R. 2533, 2641-61 paras. 199-228 (2005) [hereinafter *Triennial Review Remand Order*], *pet. for review denied sub nom.* Covad Comm. Co. v. FCC, 450 F.3d 528, 546-49 (D.C. Cir. 2006).

A. Natural Monopoly

One of the bedrock assumptions of telecommunications policy is that local telephone networks are natural monopolies.[76] A natural monopoly exists when a market is *subadditive*; this occurs when one firm can serve the entire market demand at a lower cost than could two or more firms. A sufficient condition for subadditivity exists if the scale economies are so large that the average cost curve declines over the entire industry output. One example occurs when the production technology requires the incurring of large, up-front fixed costs. The fact that average cost is always declining permits producers with larger volumes to underprice their competitors, which in turn allows them to capture a still larger share of the market. The growing disparity in sales volume causes the price disparity to widen still further until all other producers are driven from the market. When that is the case, even markets that begin as competitive will eventually come to be dominated by a single player.

The large fixed cost investments associated with establishing telephone switches and the network of wires needed to transmit telephone calls has led many observers to regard local telephone networks as natural monopolies. Natural monopoly represented one of the central justifications for early regulatory efforts in the 1920s[77] as well as the regulatory scheme created by the Communications Act of 1934.[78] Even after the FCC began to use regulation and the breakup of AT&T to promote competition in services complementary to local telephony, such as CPE, long distance, and information services, policymakers continued to believe that local telephone networks remained natural monopolies—largely by virtue of the high fixed costs associated with laying the wires needed to make local distribution possible.[79] It was not until the enactment of the Telecommunications Act of 1996 that policymakers began attempting to promote local competition in earnest.

A close analysis of the cost structure associated with the early telephone industry undercuts claims that local telephone service constituted a natural monopoly during that time. The primary source of diseconomies

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76. The following discussion of the economics of natural monopoly draws on Spulber & Yoo, *Access to Networks*, *supra* note 30, at 917; and Daniel F. Spulber, *Deregulating Telecommunications*, 12 YALE J. ON REG. 25, 31-32 (1995).

77. S. REP. NO. 67-75, at 1 (1921).

78. STUDY OF COMMUNICATIONS BY AN INTERDEPARTMENTAL COMMITTEE, 73d Cong., 2d Sess. 11-2 (Comm. Print 1934), *reprinted in* A LEGISLATIVE HISTORY OF THE COMMUNICATIONS ACT OF 1934, *supra* note 17, at 101, 115-16; *Hearings on S. 2910 Before the Senate Comm. on Interstate Commerce*, 73d Cong. 100 (1934), *reprinted in* A LEGISLATIVE HISTORY OF THE COMMUNICATIONS ACT OF 1934, *supra* note 17, at 119, 222.

79. *See supra* note 5 and accompanying text.

of scale was switching.[80] Initially, telephone connections were made manually by an operator at a switchboard. Switching was relatively simple so long as the number of subscribers connected to any particular exchange was relatively small. Increases in the number of subscribers eventually required the installation of additional switchboards interconnected through trunk lines, which in turn caused switching to become more complex. For example, in an exchange with two switchboards, one-half of all calls would arrive on one switchboard and terminate on the other, which would require the participation of two operators to set up and take down each call. Calls to exchanges with three and four switchboards would require multiple operators for two-thirds and three-quarters of all calls respectively. In addition, the presence of multiple switchboards increased the organizational problem considerably. Operators had to keep track of the board on which each customer resided and of which trunk lines were open at any particular time. The problem becomes all the more difficult after one considers that the number of connections increases quadratically with the number of users.[81] Thus, increases in the subscriber base drastically increase both the cost of service and the complexity of the organizational problem.

The diseconomies of scale in switching became a major problem for the Bell System, which had to seek rate increases as its subscriber base grew. It also became a trap for the independents, which often entered based on the promise of lower rates, only to find that their very success in attracting business away from the Bell System rendered those rates unsustainable.[82] The nonscalability of switching technology thus undercuts claims that the telephone system was a natural monopoly during the industry's early years. Although the deployment of mechanical switches eventually caused switching to become less important as a source of diseconomies of scale, the Bell System did not begin wide-scale deployment of mechanical switches until 1919.[83]

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80. For an excellent discussion of the diseconomies of scale in switching, see Milton Mueller, *The Switchboard Problem: Scale, Signaling, and Organization in Manual Telephone Swathing, 1877-1897*, 30 TECH. & CULTURE 534 (1989).

81. Spulber & Yoo, *Graph Theory Approach*, *supra* note 9, at 1696; Christopher S. Yoo, *Network Neutrality and the Economics of Congestion*, 94 GEO. L.J. 1847, 1883-84 (2006).

82. MILTON L. MUELLER, JR., UNIVERSAL SERVICE 36, 65-66 (1997); David F, Weiman & Richard C. Levin, *Preying for Monopoly? The Case of Southern Bell Telephone Company, 1894-1912*, 102 J. POL. ECON. 103, 104 (1994).

83. *See generally* H.R. Doc. No. 76-340, at 261 (1939); BELL TELEPHONE LABORATORIES, A HISTORY OF ENGINEERING AND SCIENCE IN THE BELL SYSTEM: THE EARLY YEARS (1875-1925) 552-53, 611-12 (1975); ROBERT J. CHAPUIS, 100 YEARS OF TELEPHONE SWITCHING (1878-1978), PART I: MANUAL AND ELECTROMECHANICAL SWITCHING (1878-1960s), 249 (1982); Joan Nix & David Gabel, *The Introduction of Automatic Switching into the Bell System: Market Versus Institutional Influences*, 30 J. ECON. ISSUES 737, 738 (1996).

Disputes over the extent to which the local telephone network constituted a natural monopoly persisted well into more recent times. Leading treatises on regulated industries acknowledge the persistence of disputes over whether the telephone industry was characterized by increasing or decreasing average costs.[84] A vibrant empirical literature emerged debating whether local telephone networks were natural monopolies. Some studies concluded that local telephone service was subadditive,[85] while other studies drew the opposite conclusion.[86]

Subsequent technological developments have largely rendered these disputes moot. As noted earlier, the advent of digital technologies has caused a precipitous drop in the cost of switching, which in turn has led the FCC to remove switching from the list of elements subject to UNE access.[87] Competition has even begun to emerge with respect to the local loop, the portion of the local telephone network thought most likely to retain natural monopoly characteristics. State public utility commissions have begun to deregulate local service to large business customers,[88] although the FCC continues to subject high capacity loops (except for dark fiber) to UNE access obligations.[89] Wireless has also emerged as a vibrant competitor in local telephone service in the residential and small business markets, with the number of wireless subscribers surpassing the number of wireline subscribers since 2004[90] and with thirty million American adults

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84. *See, e.g.*, JAMES C. BONBRIGHT, PRINCIPLES OF PUBLIC UTILITY RATES 16-17 (1961).

85. *See* A. Charnes, W.W. Cooper & T. Sueyoshi, *A Goal Programming/Constrained Regression Review of the Bell System Breakup*, 34 MGMT. SCI. 1 (1988); Lars-Hendrik Röller, *Proper Quadratic Cost Functions with an Application to the Bell System*, 72 REV. ECON. & STAT. 202 (1990); Lars-Hendrik Röller, *Modeling Cost Structure: The Bell System Revisited*, 22 APPLIED ECON. 1161 (1990); Wesley W. Wilson & Yimin Zhou, *Telecommunications Deregulation and Subadditive Costs: Are Local Telephone Monopolies Natural?*, 19 INT'L J. INDUS. ORG. 909 (2001). *See also* David Gabel & D. Mark Kennet, *Economies of Scope in the Local Telephone Exchange Market*, 6 J. REG. ECON. 381 (1994); F. Gasmi, J.J. Laffont & W.W. Sharkey, *The Natural Monopoly Test Reconsidered: An Engineering Process-Based Approach to Empirical Analysis in Telecommunications*, 20 INT'L J. INDUS. ORG. 435 (2002).

86. *See* David S. Evans & James J. Heckman, *Multiproduct Cost Function Estimates and Natural Monopoly Tests for the Bell System*, *in* BREAKING UP BELL 127 (David S. Evans ed., 1983); David S. Evans & James J. Heckman, *A Test for Subadditivity of the Cost Function with an Application to the Bell System*, 74 AM. ECON. REV. 615 (1984); Richard T. Shin & John S. Ying, *Unnatural Monopolies in Local Telephone*, 23 RAND J. ECON. 171 (1992); Sanford V. Berg & John Tschirhart, *A Market Test for Natural Monopoly in the Local Exchange*, 8 J. REG. ECON. 103 (1995).

87. *See supra* note 72 and accompanying text.

88. *See* Timothy J. Tardiff, *Changes in Industry Structure and Technological Convergence: Implications for Competition Policy and Regulation in Telecommunications*, 4 INT'L ECON. & ECON. POL'Y 109 (2007).

89. *See Triennial Review Remand Order*, *supra* note 70, at 2614-41 paras. 146-98.

90. FCC INDUSTRY ANALYSIS TECHNOLOGY DIVISION, WIRELINE COMPETITION BUREAU, LOCAL TELEPHONE COMPETITION: STATUS AS OF DECEMBER 31, 2004, at 1, 3, 5 tbl.1, 17

(roughly fourteen percent) relying solely on their wireless phone for service.[91] Competition from Voice-over-Internet Protocol (VoIP) provided via coaxial cable is starting to emerge with respect to residential and small business customers as well. Although state and federal regulators have exhibited some reluctance to deregulate local telephone service on the basis of intermodal competition,[92] it seems only a matter of time before one can plausibly continue to maintain that the local loop still exhibits natural monopoly characteristics.

B. Network Economic Effects

Policymakers have also invoked network economic effects as a justification for wide-scale regulation of local telephone service. Network economic effects exist when the value of a particular good is determined in large part by the number of other people connected to the same network.[93] The concern is that network economic effects will create demand-side economies of scale that will cause the largest networks to be worth the most to consumers. In this way, network economic effects can create what is sometimes called "excess inertia" that allows incumbents to maintain their dominance long after the arrival of a more efficient competitor or technology.[94]

The leaders of the Bell System clearly understood the importance of network economic effects. As it noted in its 1908 Annual Report, "[a] telephone—without a connection at the other end of the line—is . . . one of the most useless things in the world. Its value depends on the connection with the other telephone—and increases with the number of connections."[95] Indeed, the Bell System attempted to use network economic effects to leverage its initial dominance by refusing to interconnect with independent telephone systems during the early years of competition. Some scholars have suggested network economic effects played a key role in the Bell System's return to dominance after 1907,

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tbl.13 (July 2005), *available at* http://www.fcc.gov/Bureaus/Common_Carrier/Reports/FCC-State_Link/IAD/lcom0705.pdf

91. Alex Mindlin, *Cellphone-Only Homes Hit a Milestone*, N.Y. TIMES, Aug. 27, 2007, at C3.

92. *See, e.g.*, *Triennial Review Order*, *supra* note 70, at 17252 para. 445; Application of Qwest Corp. for Deregulation of Basic Local Exch. Rates, Order No. 29360, 2003 WL 22417269 (Idaho Pub. Utils. Comm'n Oct. 20, 2003).

93. For more complete analyses of network economic effects, see Christopher S. Yoo, *Vertical Integration and Media Regulation in the New Economy*, 19 YALE J. ON REG. 171, 269-85 (2002); Spulber & Yoo, *Access to Networks*, *supra* note 30, at 921-33.

94. Joseph Farrell & Garth Saloner, *Installed Base and Compatibility: Innovation, Product Preannouncements, and Predation*, 76 AM. ECON. REV. 940, 942 (1986).

95. AT&T, 1908 ANNUAL REPORT 21 (1909); *see also* BONBRIGHT, *supra* note 84, at 17.

when its market share dipped below fifty percent.[96] Some argue that the Bell System reasserted its dominant position by refusing to interconnect with the independents' *local* telephone networks. According to this argument, the network economic effects from connecting with other local customers created demand-side scale economies that gave Bell a decisive advantage.[97] Others focus on the network economic effects provided by Bell System's refusal to allow the independents to interconnect with its *long-distance* network. Under this argument, key long-distance patents, such as the Pupin coil, enabled the Bell System to provide superior long-distance service, which in turn increased the value of the network by increasing the number of customers any subscriber could reach through the network. These network economic effects, according to this variant of the argument, gave the Bell System a decisive competitive advantage which it could use to drive out the independents simply by refusing to allow them to interconnect with its long-distance network.[98]

A close analysis of the history of the era reveals that the refusal to interconnect likely did not play a substantial role in allowing the Bell System to reassert its dominance. The Bell System's long-distance network was unlikely to serve as a source of demand-side economies of scale. During this period, long distance represented only a tiny fraction of the overall demand for telephone service.[99] Indeed, contemporary observers acknowledged that its ability to provide superior long-haul, long-distance service was "of little commercial or social importance."[100] Short-haul long-distance service could be provided simply by interconnecting adjacent exchanges. Again, the Bell System held no competitive advantage for this type of traffic, because AT&T and the independents were employing the same technology.[101] Assuming that long distance was an important source of network economic effects, as noted earlier, the independent telephone companies had captured more than half of the market by 1907. They were

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96. *See* KENNETH LIPARTITO, THE BELL SYSTEM AND REGIONAL BUSINESS: THE TELEPHONE IN THE SOUTH, 1877-1920, at 250 n.4 (1989) ("The notion that Bell's refusal to interconnect was a potent competitive weapon is an article of faith in telephone literature.").

97. *See* Mark A. Lemley, *Antitrust and the Internet Standardization Problem*, 28 CONN. L. REV. 1041, 1046 n.19 (1996); Howard A. Shelanski & J. Gregory Sidak, *Antitrust Divestiture in Network Industries*, 68 U. CHI. L. REV. 1, 8 (2001).

98. JOHN BROOKS, TELEPHONE: THE FIRST HUNDRED YEARS 114 (1975); GERALD W. BROCK, THE TELECOMMUNICATIONS INDUSTRY: THE DYNAMICS OF MARKET STRUCTURE 117-19 (1981); FAULHABER, *supra* note 2, at 3-5; John V. Langdale, *The Growth of Long-Distance Telephony in the Bell System: 1875-1907*, 4 J. HIST. GEOGRAPHY 145, 155 (1978).

99. *See* 2 U.S. DEPT. OF COMMERCE, BUREAU OF THE CENSUS, HISTORICAL STATISTICS OF THE UNITED STATES: COLONIAL TIMES TO 1970, at 783 (1975) (reporting that toll calling represented less than 2.5% of all calls in 1907 and never exceeded 4.5% prior to 1934).

100. MUELLER, *supra* note 82, at 73.

101. *See id.*, at 72-76, 90-91, 141, 144.

thus in a position to neutralize any attempt by the Bell System to use network economic effects to leverage its market size simply by banding together to form a network equal in size to AT&T's.[102]

The Bell System's local telephone networks were also unlikely to have served as the source of significant network economic effects. As we noted in our previous work, network economic effects are unlikely to be a source of anticompetitive problems in markets undergoing rapid growth, because the presence of a large number of uncommitted customers would offset whatever advantages the incumbent enjoyed by virtue of its existing customer base.[103] A new entrant could achieve a network of the same or greater size than that of the incumbent simply by pursuing new customers.

This appears to be precisely what happened in the early telephone industry. The Bell System had patterned its initial business strategy on Western Union's, which primarily provided long-distance communications to business customers located in large commercial centers. As a result, the Bell System largely ignored small cities, rural areas, and residential areas, not even making much of an effort to connect larger cities to their suburbs. The skeletal nature of the Bell System's network left substantial areas of the country in which new, independent telephone companies could enter without facing any opposition. The independents were thus free to pursue the large number of unserved customers who had no allegiance to the Bell System. Indeed, once the independents had established themselves in these unserved areas, they were the ones who benefited from network economic effects, not the Bell System.[104]

The traditional account is also belied by the business strategy pursued by the independents. If AT&T were in a dominant position, one would expect the independents to be clamoring to interconnect with it. In fact, the independents did not want to interconnect with AT&T any more than AT&T wanted to interconnect with the independents. Indeed, it was only after the Bell System changed policy and liberalized its interconnection policies that it began to reassert its dominance.[105]

The early telephone industry thus most closely resembles the type of competition, identified in the theoretical literature in which two equally

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102. Roger G. Noll & Bruce M. Owen, *The Anticompetitive Uses of Regulation:* United States v. AT&T, *in* THE ANTITRUST REVOLUTION 290, 292 (John E. Kwoka, Jr. & Lawrence J. White eds., 1989).

103. Yoo, *Vertical Integration*, *supra* note 93, at 280; Spulber & Yoo, *Access to Networks*, *supra* note 30, at 918-19.

104. MUELLER, *supra* note 82, at 39-42, 55-60; Weiman & Levin, *supra* note 82, at 106-07.

105. MUELLER, *supra* note 82, at 10, 51, 78-79; Richard Gabel, *The Early Competitive Era in Telephone Communications, 1893-1920*, 34 LAW & CONTEMP. PROBS. 340, 353-54 (1969).

sized players refuse to interconnect and instead engage in a race for the market in which "[t]he successful competitor strives to become the surviving monopolist."[106] Interestingly though, this type of competition does not lead to the delays in technology adoption and supracompetitive returns associated with refusals to interconnect by dominant firms. It also has the virtue of promoting the rapid build-out of new network technologies.[107]

Spurred into a race for the market, both the Bell System and the independents began investing heavily in expanding their networks. Annual growth rates, which had been languishing at around six percent during the monopoly period, skyrocketed to over twenty percent during the competitive era.[108] By 1907, the independent telephone industry had achieved parity with the Bell System[109] and competing with Bell in fifty-nine percent of cities with populations over 5,000.[110] At this point, the independents could defeat whatever advantage AT&T might have gained by its refusal to interconnect simply by banding together to form a network of equal size.[111]

It is thus unlikely that network economic effects played a significant role in allowing the Bell System to reassert its dominance during the early twentieth century. The emergence of local telephone competition has rendered them even more inapposite today. Scholars from a wide range of perspectives generally recognize that the anticompetitive effects associated with network economic effects can only arise if the market is dominated by a single, large player. When that is not the case, competition already provides powerful incentives for networks to interconnect, and in the absence of a dominant player, any one firm's refusal to interconnect is unlikely to harm competition. On the contrary, network economic effects provide powerful incentives to interconnect because any firm refusing to do so risks being left out in the cold.[112] The FCC embraced this reasoning

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106. Gabel, *supra* note 105, at 354.

107. Stanley M. Besen & Joseph Farrell, *Choosing How to Compete: Strategies and Tactics in Standardization*, 8 J. ECON. PERSPECTIVES 117, 122-24 (1994).

108. Gabel, *supra* note 105, at 350 tbl.4.

109. Robert Bornholz & David S. Evans, *The Early History of Competition in the Telephone Industry*, *in* BREAKING UP BELL, *supra* note 86, at 7, 13.

110. MUELLER, *supra* note 82, at 39-42, 54-66, 69-76, 111-12; Weiman & Levin, *supra* note 82, at 106-07.

111. Noll & Owen, *supra* note 102, at 292.

112. *See* Gerald R. Faulhaber, *Bottlenecks and Bandwagons: Access Policy in the New Telecommunications*, *in* 2 HANDBOOK OF TELECOMMUNICATIONS ECONOMICS: TECHNOLOGY EVOLUTION AND THE INTERNET 487, 501-02 (Samit K. Majumdar et al. eds., 2005) (pointing out that in mature markets consisting of a small number of firms of roughly equal size, "the only stable outcome (i.e., the market equilibrium) is for all firms to interconnect"); Michael L. Katz & Carl Shapiro, *Network Externalities, Competition, and Compatibility*, 75 AM. ECON. REV. 424, 429 (1985) (noting that "[a]s the number of firms becomes increasingly

when declining to require wireless telephone networks to interconnect with one another, concluding that the growth of competition obviated the need for any regulatory intervention.[113] Thus the technological changes that have allowed competition in local telephone service to emerge have effectively undercut incumbents' ability to use network economic effects to harm competition.

C. Vertical Exclusion

Although the entire telephone system was initially regarded as a monopoly, the emergence of potential competition in portions of the network raised the possibility that the Bell System would use its control over the portions of the network that remained a natural monopoly to harm competition in those portions of the network where competition was now possible. Specifically, policymakers became concerned that the Bell System would use its control over the local telephone network to harm competition in complementary services.

Vertical exclusion was thus the central concern underlying the Part 68 rules mandating that the Bell System open its local telephone networks to CPE manufactured by other companies.[114] The same concern motivated the requirement that the Bell System open its local telephone networks to competing long-distance companies.[115] It also underlay the *Computer Inquiries* requirement of structural separation and equal access to unaffiliated information service providers.[116] Each of these decisions were reinforced by the consent decree settling the government's case against AT&T, which similarly mandated structural separation and equal access for long-distance and information service providers.[117] All of these restrictions were eventually incorporated into the Telecommunications Act of 1996,[118] which prohibited the local telephone companies formerly affiliated with the Bell System, known as Bell Operating Companies (BOCs), from providing long-distance services, manufacturing equipment, or engaging in two designated information services (specifically, electronic publishing and

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large," the equilibrium in which all firms interconnect converges to perfectly competitive equilibrium). *See also* Nicholas Economides, *The Economics of the Internet Backbone*, *in* 2 HANDBOOK OF TELECOMMUNICATIONS ECONOMICS, *supra*, at 374, 390 (recognizing that network economic effects give firms strong incentives to interconnect).

113. Interconnection and Resale Obligations Pertaining to Commercial Mobile Radio Serv., *Fourth Report and Order*, 15 F.C.C.R. 13523, 13534 para. 28 (2000) [hereinafter *CMRS Interconnection Order*].

114. 47 C.F.R. pt. 68 (2008); *see supra* note 25 and accompanying text.

115. *See supra* notes 25-27 and accompanying text.

116. *See supra* note 28-29 and accompanying text.

117. *See supra* notes 30-31 and accompanying text.

118. Telecommunications Act of 1996, Pub. L. No. 104-104, 110 Stat. 56 (1996) (codified in scattered sections of 47 U.S.C. (2000)).

alarm monitoring) in their home regions. The 1996 Act permitted the BOCs to offer other information services immediately and to offer electronic publishing so long as they did so through a separate affiliate.[119]

Concerns about vertical exclusion depend on the assumption that local telephone service remains monopolized, because without market power in one market, the firm attempting to engage in vertical exclusion would have nothing to use as leverage.[120] The sunset provisions of the 1996 Act reveal the expectation that concerns about vertical exclusion would ultimately be dissipated by the emergence of competition in local telephone service. By their own terms, the statutory restrictions on information services expired in 2000 and 2001.[121] The 1996 Act also eliminated the prohibition against providing long-distance service and manufacturing equipment for BOCs either facing facilities-based competition or satisfying a fourteen-point competitive checklist establishing that they are providing nondiscriminatory access to their local telephone networks, although the BOCs seeking to offer those services had to do so through a separate affiliate for an additional three years.[122] The FCC has ruled that sufficient progress has been made in every state except Alaska and Hawaii to justify permitting BOCs to begin offering long-distance service.[123] With the increasing competitive pressure being brought by wireless carriers and broadband providers offering VoIP, it appears to be just a matter of time before vertical exclusion by local telephone companies ceases to be a regulatory concern.

In addition, certain services depend on a degree of vertical integration that structural separation and equal access requirements render impossible. Two persistent problems raised by the *Computer Inquiries* illustrate this fact.[124] The advent of digital switching placed computing power in the switch itself, which was capable of supporting a vast new array of vertical switching services, such as voice mail, call waiting, call forwarding, and advance calling. Although such services could be offered by independent providers, they appeared to function most efficiently when their capabilities were designed directly into the telephone switch. Allowing local telephone companies to offer these services on an integrated basis, however, was inconsistent with the regime of interoperability and transparency implicit in

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119. 47 U.S.C. §§ 271(b)(1), 273(a), 274(a), 275(a)(1).

120. Yoo, *Vertical Integration*, *supra* note 93, at 188.

121. § 274(g)(2), § 275(a)(1).

122. *Id.* § 271(c)(2), (d)(1); § 272(f)(2); § 273(a).

123. FCC, BOC AUTHORIZATIONS TO PROVIDE IN-REGION INTERLATA SERVICES UNDER SECTIONS 271 AND 272, http://www.fcc.gov/Bureaus/Common_Carrier/in-region_applications/ (last visited Nov. 22, 2008).

124. Christopher S. Yoo, *Beyond Network Neutrality*, 19 HARV. J.L. & TECH. 1, 15-18 (2005).

equal access and structural separation and needed an express regulatory waiver before they could be provided in this manner.[125] Estimates of the cost of the delay in the introduction of such services caused by regulations to protect against vertical exclusion exceed $1 billion per year.[126]

Another classic example of the problems associated with attempts to regulate vertical exclusion is the emergence of digital transmission, during which local telephone companies began moving away from routing traffic on a synchronous circuit-switched basis and began to employ asynchronous packet-switched protocols in portions of their networks. The shift to digital transmission technologies required the network to engage in protocol conversion at different points that again was inconsistent with the regime of interoperability and transparency implicit in equal access and structural separation. After considerable regulatory wrangling, the FCC concluded that the costs of the regulations exceeded their benefits and permitted protocol conversion, notwithstanding its inconsistency with the commitment to vertical disintegration embodied in *Computer Inquiry II*.[127]

These examples illustrate some of the efficiency losses associated with attempting to regulate vertical exclusion in telecommunications. Technological developments can cause interfaces that were once natural points of separation between companies to shift or collapse. These costs render all the more attractive the regulatory alternative of eliminating the problems of vertical exclusion by promoting facilities-based competition rather than by attempting to mandate structural separation and equal access.

D. Ruinous/Managed Competition

Firms competing in industries characterized by high fixed costs have long raised the specter that the market will devolve into a form of ruinous

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125. *Computer III Phase I Order*, *supra* note 32, at 1112-14 paras. 313-17.

126. Jerry A. Hausman, *Valuing the Effect of Regulation on New Services in Telecommunications*, *in* BROOKINGS PAPERS IN ECON. ACTIVITY, MICROECONOMICS: 1997 1, 14-15 (Clifford Winston, Martin N. Baily & Peter C. Reiss eds., 1997).

127. *See* Implementation of the Non-Accounting Safeguards of Secs. 271 and 272 of the Comm. Act of 1934, *First Report and Order and Further Notice of Proposed Rulemaking*, 11 F.C.C.R. 21905, 21955-58 paras. 100-05 (1996) [hereinafter *Non-Accounting Safeguards Order*], *aff'd sub nom.* Bell Atl. Tel. Cos. v. FCC, 131 F.3d 1044 (D.C. Cir. 1997). *See also*, *Computer III Phase I Order*, *supra* note 32, at 1100-09 paras. 289-306; Petition for Waiver of Sec. 64.702 of the Comm'n's Rules, *Memorandum Opinion and Order*, 100 F.C.C.2d 1057 (1985) [hereinafter *Protocol Waiver Order*]; Petition of AT&T Co. for Limited & Temporary Waiver of 47 CFR Sec. 64.702 Regarding Its Provision of Unregulated Services Externally to the AT&T-C Network, *Memorandum Opinion and Order*, 59 Rad. Reg. 2d (P&F) 505 (1985) [hereinafter *AT&T Waiver Petition*]; Communications Protocols under Section 64.702 of the Comm'n's Rules and Regs., *Memorandum Opinion, Order and Statement of Principles*, 95 F.C.C.2d 584, 594 paras. 21-22, 595 para. 24 (1983) [hereinafter *Protocols Order*].

competition in which no firm can operate profitably.[128] Ruinous competition hypothesizes that once firms have sunk the fixed costs needed to enter, they will not exit so long as they can charge prices that cover their marginal costs. The resulting competition drives prices down to marginal cost, which in turn prevents firms from generating sufficient revenue to recover their fixed costs. To the extent that a market is a natural monopoly, entry by a second firm wastes resources because only one competitor will ultimately emerge, which necessarily means that any investment in laying a second set of wires will ultimately prove fruitless. Some sort of coordinated action, either through collusion or government regulation, was viewed as the only viable solution to endemic overproduction and eventual collapse into a natural monopoly.[129]

The Bell System raised the classic argument that entry by the independents had caused the industry to engage in ruinous competition. For example, in AT&T's Annual Reports, company president Fredrick P. Fish repeatedly complained that competition had driven rates too low to allow it to recover its fixed costs.[130] Theodore N. Vail picked up this refrain after he assumed the presidency of AT&T in 1907, complaining that "[d]uplication of plant is a waste to the investor" and that "[d]uplication of charges is a waste to the user."[131] Competition simply meant "the public must pay double rates for service, to meet double charges, on double capital, double operating expenses and double maintenance."[132] Concerns about the costs to consumers from wasteful duplication also appeared in the report of the Study that laid the foundation for the Communications Act of 1934.[133] The avoidance of wasteful duplication was reflected in the fact that the order breaking up AT&T made no attempt to promote competition in local telephone service[134] as well as the presumption inherent in the 1996 Act's UNE access provisions that some facilities needed to offer local telephone service would not be duplicated.[135]

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128. Daniel F. Spulber & Christopher S. Yoo, *Rethinking Broadband Internet Access*, 22 HARV. J.L. & TECH. (forthcoming 2008).

129. *See* New York v. United States, 331 U.S. 284, 346 (1947); Interstate Commerce Comm'n v. Inland Waterways Corp., 319 U.S. 671, 688 n.24 (1943); New State Ice Co. v. Liebmann, 285 U.S. 262, 292-94 (1932) (Brandeis, J., dissenting).

130. AT&T, 1904 Annual Report 10 (1905); AT&T, 1906 Annual Report 12 (1907).

131. AT&T, 1907 Annual Report 18 (1908).

132. *Id.*

133. STUDY OF COMMUNICATIONS BY AN INTERDEPARTMENTAL COMMITTEE, *supra* note 78, at 11-12.

134. United States v. W. Elec. Co., 673 F. Supp. 525, 537-38 (D.D.C. 1987).

135. AT&T Corp. v. Iowa Utils. Bd., 525 U.S. 366, 416-17 (1999) (Breyer, J., concurring in part and dissenting in part); *see also* Verizon Comm., Inc. v. FCC, 535 U.S. 467, 545 (2002) (Breyer, J., concurring in part and dissenting in part).

Ruinous competition has been heavily criticized as a basis for governmental intervention. The excess capacity caused by multiple firms' decisions to incur fixed costs simply causes incumbent firms to forego making any further capital investments until the market returns to long-run equilibrium. Although firms may suffer substantial losses in the short run, the ensuing competition would yield substantial welfare benefits to consumers in the form of lower prices, while simultaneously identifying the most efficient firm and providing for an empirical test of whether a particular market was in fact a natural monopoly. The only justification for intervention would be to protect the investors in these companies, which would violate the standard admonition that regulators should protect competition, not competitors. It is for this reason that then-Harvard law professor and now-Justice Stephen Breyer dismissed the rationale as an "empty box" with no particular economic meaning or content.[136] These criticisms have been echoed both by economists[137] and by the Supreme Court.[138]

These criticisms apply to the arguments advanced by AT&T. The duplication of costs, about which Vail complained, is an inevitable part of the market-based economy. As Richard Gabel noted in his landmark study of the early telephone industry, "[a]ll competition involves *some* redundancy of plant facilities and work effort. The question is whether the pressure of competing market forces produces a better or cheaper product than a single supply service."[139] As the independent telephone industry pointed out at the time, "'[w]hat forces the business man to take two telephones? The same thing that forces him to advertise his goods in two newspapers in a town instead of one—to reach the people.'"[140] A

136. BREYER, *supra* note 5, at 29-35.

137. *See, e.g.*, J.M. CLARK, STUDIES IN THE ECONOMICS OF OVERHEAD COSTS (1923); CARL KAYSEN & DONALD TURNER, ANTITRUST POLICY 195-97 (1959); F.W. TAUSSIG, 2 PRINCIPLES OF ECONOMICS 53-54 (3d ed. 1922); John Maurice Clark, *A Contribution to the Theory of Competitive Price*, 28 Q.J. ECON. 747 (1914); F.H. Knight, *Cost of Production and Price Over Long & Short Periods*, 29 J. POL. ECON. 304 (1921); Roger G. Noll, *Economic Perspectives on the Politics of Regulation*, *in* 2 HANDBOOK OF INDUSTRIAL ORGANIZATION 1253, 1257 (Richard Schmalensee & Robert D. Willig eds., 1989).

138. *See* Arizona v. Maricopa County Med. Soc'y, 457 U.S. 332, 346 (1982); Nat'l Soc'y of Prof'l Eng'rs v. United States, 435 U.S. 679, 689-90 (1978); United States v. Container Corp. of Am., 393 U.S. 333, 338 n.4 (1969); Fashion Originators' Guild of Am. v. Fed. Trade Comm'n, 312 U.S. 457 (1941); United States v. Socony-Vacuum Oil Co., 310 U.S. 150, 220-24 (1940); United States v. Trans-Mo. Freight Ass'n, 166 U.S. 290 (1897). *But see* Appalachian Coals, Inc. v. United States, 288 U.S. 344 (1933) (holding that competing coal producers could form an agreement to promote efficiency so long as the intent was not to unreasonably restrain trade), *overruled by* Copperweld Corp. v. Indep. Tube Corp., 467 U.S. 752 (1984).

139. Gabel, *supra* note 105, at 342.

140. MUELLER, *supra* note 82, at 95 (quoting 11 TELEPHONY (June 1906)).

newspaper monopoly would obviate the need for placing advertisements in multiple newspapers, but at the cost of lower circulation and higher prices.

The evidence suggests that, on balance, competition provided significant benefits to consumers. Subscribers who purchased service from both the Bell System and the independent were able to obtain access to five to ten times the number of subscribers for a total price that was roughly the same or less than that paid during the monopoly period.[141] At the same time, the benefits from eliminating competition in favor of unified service provided through a single telephone network were attenuated by the fact that most telephone subscribers only sought to communicate with a relatively small group of other people. Indeed, as we have explained in detail elsewhere, heterogeneity of consumer preferences can render equilibrium with multiple incompatible systems optimal.[142] Most customers needed only to purchase one service, as groups tended to segregate themselves into discrete user communities clustered on one phone system or the other. As a result, the benefits of unifying these systems would be minimal, and even those benefits could be easily realized by using public pay phones or the free phone service provided by bars and other local merchants.[143] Thus, the elimination of competition provided few benefits to consumers.

Instead, the Bell System's arguments are better understood as part of what Gabel has described as a deliberate "flight from competition."[144] By 1907, the corporate leadership of the Bell System acknowledged that its initial strategy of trying to expand its network, cut rates, and refuse to interconnect with the independents was a colossal failure. The price cuts had a devastating effect on the Bell System's profitability, with revenue dropping from $88 per subscriber in 1905 to $43 per subscriber in 1907.[145] Establishing local telephone service in the areas it did not yet serve required enormous amounts of capital, which the Bell System struggled to raise. Committed as it was to a business strategy centered on long-distance service, service provided by the Bell System required higher quality equipment, which in turn made its local telephone networks more costly than the independents'. In contrast, the independent companies were able to construct systems at lower costs, financed largely by local sources of capital raised by local residents who were able to leverage preexisting

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141. MUELLER, *supra* note 82, at 94; Bornholz & Evans, *supra* note 109, at 30; Weiman & Levin, *supra* note 82, at 123-24.

142. Yoo, *Beyond Network Neutrality*, *supra* note 124, at 27-37.

143. BROCK, TELECOMMUNICATIONS INDUSTRY, *supra* note 98, at 110; MUELLER, *supra* note 82, at 82-85.

144. Gabel, *supra* note 105, at 358.

145. FCC, INVESTIGATIONS OF THE TEL. INDUS. IN THE UNITED STATES, H.R. Doc. No. 76-340, at 133 (1939).

business relationships. Interconnecting with adjacent local systems allowed the independent telephone companies to establish regional long-distance networks that were just as effective for short-haul toll calling as the Bell System.[146]

Spurred into a race for the market, both the Bell System and the independents began investing heavily in expanding their networks. Annual growth rates, which had been languishing at around six percent during the monopoly period, skyrocketed to over twenty percent during the competitive era.[147] As noted earlier, by 1907 the independent telephone industry had achieved parity with the Bell System and competed with Bell in fifty-nine percent of cities.[148] At this point, if the independents coordinated their activity, they could have defeated whatever advantage AT&T might have gained by its refusal to interconnect simply by banding together to make a network of equal size.[149]

The failure of its initial response led the Bell System to switch strategies in 1907, when the New York-based Baker-Morgan banking interests took control from the Boston-based Forbes family and replaced company president Frederick Fish with Theodore Vail.[150] The Bell System stopped trying to outbuild the independents and instead attempted to co-opt them through a pair of classic anticompetitive tactics. The first was merger to monopoly, in which the Bell System offered to buy out key competing systems. If the independent refused, the fallback strategy was division of markets, in which the Bell System agreed to withdraw from the independent telephone company's service area in return for the independent's promise to restrict its activities to a "small and compact" territory and its agreement to interconnect exclusively with the Bell System's long-distance network. The Bell System combined these classic anticompetitive strategies with an aggressive public relations campaign emphasizing the inconvenience and wasteful duplication associated with maintaining two different telephone systems and the benefits of being able to contact all telephone subscribers through a single network.[151] The primary downside to the disappearance of competition would be the simultaneous disappearance of downward pressure on rates. Vail's response to this concern was to drop Bell's longstanding opposition to

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146. MUELLER, *supra* note 82, at 70; Gabel, *supra* note 105, at 345-46; *see also* Weiman & Levin, *supra* note 82, at 109-23.

147. Gabel, *supra* note 105, at 350 tbl.4.

148. MUELLER, *supra* note 82, at 111-12.

149. *See* Noll & Owen, *supra* note 102, at 291-92.

150. Gabel, *supra* note 105, at 355.

151. MUELLER, *supra* note 82, at 76-80, 93-94, 107-13; Weiman & Levin, *supra* note 82, at 118-21.

government intervention and instead to endorse direct regulation of telephone rates.[152]

The primary beneficiary of unified service and the concomitant elimination of price competition would not be consumers, but rather the shareholders of the Bell System. Unification of local telephone service also benefited those classes of business that depended on the ability to contact regional and national business centers, such as banks, railroads, hotels, and wholesale suppliers, and thus were the only customers who felt compelled to purchase service from both the Bell System and the independents. Unified service provided few benefits to small businesses and residences, which placed a substantially lower value on the ability to contact a broader range of people.[153] For example, in the case of Norfolk, Virginia, the Bell System's acquisition of the independent allowed the 700 business customers who purchased both services to reduce their monthly charges by twenty-five percent.[154] The 2,100 business customers who previously only purchased one service would pay higher rates, an increase of twenty percent for customers served by Bell prior to the merger and an increase of one hundred percent for customers previously served by the independent.[155]

It was the business users that subscribed to both systems that provided the key political support for the government's eventual acquiescence in the return of monopoly. After some initial resistance, the independents decided to cooperate with the Bell System's efforts. Having already built out much of the unserved areas of the country, the independents had faced a transition to the far more demanding strategy of pursuing more intensive development of established markets. Bell mergers with selected independents also fragmented their ability to provide short-haul long-distance service by directly interconnecting adjacent exchanges, until the Bell System's so-called Vail Commitment of 1912, which promised to leave unchanged the independent toll-line connections already established by any acquired company. The independents' efforts to establish their own long-haul long-distance network were hampered by the fact that they were not a unified enterprise, which made coordination difficult and left them vulnerable to divide-and-conquer strategies, in addition to the Morgan banking interests' ability to persuade key players to withdraw their financial support for the independents' efforts to establish their own long-

152. AT&T, 1907 Annual Report at 18-19 (1908); AT&T, 1910 Annual Report at 23, 32-33 (1911); Theodore N. Vail, *Public Utilities and Public Policy*, ATLANTIC MONTHLY, Mar. 1913, at 307, 311; FCC, INVESTIGATIONS OF THE TEL. INDUS. IN THE UNITED STATES, H.R. Doc. No. 76-340, at 133 (1939).

153. MUELLER, *supra* note 82, at 83-84, 99-100; Robinson, *supra* note 17, at 6-7; Gabel, *supra* note 105, at 355-58.

154. Weiman & Levin, *supra* note 82, at 123.

155. *Id.*

distance network. Faced with dim prospects, the independents realized that merger with the Bell System was their best option.[156]

This change in strategy reversed the downward trend in the Bell System's market share. The number of noncompeting independent telephone systems that had accepted the Bell System's offer of accommodation jumped from twenty-five percent to seventy-nine percent between 1907 and 1909, and rose to eighty-nine percent by 1913.[157] The number of cities with a population over 5,000 in which competition existed plummeted from fifty-nine percent in 1907 to thirty-seven percent in 1913.[158] By 1934, the Bell System's market share had once again reached eighty percent.[159] With a few exceptions, the independent companies that remained, for the most part, served discrete areas in which the Bell System did not operate.

Thus, monopoly was not the justification for regulation. Regulation was instead the justification for monopoly. Regulation, moreover, proved ineffective at curbing rates. Consider state regulation of intrastate rates. Debates over the proper method for determining the rate base prevented state regulatory authorities from developing a coherent basis for setting rates. The complexity of the corporate structure, in which the parent company owned the operating companies and rented telephone equipment to them through Western Electric, made it difficult for individual state authorities to discern each operating company's actual financial results, let alone regulate their profits. The regulatory challenge was made all the more difficult by the fact that state commissions were almost completely dependent on the Bell System for the information they needed and that the parent company was regulated at the federal level, while the operating companies were regulated at the state level and Western Electric was not regulated at all.[160] Thus, even histories of the early telephone industry that are largely sympathetic to the Bell System understood that "regulation, coming late and still almost non-existent in several of the States, has had relatively little effect in influencing the growth and financial success of the Bell telephone system."[161]

Federal regulation of interstate rates was similarly unsuccessful. In the words of Gerald Brock, "[t]he early FCC was an ideal regulatory

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156. MUELLER, *supra* note 82, at 75-76, 78-79, 109-13; Bornholz & Evans, *supra* note 109, at 16-17, 28; Gabel, *supra* note 105, at 350, 353-54, 357; Weiman & Levin, *supra* note 82, at 122-24.

157. MUELLER, *supra* note 82, at 110.

158. *Id.* at 111-12.

159. BROCK, TELECOMMUNICATIONS INDUSTRY, *supra* note 98, at 174.

160. 1934 House Hearings, *supra* note 17, at 69 (statement of Paul Walker); BROCK, TELECOMMUNICATIONS INDUSTRY, *supra* note 98, at 159-61.

161. STEHMAN, *supra* note12, at 262.

agency from AT&T's perspective. It provided very little control or restriction on AT&T's interstate rates and activities but it did help prevent competition from arising."[162] For the first three decades following the enactment of the 1934 Act, the FCC failed to undertake any formal investigations or to create any systematic basis for evaluating the reasonableness of AT&T's rates. Instead, the FCC engaged in a system of "continuing surveillance," in which long-distance rates were established through informal negotiations between AT&T and the agency.[163]

The experience of the early telephone industry eloquently demonstrates why the conventional economic wisdom now rejects ruinous competition as the basis for regulation. Eventually, regulated monopoly was justified by the ability to use cross-subsidies to support providing service in areas that would not otherwise have service. Although the conventional wisdom holds that promoting universal service in this manner was an objective since the enactment of the Communications Act of 1934,[164] such cross-subsidies were not mentioned during the legislative deliberations over the Act and did not emerge until the 1970s, when AT&T began to face competition from new long-distance providers. The timing suggests that relying on cross-subsidies is again better understood as a flight from competition rather than as a principled justification for regulated monopoly.[165]

Although policymakers have rejected ruinous competition as a justification for using regulation to eliminate competition altogether, they have attempted to manage competition for the purpose of facilitating entry. For example, the FCC has long imposed asymmetric regulation that subjected incumbents to rate regulation even after competition had emerged, while refusing to subject new entrants to the same strictures.[166] The FCC was concerned that as long as the incumbent remained dominant, it continued to possess sufficient market power to offer supracompetitive prices. The advent of competition provided an additional twist, however, that made rate regulation even more difficult to enforce. The FCC was also concerned that dominant carriers might engage in predatory pricing.

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162. Gerald W. Brock, *Historical Overview*, *in* 1 HANDBOOK OF TELECOMMUNICATIONS ECONOMICS 43, 53 (Martin E. Cave et al. eds., 2002).

163. *Id.*

164. *See, e.g.*, STUDY OF COMMUNICATIONS BY AN INTERDEPARTMENTAL COMMITTEE, *supra* note 72, at 9; BONBRIGHT, *supra* note 84, at 114-15, 383 n.27; TEMIN, *supra* note 22, at 16.

165. MUELLER, *supra* note 82, at 150-64.

166. *See generally* Scott M. Schoenwald, *Regulating Competition in the Interexchange Telecommunications Market: The Dominant/Nondominant Carrier Approach and the Evolution of Forbearance*, 49 FED. COMM. L.J. 367 (1997) (providing an overview of the FCC's rulings on dominance/nondominance).

Regulators were thus simultaneously concerned that dominant firms might charge prices that were either too high or too low.[167]

The most prominent example of asymmetric rate regulation was with respect to long distance during the 1980s, during which time competition was just beginning to become established.[168] For example, until 1987, the FCC required AT&T to pay access charges to local telephone companies that were fifty-five percent higher than those paid by other long-distance carriers.[169] In addition, the FCC exempted new long-distance companies, such as MCI and Sprint, from most tariffing requirements, while continuing to subject AT&T to rate regulation until its dominance over the long-distance market dissipated in 1995.[170] The courts invalidated the FCC's detariffing decisions, ruling that the agency lacked the power to exempt any long-distance carriers from rate regulation.[171] The 1996 Act gave the FCC the discretion to forbear from enforcing regulations it found to be unnecessary to protect consumers or to promote the public interest.[172] The FCC exercised this new authority to forbear from enforcing the tariffing requirements against long-distance carriers, a ruling that was eventually upheld by the courts.[173]

In addition, the FCC also attempted to facilitate entry by new long-distance companies by requiring AT&T to lease portions of its long-distance network to its competitors. Although the FCC initially invoked a number of different rationales, the concern that has emerged as the most

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167. Policy and Rules Concerning Rates for Competitive Common Carrier Servs. & Facilities Authorizations Therefor [sic], *First Report and Order*, 85 F.C.C.2d 1, 21 para. 56 (1980).

168. Indeed, some commentators have suggested that the FCC's regulatory efforts did more to promote long-distance competition than did technological change. These scholars argue that by the time of the breakup of AT&T, fiber optics had replaced microwave as the primary technology for long-distance transmission. Because this is essentially a wireline technology, it once again bore the natural monopoly characteristics. *See* PAUL W. MACAVOY, THE FAILURE OF ANTITRUST AND REGULATION TO ESTABLISH COMPETITION IN LONG-DISTANCE TELEPHONE SERVICE 93-98 (1996); Peter W. Huber, *Telephone Competition, and the Candice-Coated Monopoly*, REGULATION, Mar.-Apr. 1993, at 34; Paul W. MacAvoy & Kenneth Robinson, *Wining by Losing: The AT&T Settlement and Its Impact of Telecommunications*, 1 YALE J. ON REG. 1, 31 (1983).

169. MTS and WATS Market Structure, *Memorandum Opinion and Order*, 97 F.C.C.2d 834, 860-62 paras. 78-88 (1984), *aff'd in relevant part sub nom.* Nat'l Ass'n of Regulatory Util. Comm'rs v. FCC, 737 F.2d 1095 (D.C. Cir. 1984).

170. Motion of AT&T Corp. to Be Reclassified as a Non-Dominant Carrier, *Order*, 11 F.C.C.R. 3271 (1995).

171. MCI Telecomms. Corp. v. AT&T Co., 512 U.S. 218 (1994); AT&T Co. v. FCC, 978 F.2d 727 (D.C. Cir. 1992); MCI Telecomms. Corp. v. FCC, 765 F.2d 1186 (D.C. Cir. 1985).

172. 47 U.S.C. § 160 (2000).

173. Policy and Rules Concerning the Interstate, Interexchange Marketplace, *Second Report and Order*, 11 F.C.C.R. 20730 (1996), *clarified*, 12 F.C.C.R. 20787 (1997), *aff'd sub nom.* MCI WorldCom, Inc. v. FCC, 209 F.3d 760 (D.C. Cir. 2000).

important was that the capital requirements needed to establish long-distance service might impede new entrants from offering nationwide service from the outset, which in turn made it more difficult for new entrants to compete with AT&T. The FCC therefore imposed regulations providing new entrants with access to portions of AT&T's network to fill in the transitional coverage gaps that existed as they built out their networks in the hope that new entrants would use access as a stepping stone to true facilities-based competition.[174] Congress and the FCC also invoked this rationale to justify the provisions of the 1996 Act mandating access to local telephone networks.[175]

As we discussed in our earlier work, access requirements can be quite problematic from the standpoint of both dynamic efficiency and administrability.[176] As Justice Breyer noted in his separate opinion in *Iowa Utilities Board*:

> [A] sharing requirement may diminish the original owner's incentive to keep up or to improve the property by depriving the owner of the fruits of value-creating investment, research, or labor. . . . [One cannot] guarantee that firms will undertake the investment necessary to produce complex technological innovations knowing that any competitive advantage deriving from those innovations will be dissipated by the sharing requirement.[177]

A majority of the Supreme Court later echoed Justice Breyer's concerns about access requirements' impact on the incumbents' incentives to reinvest in their network in its 2004 *Trinko* decision.[178] In so doing, the Court added the additional concern that enforced sharing also deterred investment by potential new entrants as well, warning that "[c]ompelling such firms to share the source of their advantage . . . may lessen the incentive for the monopolist, the rival, or both to invest in those economically beneficial facilities."[179]

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174. Reg. Policies Concerning Resale & Shared Use of Common Carrier Domestic Public Switched Network Services, *Report and Order*, 83 F.C.C.2d 167, 181-82 para. 32, (1980), *aff'd sub nom.* S. Pac. Comm. Co. v. FCC, 682 F.2d 232 (D.C. Cir. 1982). *See generally* HUBER, KELLOGG & THORNE, *supra* note 2, § 9.4.2.

175. S. REP. NO. 104-230, at 147 (1996) (Conf. Rep.); Local Competition Order, *supra* note 50, at 15509 para. 12; Verizon Comm., Inc. v. FCC, 535 U.S. 467, 491-92 (2002).

176. *See* Yoo, *Vertical Integration*, *supra* note 93, at 244-47, 268-69; Spulber & Yoo, *Access to Networks*, *supra* note 30, at 896-97, 931-33, 970-76.

177. AT&T Corp. v. Iowa Utils. Bd., 525 U.S. 366, 428-29 (1999) (Breyer, J., concurring in part & dissenting in part) (citation omitted); *accord Verizon*, 535 U.S. at 550-51 (Breyer, J., concurring in part & dissenting in part) (noting that compelling incumbents to share the cost-reducing benefits of a successful innovation destroys the incumbent's incentives to innovate in the first place).

178. Verizon Comm., Inc. v. Law Offices of Curtis V. Trinko, 540 U.S. 398 (2004).

179. *Id.* at 407-08.

The concerns identified by the Supreme Court underscore the extent to which access requirements mandate that regulators strike a very delicate balance. If access prices are set too high, no one will avail themselves of the opportunity, and mandating access will simply impose costs without providing any corresponding benefits. If access prices are set too low, new entrants will forego facilities-based investment and will instead simply take advantage of the pricing offered through regulation. Investment distortions can only be avoided if access prices are set at the precise level that would mimic competitive outcomes. Establishing what those prices would be is extremely difficult in the absence of external, unregulated markets that can serve as benchmarks. It is also difficult when regulators are dependent on the regulated entity for most of their information, as is often the case in local telephony. Moreover, pricing challenges are likely to be particularly problematic in industries that are technologically dynamic.

A growing empirical literature confirms that the access requirements imposed by the 1996 Act have failed to promote investment in new local telephone facilities or that new entrants have used access regulation as a stepping stone toward full facilities-based competition.[180] The consequence is that a growing number of advocates who previously supported mandating access to telecommunications networks have become increasingly skeptical that doing so will provide any substantial economic benefits.[181]

IV. THE DIFFERENT TYPES OF ACCESS TO LOCAL TELEPHONE NETWORKS

Another major problem with the current approach to regulating access to local telephone networks is the absence of any theory of network

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180. *See generally* Augustin J. Ros & Karl McDermott, *Are Residential Local Exchange Prices Too Low?*, *in* EXPANDING COMPETITION IN REGULATED INDUSTRIES 149 (Michael A. Crew ed., 2000); Robert W. Crandall. Allan T. Ingraham & Hal J. Singer, *Do Unbundling Policies Discourage CLEC Facilities-Based Investment?*, 4 TOPICS IN ECON. ANALYSIS & POL'Y 14 (June 7, 2004), *available at* http://www.bepress.com/bejeap/topics/vol4/iss1/art14/; Jerry A. Hausman & J. Gregory Sidak, *Did Mandatory Unbundling Achieve Its Purpose? Empirical Evidence from Five Countries*, 1 J. COMPETITION L. & ECON. 173 (2005); Thomas W. Hazlett, *Rivalrous Telecommunications Networks With and Without Mandatory Sharing*, 58 FED. COMM. L.J. 477 (2006); James Zolnierek, James Eisner & Ellen Burton, *An Empirical Examination of Entry Patterns in Local Telephone Markets*, 19 J. REG. ECON. 143 (2001); Robert S. Pindyck, Mandatory Unbundling and Irreversible Investment in Telecom Networks (Nat'l Bureau of Econ. Research, Working Paper No. 10287, 2004), http://www.nber.org/papers/w10287.pdf; James Eisner & Dale E. Lehman, Regulatory Behavior and Competitive Entry (2001) (unpublished manuscript presented at the 14th Annual Western Conference, Center for Research in Regulated Industries), http://www.aestudies.com/library/elpaper.pdf.

181. *See, e.g.*, Paul L. Joskow & Roger G. Noll, *The Bell Doctrine: Applications in Telecommunications, Electricity, and Other Network Industries*, 51 STAN. L. REV. 1249 (1999).

configuration. As noted earlier, the current cost-based approach has the effect of treating each network element as if it existed in a vacuum without taking into account the interactions between individual elements that can cause networks to behave in unpredictable ways. The lack of a theory of network configuration makes it impossible to assess how altering the costs of particular elements and introducing additional flows into a network can change optimal network design, network capacity, and network reliability. It also obscures the fact that different types of access can have drastically different effects on transaction costs.

In this Part, we employ a conceptual framework that we have developed based on a branch of mathematics known as graph theory to analyze access to local telephone networks. Our approach captures one of networks' key attributes: the manner in which they can compensate for changes by rerouting traffic in other ways. This causes networks to behave like complex systems that cannot be understood by considering their individual components in isolation.

Graph theory reduces networks into two types of elements.[182] "Nodes" are points from which network flows begin, end, or are redirected. Nodes are connected by "links." The nodes in a last-mile broadband network include the servers that provide Internet applications and content, the host computers operated by the end-users who are the ultimate consumers of applications and content, and the routers in the middle of the network that determine along which path particular traffic will flow. The links in a last-mile broadband network are the wires (or, in the case of wireless Internet, the spectrum channels) that interconnect these servers, host computers, and routers. The cost, capacity, and location of each link and node can vary.

Depicting networks as systems of links and nodes makes it possible to analyze how to design networks to deliver the highest levels of performance at the lowest cost. For example, the architecture that connects all of the nodes in a network with the fewest links is known as a "spanning tree." For a network of n nodes, there exist n^{n-2} possible spanning trees, where n is greater than or equal to two.[183] Algorithms exist that make it possible to sort through all of the possible spanning trees to identify the "minimum spanning tree," which is the network design that connects all of the nodes in the network at the least cost.[184] In addition, network owners

182. For our initial discussion of these principles, see Spulber & Yoo, *Graph Theory Approach*, *supra* note 9, at 1693-1707.

183. *See* Arthur Cayley, *A Theorem on Trees*, 23 Q.J. PURE & APPLIED MATHEMATICS 376 (1889).

184. *See, e.g.*, R.C. Prim, *Shortest Connection Networks and Some Generalizations*, 36 BELL SYS. TECH. J. 1389 (1957).

have the option of deploying higher-volume server or transmission technologies if the reduction in variable cost and improvement in performance is large enough to justify incurring the additional capital expense. Together, these concepts help determine the least-cost architecture for delivering different amounts of network capacity.[185]

Network performance is determined not only by its cost and capacity; it also depends on the network's reliability, typically measured by its ability to guarantee certain minimum levels of bandwidth. One of the limitations of cost-minimizing architectures like minimum spanning trees is that every pair of nodes is connected by a single path. As a result, cost-minimizing architectures are vulnerable to congestion because the saturation of any network element will force the packets into a queue. The resulting delays will necessarily degrade network performance. Ensuring minimum levels of reliability becomes more difficult as the variability of the relevant traffic flows increases. Network owners can increase network reliability by adding additional links that create "cycles," which exist when more than one path connects two nodes. Although the introduction of such redundancy increases network cost, it also promotes network reliability by allowing traffic to be rerouted along different paths if any particular pathway becomes congested.[186]

Analyzing networks in this manner permits network owners to choose architectures that deliver the levels of network capacity and reliability that customers demand at the lowest cost. Mandating access to the network can adversely affect each of these dimensions. For example, access mandates can alter the volume and patterns of network traffic, either by introducing new additional traffic into the network or by diverting traffic outside the network until the network owner no longer finds it beneficial to employ higher-volume, cost-reducing technologies. In addition, certain types of access can reduce the effective capacity of particular network elements by occupying some of its functionality. The net effect can alter the costs of operating the network as well as the network's optimal configuration.[187]

Graph theory also shows how networks can ameliorate some of these problems. To the extent that some resources are slack, the network can reroute traffic along other pathways to compensate for any unexpected changes in network volume or network element capacity. Redirecting traffic in this manner can increase the cost of operating the network and can increase congestion, thereby degrading network performance in those portions of the network through which traffic is rerouted—even in areas of the network that may be located far from the node from which access is

185. *See* Spulber & Yoo, *Graph Theory Approach*, *supra* note 9, at 1701-03.
186. *See id.* at 1699-1701.
187. *See id.* at 1698-99, 1709, 1717.

sought. Graph theory thus demonstrates how imposing an access requirement can have a dramatic impact on portions of the network that are discontinuous with the portion of a network affected by the access requirement. In so doing, it reflects the insight that networks are complex systems that can only be understood by taking into account the relationship between each component, as well as the projected traffic flows.[188]

As a theoretical matter, graph theory could be used as a basis for calculating prices directly based on the capacity of each network element and the flows being introduced into the system.[189] The multidirectional nature of the traffic flows in a local telephone network renders direct calculation of the resulting prices intractable.

To say that graph theory cannot be used to generate prices does not mean that it might not yield valuable intuitions. For example, graph theory can model how different types of access can have a different impact on transaction costs. According to the Coasean theory of the firm, every entity decides whether to perform particular production functions internally or to contract them out based on which solution minimizes transaction costs.[190] Access mandates disrupt the firm's natural boundaries by forcing the network to externalize functions that it would otherwise perform internally. In addition, the fact that access necessarily presupposes that some traffic will originate and terminate outside of the network will make it more difficult for the network owner to obtain the information about projected network flows needed to determine the optimal network design. The fact that this information is held by the network owner's competitors also raises the possibility that the party seeking access may attempt to use that information to its own strategic advantage.

Many of the insights on how mandating network access affects network costs, capacity, reliability, and transaction costs can be captured by classifying access regimes into the five categories depicted in Figure 1: (1) retail access, (2) wholesale access, (3) interconnection access, (4) platform access, and (5) unbundled access. Network components owned and operated by the network are represented as solid lines and nodes. The portions of the network obtained through access requirements are depicted by dotted lines.[191]

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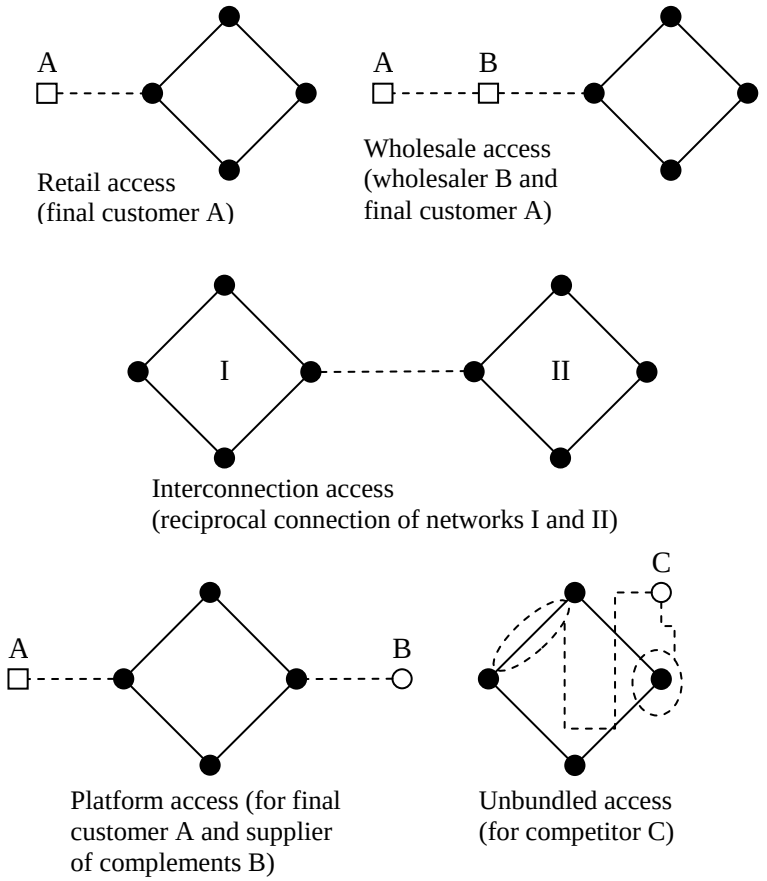
188. *See id.* at 1705-06, 1710-11.

189. *See id.* at 1719-21.

190. *See* R.H. Coase, *The Theory of the Firm*, 4 ECONOMICA 386, 394-98 (1937).

191. Figure 1 was originally printed in Spulber & Yoo, *Graph Theory Approach*, *supra* note 9, at 638-39.

Figure 1. The Five Forms of Access to Networks



The categories vary with the type of entity (e.g., customers, competitors, or providers of complementary services), as well as the extent of the network to which access is provided. A close analysis of the different types of access reveals that each has a different impact on network demand, cost, configuration, capacity, reliability, and transaction costs. A better understanding of how the impact of each type of access varies provides insights into the relative costs and benefits associated with each type of access.

A. Retail Access

Retail access represents perhaps the most common form of access imposed on telecommunications providers.[192] It provides every end-user the right to benefit from the network's services on the same terms and conditions as other end-users. While the FCC has largely deregulated retail access for *interstate* services, state public utility commissions have continued to mandate retail access to *local* telephone networks. Although new carriers are often allowed to pick and choose among their customers, the incumbent local telephone company is typically designated the "carrier of last resort" and is unable to deny service to anyone who requests it. Because carriers could render retail access a nullity simply by charging exorbitant prices, retail access is generally accompanied by direct regulation of retail rates.[193]

Retail access interferes with a network owner's ability to manage its network. Network owners configure their network based on the predicted level of network demand to provide service that satisfies consumers' expectations about reliability at the least cost. Unanticipated increases in demand leaves the network owner with the option of increasing network capacity, refusing to accept new customers, rationing demand by increasing prices, or by bringing demand back into line with supply by allowing service to degrade. Although expanding network capacity remains the best long-term solution, the simple reality that network capacity cannot be expanded instantaneously means that that option may not be a short-run option. Retail access has the effect of foreclosing the second and third solutions by preventing the network owner from refusing customers and by limiting the prices it can charge.

In addition, designating the incumbent as the carrier of last resort gives rise to a moral hazard problem that has been termed "the return of the 'prodigal son.'"[194] In effect, retail access creates the possibility that a customer that leaves the incumbent for a competitor might return, in which case the incumbent would have no choice but to provide service. An incumbent whose customers demand certain levels of quality will thus have to maintain excess capacity as insurance against this possibility. The resulting distortion in the optimal network configuration requires the incumbent to cross-subsidize its competitors. More importantly, by forcing

192. For a more complete exposition on retail access, see *id.* at 639-40, 647-50, 661-62.

193. *See id.* at 639-40; Daniel F. Spulber & Christopher S. Yoo, *Mandating Access to Telecom and the Internet: The Hidden Side of* Trinko, 107 COLUM. L. REV. 1822, 1878-79 (2007).

194. J. GREGORY SIDAK & DANIEL F. SPULBER, DEREGULATORY TAKINGS AND THE REGULATORY CONTRACT 125-26 (1997).

the network owner to deviate from the optimal network configuration, retail access inevitably results in a cost increase.

The rate regulation inevitably associated with retail access has raised additional implementation problems. Regulators have traditionally used a cost-of-service approach according to the following formula:

$$R = O + Br$$

where R is the total revenue the carrier is allowed to generate, O is the carrier's operating expenses on which the carrier is not allowed to earn a rate of return (such as taxes, wages, energy costs, and depreciation), B is the rate base of capital investment on which the carrier is allowed to earn a rate of return, and r is the appropriate rate of return. The rates are then determined by dividing the total revenue that the carrier is allowed to earn by the number of units consumers are expected to demand.

Although this formula is easy to state, regulators and courts have long recognized that it is exceedingly difficult to apply. As an initial matter, determining the appropriate rate of return has proven quite difficult because such a determination depends on identifying other ventures bearing similar risk. This determination is complicated by the fact that small differences in rates of return can have dramatic effects on the total revenue that the carrier is allowed to generate.

Determining the proper rate base has also proven to be a significant regulatory challenge. Ratemaking authorities initially calculated the rate base as "fair value," usually conceived as the replacement cost of the network, which allowed the rate base to reflect changes in value.[195] The problem was that replacement cost was difficult to administer, typically devolving into a battle between experts. Determining how much particular configurations of network elements would cost on the current market raised difficult problems of proof. In addition, changes in demand and technology would often render particular facilities obsolete or would imply a very difficult network configuration. The fair value approach left unclear whether the rate base would be based on the reproduction cost of the network as actually configured or of a hypothetical network configured in the most efficient manner. The Supreme Court has called calculating the appropriate rate base an "embarrassing question"[196] as well as a "laborious and baffling task."[197]

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195. Although using replacement cost as the rate base is associated with Smyth v. Ames, 169 U.S. 466, 546 (1898), it did not become clearly established until the next year in San Diego Land & Town Co. v. City of National City, 174 U.S. 739, 757 (1899). *See generally* Stephen A. Siegel, *Understanding the* Lochner *Era: Lessons from the Controversy Over Railroad and Utility Rate Regulation*, 70 VA. L. REV. 187, 227-31 (1984).

196. *Smyth*, 169 U.S. at 546.

197. Missouri *ex rel*. Sw. Bell Tel. Co. v. Pub. Serv. Comm'n, 262 U.S. 276, 292 (1923) (Brandeis, J., concurring in the judgment).

The speculative nature of determining replacement cost led Justice Brandeis to propose basing the rate base on historical cost.[198] While recognizing that historical cost was less economically suited to reflecting changes in value, it had the virtue of being easier to administer. At the same time, this approach limited the rate base to investments that were "prudent," a determination that tends to be fraught with hindsight bias.[199] Regulators and courts have struggled with the proper methodology for calculating the rate base ever since.[200]

Cost-of-service ratemaking also induces a number of systematic inefficiencies. As an initial matter, cost-plus pricing regimes give firms little incentive to economize. Firms, moreover, are allowed to earn a rate of return on capital expenses, but not on operating expenses. Most firms usually have the choice to use production processes that are more or less capital intensive. The ratemaking methodology discussed above thus introduces a bias in favor of capital-intensive solutions, even when other solutions would be more efficient.[201] Some regulators have attempted to eliminate these distortions by introducing price-cap regulation, in which the prices firms are allowed to charge do not depend on actual costs. Determining initial price levels and price adjustments in subsequent years has proven to be extremely difficult.[202] The empirical literature is divided on whether price caps lead to lower or higher rates.[203]

Retail access can also dull competitive forces in other ways. The filing of tariffs requires local telephone companies to give their competitors advance notice of any changes in strategy. In addition, collusion is easier to maintain when products are undifferentiated and when the prices charged are visible. The tariffing process serves both of these functions and even

198. *Id.* at 293-95 & 294 n.6.

199. *Id*.

200. *See* Siegel, *supra* note 195, at 224–59 (tracing the history of the battle over proper way to calculate cost for ratemaking purposes).

201. *See* Harvey Averch & Leland L. Johnson, *Behavior of the Firm Under Regulatory Constraint*, 52 AM. ECON. REV. 1053 (1962).

202. *See, e.g.*, U.S. Tel. Ass'n v. FCC, 188 F.3d 521, 524-27 (D.C. Cir. 1999); Jeffrey I. Bernstein & David E. Sappington, *Setting the X Factor in Price-Cap Regulation Plans*, 16 J. REG. ECON. 5 (1999); Gregory J. Vogt, *Cap-Sized: How the Promise of the Price Cap Voyage to Competition Was Lost in a Sea of Good Intentions*, 51 FED. COMM. L.J. 349 (1999).

203. For studies concluding that price caps lead to lower rates, see Robert Kaestner & Brenda Kahn, *The Effects of Regulation and Competition on the Price of AT&T Intrastate Telephone Service*, 2 J. REG. ECON. 363 (1990); Alan D. Mathios & Robert P. Rogers, *The Impact of Alternative Forms of State Regulation of AT&T on Direct-Dial, Long-Distance Telephone Rates*, 20 RAND J. ECON. 437 (1989). For studies concluding the contrary, see Jaison R. Abel, *Entry into Regulated Monopoly Markets: The Development of a Competitive Fringe in the Local Telephone Markets*, 45 J.L. & ECON. 289 (2002); Christopher R. Knittel, *Regulatory Restructuring and Incumbent Price Dynamics: The Case of U.S. Local Telephone Markets*, 86 REV. ECON. & STAT. 614 (2004).

places the state public utility commission in position to punish any deviations from the cartel price. Even absent overt collusion, standardizing products and increasing price transparency facilitates non-cooperative oligopolistic behavior as well.

Retail access can also foreclose welfare-enhancing forms of price discrimination.[204] When fixed costs are large relative to variable costs—as is traditionally the case in local telephone service—the average cost curve lies above the marginal cost curve over the entire industry output. Thus, any price that allows the network owner to cover its costs necessarily creates some degree of deadweight loss. Discriminatory pricing regimes, such as Ramsey pricing,[205] can ameliorate this deadweight loss by allocating a larger proportion of the fixed costs to those customers whose demand is most inelastic and allocating a smaller proportion to those customers who are most price sensitive. In fact, price discrimination can theoretically lead to efficient outcomes if fixed costs are allocated in perfect inverse proportion to elasticity of demand.

Retail access can also increase transaction costs. Historically, many of the transaction costs have been the direct costs of participating in the tariffing process. Retail access also increases transaction costs indirectly. As an initial matter, tariffing provides incentives for competitors to challenge rates even when those challenges are unlikely to succeed on the merits. To the extent that retail access requires that all customers pay uniform rates for uniform services, it also limits network owners' ability to customize their offerings to the needs of particular customers.

As noted earlier, retail access can also adversely affect the incentives for both incumbents and competitors to invest in network capacity. If retail access prices are set too high, they will have no effect. If retail access prices are set too low, competitors will find entry and expansion of their networks unremunerative because the regulated price will dampen customers' incentives to change networks. At the same time, low access prices reduce the incumbent's incentives to reinvest in their networks as well. The alternative is to follow the more orthodox mechanism of allowing the presence of short-run supracompetitive returns to signal competitors that the market is in long-run disequilibrium and to provide incentives for them to expand production. This mechanism can only function if retail access prices are set at market levels.

The best way to promote economic efficiency would be to base retail access rates on the price of local telephone service on the open market.

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204. Christopher S. Yoo, *Network Neutrality, Consumers, and Innovation*, 2008 U. CHI. LEGAL F. (forthcoming 2008).

205. *See* F.P. Ramsey, *A Contribution to the Theory of Taxation*, 37 ECON. J. 47, 58-59 (1927).

Although local telephone service has long been regarded as a natural monopoly in which direct competition is impossible, the emergence of platform competition has begun to provide a wide range of possible external markets that can serve as bases for determining market value. New entrants have followed the lead of the CAPs and have constructed fiber-optic networks that offer increasing competition with the network operated by the incumbent local exchange carriers (LEC).[206]

Even more importantly, providers of wireless telephone services have successfully emerged as direct competitors to the incumbent LECs. The FCC chose to deploy the first generation of wireless devices, comprised of analog cellular telephony, by only issuing two licenses per city, with one of those licenses automatically going to the incumbent LEC servicing that city.[207] As a result, wireless initially offered only modest improvements to the competitive environment. The arrival of second generation wireless devices, known as "personal communication services" (PCS), significantly increased the number of competitive options.[208] The result is that the wireless telephone industry has become highly competitive, with ninety-three percent of the U.S. population able to choose from among four different wireless providers.[209] As a result, Congress preempted state regulation of wireless rates in 1993.[210] Once third generation wireless devices (3G) are fully deployed, competition in the wireless industry is likely to provide sufficient competition to drive market-prices towards efficient levels.

Federal regulatory authorities have been surprisingly reluctant to regard wireless as a competitor to traditional local telephone service. For example, the legislative history of the 1996 Act indicated that competition from cellular telephone companies should not be considered when determining whether an incumbent local telephone company faced sufficient competition to justify releasing it from the prohibition on

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206. Evan Ramstead & Kortney Stringer, *Road Kill: In Race to Lay Fiber, Telecom Firms, Wreak Havoc on City Streets*, WALL ST. J., Feb. 27, 2001, at A1 (describing recent efforts to lay fiber in Atlanta, Austin, Boston, Cincinnati, Dallas, Kansas City, San Antonio, Portland, Richmond, and Washington, D.C.).

207. Use of the Bands 825-845 MHz & 870-890 MHz for Cellular Comm. Syst., *Second Report and Order*, 86 F.C.C.2d 469, 476-93 paras. 15-47 (1981).

208. Amendment of the Comm'n's Rules to Establish New Personal Comm. Serv., *Second Report and Order*, 8 F.C.C.R. 7700, 7732-33 paras. 73-77 (1993).

209. Implementation of Section 6002(b) of Omnibus Budget Reconciliation Act of 1993: Annual Report and Analysis of Competitive Market Conditions with Respect to Commercial Mobile Services, *Eleventh Report*, 21 F.C.C.R. 10947, app. A, tbl.6 (2006).

210. Omnibus Budget Reconciliation Act of 1993, Pub. L. No. 103-66, sec. 6002, § 332(c)(3)(A), 107 Stat. 312, 394-95 (codified at 47 U.S.C. § 332(c)(3)(A)) ("no State or local government shall have any authority to regulate the entry of or the rates charged by any commercial mobile service").

offering long-distance services.[211] State regulators followed a similar pattern. When Qwest asked the Idaho Public Utility Commission (PUC) to deregulate their rates in light of the emergence of competition from wireless, the Idaho PUC found evidence that cell phones are functionally equivalent and competitively priced with Qwest's local service unpersuasive.[212]

Regulators have begun to relax this assumption over time. For example, the FCC acknowledged in 1998 that wireless is a direct competitor to wireline local telephone service after the deployment of PCS.[213] Most states have completely deregulated local telephone service provided to large business customers, which has become quite competitive. State regulators are also inching toward deregulating local telephone service for residences and small businesses.[214] Once that occurs, the distortions associated with retail access will disappear.

B. Wholesale Access

Wholesale access is a right given to a network owner's competitors to purchase services normally sold by the network at retail and resell those services to end-users.[215] Policymakers have also experimented with various forms of wholesale access over the years. The issue first arose when the New York Public Service Commission and the FCC approved Rochester Telephone's voluntary decision to divest its local telephone network into a separate company that would offer basic network services to all comers on a wholesale basis.[216] Wholesale access was mandated without structural separation by the resale provisions of the 1996 Act, which required all

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211. H.R. REP. NO. 104-458, at 147 (1996) (Conf. Rep.) (noting that neither cellular service nor resale of a BOC's local exchange services would satisfy the statutory "facilities-based competitor requirement").

212. *See* Application of Qwest Corp. for Deregulation of Basic Local Exchange Rates, Order No. 29360, 2003 WL 22417269 (Idaho Pub. Utils. Comm'n Oct. 20, 2003).

213. Application of BellSouth Corp., BellSouth Telecomm., Inc., and BellSouth Long Distance, Inc., for Provision of In-Region, InterLATA Serv. in La., *Memorandum Opinion and Order*, 13 F.C.C.R. 20599, 20622-23 paras. 29-33 (1998); *accord* Application by SBC Comm., Inc., Nev. Bell Tel. Co., and Southwestern Bell Comm. Serv., Inc., for Authorization to Provide In-Region, InterLATA Services in Nev., *Memorandum Opinion and Order* 18 F.C.C.R. 7196, 7206-10 paras. 18-26 (2003); Application by Qwest Comm. Int'l, Inc., for Authorization to Provide In-Region, InterLATA Services in N.M., Or., & S.D., *Memorandum Opinion and Order* 18 F.C.C.R. 7325, 7334-42 paras. 18-31 (2003).

214. Tardiff, *supra* note 88, at 125.

215. For a more complete exposition on retail access, see Spulber & Yoo, *Network Regulation*, *supra* note 10, at 640-41, 650-56, 662-69.

216. Petition of Rochester Tel. Corp. for Approval of Proposed Restructuring Plan, *Opinion and Order Approving Joint Stipulation Agreement*, 160 Pub. Util. Rep. 4th 554 (N.Y. Pub. Serv. Comm'n 1994), *aff'd* Rochester Tel. Corp., *Order*, 10 F.C.C.R. 6776, 77 Rad. Reg. 2d (P & F) 539 (1995) (The company's more advanced service offerings were divested into a standalone company called Frontier Telecommunications of Rochester).

companies providing local telephone service on the day the statute was enacted "to offer for resale at wholesale rates any telecommunications service that the carrier provides at retail to subscribers."[217] The Pennsylvania PUC, while rejecting requests to divide Verizon's wholesale and retail units into separate companies, nonetheless required Verizon to provide wholesale access to Verizon's competitors.[218]

For the reasons we discussed at greater length in our previous work,[219] wholesale access can adversely affect network performance. As noted in the discussion on retail access, unexpected deviations in demand can alter the optimal network configuration. The fact that demand under wholesale access depends on two prices—both the price of retail and wholesale access—renders the impact of wholesale access on network demand ambiguous. Depending on these two prices, network demand may either increase or decrease, which in turn adversely affects network cost, capacity, and reliability of the network. Either result will have an adverse impact on the efficiency with which the network owner can provide service.

By externalizing the marketing functions, wholesale access can also increase transaction costs. At a minimum, wholesale access requires local telephone companies who were not already offering wholesale access services to the public to establish new systems through which competitors can order wholesale access and to track the quantity of services being provided. Furthermore, according to the Coasean theory of the firm,[220] network owners minimize transaction costs by internalizing functions if, and only if, the internal monitoring and organizational costs associated with producing a particular input internally are lower than the transaction costs to contract for a particular service externally. Indeed, we see a wide variety of arrangements with respect to local telephone service. Consider the wireless telephone industry, for example. In some cases, wireless companies sell part of their output to consumers through proprietary outlets, while simultaneously selling part of their output through independent retailers, such as Circuit City, Radio Shack, and Best Buy. In addition, some wireless providers voluntarily provide wholesale access to mobile virtual network operators (MVNOs), which buy network services wholesale and combine them with other services, such as customized handsets and priority placement of certain content, to provide a unique

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217. 47 U.S.C. § 251(c)(4)(A) (2000). That this provision is what we call a wholesale access provision follows from the fact that the statute limits this form of access to services "provide[d] at retail to subscribers who are not telecommunications carriers." *Id.* It is thus restricted to end customers.

218. *See* Verizon Pa., Inc., *Order*, 95 Pa. P.U.C. 301 (Pa. Publ. Util. Comm'n 2001).

219. Spulber & Yoo, *Network Regulation*, *supra* note 10, at 656.

220. *See* R.H. Coase, *The Theory of the Firm*, 4 ECONOMICA 386, 394-98 (1937).

product for the customer. Wholesale access disrupts this balance by forcing local network owners to make their entire networks available at wholesale prices even when it is transaction-cost minimizing for them to do so.

Congress thought that this non-facilities-based competition made possible by wholesale access might be the only form of competition possible in many markets in which a facilities-based competitor was unlikely to emerge in the near term.[221] As the D.C. Circuit has noted, wholesale access provides a "completely synthetic" form of competition.[222] Because all firms are providing service on the same network, there is no opportunity for firms to compete either by lowering cost or by providing innovations in service. Herbert Hovenkamp describes the type of competition in the following terms:

> Imagine that a town has only one seller of bananas, which is the local Kroger grocery store. Seeking to promote banana competition, the town passes a banana competition ordinance requiring Kroger to sell bananas at a steeply discounted wholesale price to individual entrepreneurs who push banana carts around the store, perhaps underselling Kroger itself by a few cents. In this case Kroger supplies the store facility, storage, heat, light, and even the bananas themselves, with the small sellers supplying little more than their labor.
>
> The banana competition ordinance simply confuses competition with large numbers of retailers. True banana competition would require individual stores with their own facilities, purchasing bananas on the market and retailing them to consumers. Nevertheless, this is what the 1996 Telecommunications Act does. Small CLECs can lease most of their inputs from the Bells and even locate some of their equipment on Bell property. They are entitled to purchase the equipment and services they need at regulated wholesale prices, and then resell the services in competition with the Bells.[223]

It is for this reason that most commentators have found little value in the type of competition induced by wholesale access.[224] Under wholesale access, the only way that providers can compete with one another is by squeezing their profit margins until prices converge to cost. Regulatory

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221. H.R. REP. NO. 104-204, pt. I, at 72 (1995).

222. U.S. Telecom Ass'n v. FCC, 290 F.3d 415, 424 (D.C. Cir. 2002); *see also* Covad Comm. Co. v. FCC, 450 F.3d 528, 548 (D.C. Cir. 2006).

223. Herbert Hovenkamp, *Antitrust and the Regulatory Enterprise*, 2004 COLUM. BUS. L. REV. 335, 369-70.

224. *See, e.g., id.* at 369; Joskow & Noll, *supra* note 181, at 1281-82; Gregory L. Rosston & Roger G. Noll, *The Economics of the Supreme Court's Decision on Forward Looking Costs*, 1 REV. NETWORK ECON. 81, 88-89 (2002). T. Randolph Beard, George S. Ford & Lawrence J, Spiwak, *Why ADCo? Why Now? An Economic Exploration into the Future of Industry Structure for the "Last Mile" in Local Telecommunications Markets*, 54 FED. COMM. L.J. 421 (2002).

authorities could dissipate any rents just as effectively simply by setting retail prices at appropriate levels. Indeed, because wholesale access prices are typically based on retail prices less any avoided costs, wholesale access mandates raise all of the problems associated with regulating retail rates, with the added complication that regulators must also determine the magnitude of the marketing and operational costs actually avoided.

Wholesale access also has the potential to impair dynamic efficiency. To have any benefit, wholesale access prices must be set very precisely. If set too high, the entire wholesale access regime does not constrain the incumbent and instead simply imposes regulatory costs without providing any compensating benefits. If set too low, wholesale access destroys incentives for competitors to invest in their own networks and dampens the incentives for the incumbent to invest in its own facilities, because any benefit that it develops would have to be shared at wholesale cost. Indeed, the incumbent faces a moral hazard problem in that its competitors can avoid the risks of opening new markets simply by waiting until the incumbent undertakes the necessary investments and then entering only those markets that prove profitable.

These difficulties are aptly demonstrated by the two major instances in which wholesale access has been mandated. Consider first the Rochester Telephone's Open Market Plan, which proposed separating its local telephone network into a separate company that would serve all comers on a wholesale basis.[225] The New York Public Service Commission (NYPSC) soon became concerned that the system of structural separation embodied in the Open Market Plan was unworkable. At the same time, the NYPSC received repeated requests for decreases in wholesale access prices, increasing the discount from full retail price from 5% to as much as 19.6%,[226] as well as complaints about delays and difficulties in the process of ordering service. The wholesale access provisions of the Open Market Plan were eventually superseded by the 1996 Act and by Global Crossing's acquisition of Rochester. During the period the Open Market Plan was in effect, the NYPSC acknowledged that "competition ha[d] yet to develop to any noticeable extent."[227]

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225. Robert W. Crandall & J. Gregory Sidak, *Is Structural Separation of Incumbent Local Exchange Carriers Necessary for Competition?*, 19 YALE J. ON REG. 335, 379-83 (2002).

226. *Id.* at 381.

227. *See* Joint Complaint of AT&T Comm. of New York, Inc., MCI Telecomm. Corp., WorldCom, Inc. d/b/a LDDS WorldCom and the Empire Ass'n of Long Distance Tele. Cos., Inc., No. 95-C-0657, 1998 WL 744059, at *1, *3 (N.Y. Pub. Serv. Comm'n July 15 1998) (recognizing that "little competition has developed in the company's service territory to date").

Studies analyzing the wholesale access provisions of the 1996 Act have similarly concluded that wholesale access has failed to serve either as a basis for competition among resellers or as a stepping stone toward facilities-based competition.[228] In fact, the growth of wholesale access appears to be correlated with a drop in investment in facilities by both new entrants and incumbents, a connection largely corroborated in financial analysts' reports.[229] Likewise, abandonment of wholesale access was accompanied by a move toward facilities-based competition through VoIP and emerging wireless technologies.[230] Indeed, competitors and financial analysts agreed that wholesale access was uneconomical as a competitive strategy.[231]

C. Interconnection Access

Interconnection access refers to reciprocal connections between two networks competing to offer similar services to the same customers as the network owner.[232] It gives each provider the right to handoff traffic originating on its own network for termination on the other provider's network. It also obligates the provider to terminate traffic originating on the competitor's network. These mandated reciprocal connections combine the two smaller networks to form a larger network.

Interconnection access arises any time two local telephone companies serve the same calling area. Because of the Bell System's strategy of either acquiring competing local systems or ceding the field to those competitors that refused to merge, Bell-owned local telephone companies rarely operated in the same calling areas as an independent local telephone company. It did happen on occasion, such as in the Los Angeles area where GTE and Pacific Bell both provided local service to different parts of the

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228. *See, e.g.*, Hausman & Sidak, *supra* note 180, at 193-205.

229. *See infra* note 231.

230. *See* Hausman & Sidak, *supra* note 180, at 193-205; Hazlett, *supra* note 180, at 485-86.

231. Almar Latour & Shawn Young, *Rules Change Could Alter the Fate of Long-Distance Giants*, WALL ST. J., June 11, 2004, at B1; *AT&T's Armstrong Says Bells' Discounts Delay Competition*, TELECOMMUNICATIONS, Feb. 16, 1998, at 11 (reporting on AT&T Chairman Michael Armstrong's speech calling total service resale "fool's errand" and noting that AT&T was losing $3 per month per customer offering local service on a total resale basis); *AT&T Targets Local Service, Administrative Costs and Perks in Cost Cutting*, COMM. DAILY, Dec. 22, 1997; *MCI Abandons Reselling Residential Local Service To Focus on Facilities-Based Business Offerings*, TELECOMMUNICATIONS, Jan. 26, 1998, at 17 (quoting MCI Comm. Corp. President and Chief Operating Officer Timothy F. Price; resale of residential local exchange services "just doesn't work"); *MCI Says It Will Scrap Resale Plans In Favor of Facilities-Based Competition*, COMM. TODAY, Jan. 23, 1998.

232. For a more complete exposition on interconnection access, see Spulber & Yoo, *Network Regulation*, *supra* note 10, at 641-42, 656-57, 669-70.

Los Angeles area.[233] As noted earlier, after the emergence of CAPs providing local telephone service in central business districts, the FCC mandated interconnection access. The 1996 Act formalized this requirement by mandating that all incumbents provide interconnection access.[234]

Interconnection access disrupts network management to a much greater degree than retail and wholesale access. As we noted in our previous work, the impact of interconnection access on network demand is ambiguous.[235] On the one hand, by increasing the number of customers that subscribers can reach, interconnection access causes the value of the network to increase, which in turn should cause network demand to increase. On the other hand, the presence of alternative local telephone networks means that some customers may choose other local telephone providers, which places downward pressure on network demand. Whether, on balance, network demand will increase or decrease depends on which of these two effects dominates.

The possibility that network demand may fall means that network owners may no longer have sufficient volume to take advantage of cost-reducing technologies. In addition, in contrast to retail and wholesale access, which only mandates access at the edges of the network where the network owner already offers service, interconnection access requires the creation of new points of entry at major nodes in the middle of the network. Networks that do not voluntarily offer service at these points will have to create new interfaces to permit interconnection and to meter service at these locations. Permitting access at these points also introduces a new source of flows in the middle of the network, which can have a major impact on optimal network configuration and may cause congestion in portions of the network located quite far from the access point. The fact that traffic now originates and terminates outside of a single network also increases the cost of obtaining the information necessary for network planning and creates the possibility of strategic behavior to take advantage of the information asymmetries.

Some commentators have also warned that incumbent local telephone companies can use the refusal to provide interconnection access to harm competition.[236] They argue that in the absence of interconnection, network

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233. *See* Spulber & Yoo, *Graph Theory Approach*, *supra* note 9, at 641.

234. 47 U.S.C. §151(a)(1) (2000) ("Each telecommunications carrier has the duty to interconnect directly or indirectly with the facilities and equipment of other telecommunications carriers.").

235. Spulber & Yoo, *Network Regulation*, *supra* note 10, at 656-57.

236. *See* Nicholas Economides et al., *Regulatory Pricing Rules to Neutralize Network Dominance*, 5 INDUS. & CORP. CHANGE 1013 (1996); Faulhaber, *supra* note 112, at 495-506; Eli M. Noam, *Will Universal Service and Common Carriage Survive the*

economic effects will lead customers to flock to the largest network. Once the market reaches its tipping point, the value of the network belonging to the dominant player will so far outstrip that of its competitors that the market collapses into a natural monopoly. Once tipped, the difficulties that new entrants face in generating sufficient volume to "un-tip" the market can cause the resulting monopoly to become locked-in.

The analysis is not quite so simple, however. Because so much of the literature focuses on the potentially anticompetitive consequences of network economic effects, it is often overlooked that network economic effects also provide powerful incentives in favor of interconnection.[237] As noted earlier, in a market with a sufficient number of equally-sized players, any player that refused to interconnect would put itself at a tremendous competitive disadvantage.[238] As also noted above, this conclusion is reflected in the FCC's current policy toward interconnection access in the wireless industry, in which it concluded that the presence of multiple equally sized providers provided sufficient incentive to ensure interconnection access even in the absence of regulation.[239]

Furthermore, refusal to interconnect is less likely to harm competition in markets undergoing rapid growth because the primary focus in such markets is the acquisition of new users.[240] The only scenario in which equally sized players have an incentive not to interconnect is when two equally sized firms engage in a race for the market. Interestingly though, this type of competition does not lead to the delays in technology adoption and supracompetitive returns associated with refusals to interconnect by dominant firms.[241] It also has the virtue of promoting the rapid build-out of new network technologies. Indeed, this appears to be precisely the type of competition that ensued during the early competitive era of local telephone service between 1896 and 1907 described above, during which time mandating interconnection would only serve to slow the build-out of the network. Once the telephone industry had used mergers and division of markets to eliminate competition in local telephony, individual companies no longer had any incentive not to interconnect because telephone

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Telecommunications Act of 1996?, 97 COLUM. L. REV. 955, 973-74 (1997); Shelanski, *supra* note 23, at 99-100.

237. Michael L. Katz & Carl Shapiro, *Systems Competition and Network Effects*, J. ECON. PERSP. Spring 1994, at 93, 105 (noting that "[i]n markets with network effects, there is natural tendency toward de facto standardization").

238. *See supra* note 112 and accompanying text.

239. *See supra* note 113 and accompanying text.

240. *See supra* note 103 and accompanying text.

241. Besen & Farrell, *supra* note 107, at 122-24.

companies with nonoverlapping local service monopolies have every incentive to interconnect with one another.[242]

Mandating interconnection access necessarily requires regulatory authorities to establish access prices. The 1996 Act requires local carriers to interconnect and to settle the charges through a system of mutual and reciprocal compensation,[243] which the statute provided would be based on "a reasonable approximation of the additional costs of terminating such calls."[244] The FCC determined that reciprocal compensation rates would be based on TELRIC.[245]

As we have discussed in our earlier work, any approach that bases prices on the cost of particular network components in essence treats each component as if it existed in isolation.[246] In so doing, these approaches fail to capture networks' defining characteristic, i.e., that they are complex systems in which the value of any one component depends on its relationship with and the flows carried by the rest of the network. One of TELRIC's central failings is its inability to take the network's configuration into account.

The problem of determining rates is made all the worse by mandating interconnection "at any technically feasible point."[247] This requirement prevents the network owner from minimizing the adverse impact to its system by choosing which facilities to employ when fulfilling any particular request for service. In the worst case scenario, the right to designate the point of interconnection gives competitors the opportunity to act strategically by basing their access requests not on their needs, but rather on what would inflict the greatest harm on the network owner. A network owner may wish to hedge against this possibility by maintaining excess capacity in case one of its competitors decides to request access to a key portion of its network. This has the drawback of forcing the network owner to make capital investments that may never be used. Indeed, competitors that are acting strategically may well take into account whether the network owner maintains such excess capacity when deciding whether and where to request access. If so, the mere fact that the network owner has added excess capacity to hedge against the possibility of a strategic access request effectively guarantees that access will be sought elsewhere.

The emergence of local telephone competition has begun to provide market benchmarks that can obviate the need to establish interconnection

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242. Spulber & Yoo, *Mandating Access*, *supra* note 193, at 1892-96.
243. 47 U.S.C. § 251(b)(5) (2000).
244. See *id.* § 252(d)(2)(A)(ii).
245. *See supra* note 68 and accompanying text.
246. Spulber & Yoo, *Graph Theory Approach*, *supra* note 9 at 1709-13.
247. 47 U.S.C. § 251(c)(2)(B).

access rates through regulation.[248] As noted earlier, wireless telephone services have successfully emerged as direct competitors to wireline telephony. The emergence of the wireless industry is important because wireless-to-wireless interconnection is currently unregulated.[249] As a result, the terms of interconnection between wireless carriers are determined through arms-length negotiations that can provide precisely the type of external benchmark needed to determine the market value of transport and call termination services. Admittedly, interconnection between wireless carriers does involve somewhat different considerations than interconnection with incumbent LECs. Direct comparisons are complicated by the significant differences in utilization rates as well as the emergence of wireless pricing schemes that do not differentiate between local and long-distance service. The analysis is further obscured by the fact that such interconnection between wireless carriers is often accomplished indirectly through the LECs.[250] Still, as wireless and other facilities-based competitors grow, rates charged for interconnection between wireless competitors will continue to emerge as a market-based reference point that can be used to resolve most pricing problems. The number of external benchmarks will only continue to grow as local cable operators and other types of broadband providers begin to offer local telephone service.

In the absence of external benchmarks based on actual market transactions, resort to some cost-based, second-best measure of market value becomes necessary. As noted earlier, economic theory suggests that cost-based measures should include the foregone benefits that the network owner could have enjoyed had it not been required to devote a portion of its network element to its competitor. One example is the Efficient Component Pricing Rule (ECPR), which sets rates as the sum of the direct incremental costs of providing an input and the opportunity costs that the incumbent incurs when the new entrant provides the services instead of the incumbent.[251] The TELRIC methodology incorporates the first of these two

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248. The discussion that follows is based on Spulber & Yoo, *Access to Networks*, *supra* note 30, at 971-75.

249. *CMRS Interconnection Order*, *supra* note 113, at 13534 para. 28. For an overview of the early history of these somewhat protracted proceedings, see HUBER, KELLOGG & THORNE, *supra* note 2, § 10.5.3.

250. *CMRS Interconnection Order*, *supra* note 113, at 13533-34 paras. 26-27. Historically, such comparisons were further complicated by the FCC's decision to award one of the two available first generation cellular licenses to the incumbent LEC, which in turn produced reasons to question whether in fact interconnection agreements between wireless carriers in fact represented arms-length transactions. The deployment of competitive wireless networks on a national scale, the subsequent emergence of PCS, and the impending arrival of third generation wireless devices should eliminate this problem in the near future—if it has not done so already.

251. One of the authors of this piece has elsewhere advanced the argument that, in addition to ECPR, the rates charged for access to unbundled network elements should also

components. Unfortunately, it does not include any factor to reflect the network owner's opportunity cost. In so doing, TELRIC in essence contradicts the insights of neoclassical economics by basing value solely on supply-side concerns without taking demand-side effects into consideration. As such, TELRIC is fundamentally inconsistent with the analysis of markets that serves as the foundation for all modern economic theory.[252]

Although the FCC considered and rejected arguments that it should base access rates on ECPR, its reasons for doing so do not withstand analysis. The first reason was that the FCC believed that the statutory requirement that prices be based on "cost" precluded it from considering opportunity cost.[253] The *Verizon* Court specifically rejected this reasoning when it found the term, "cost," to be "too protean" to support any such plain language argument.[254] If anything, the FCC's argument is directly undercut by the fact that it is now an economic truism that opportunity costs represent a true economic cost borne by the incumbent LEC.[255] Indeed, the Supreme Court recognized as much when it cited "opportunity cost" as an example of a forward-looking "cost" that fell within the purview of the statute.[256]

The FCC's second reason for rejecting ECPR is equally misplaced. The FCC asserted that because ECPR calculates opportunity cost based on current retail prices, it locks in supracompetitive returns without providing a mechanism for moving prices towards competitive levels.[257] The FCC's reasoning overlooks the fact that the emergence of competition will cause retail prices to drop as well. Furthermore, any monopoly rents that may be present in retail prices are more properly regarded as the result of the

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include a non-by-passable end-user charge to compensate incumbent LECs for costs stranded by deregulatory innovations that caused investment-backed expectations to fail. *See* SIDAK & SPULBER, *supra* note 194, at 334-35. Extended discussion of these issues fall outside the scope of this Article. For the time being, it suffices to point out that the argument advanced in this Article, while consistent with the imposition of such user charges, does not require it.

252. *See* Christopher S. Yoo, *New Models of Regulation and Interagency Governance*, 2003 MICH. ST. DCL L. REV. 701, 712-13.

253. *Local Competition Order*, *supra* note 50, at 15859 para. 709.

254. Verizon Comm., Inc. v. FCC, 535 U.S. 467, 501 (2002). In the same opinion, the court also noted that the term "cost" is "a chameleon" and called it a "virtually meaningless term" that "say[s] little about the method employed to determine a particular rate." *Id.* at 500-01 (internal quotations omitted).

255. *See* SIDAK & SPULBER, *supra* note 194, at 322-23, 404-10.

256. *Verizon*, 535 U.S. at 499 n.17.

257. *Local Competition Order*, *supra* note 50, at 15859 para. 709; *see also Special Access Order*, *supra* note 42, at 7426 para. 123, 7430 para. 129 (rejecting the use of "net revenue" test proposed by Alfred Kahn in setting interconnection rates in the FCC's *Special Access Order* proceeding).

failure of the methodology for implementing retail access than a flaw in taking opportunity cost into consideration when setting wholesale rates. These concerns may well justify reconsidering the approach for setting retail rates. They do not justify distorting wholesale rates, such as interconnection access prices, by failing to include some means for taking demand-side determinants of value into account.[258]

Although the Supreme Court upheld the FCC's ratemaking methodology in *Verizon*, it would be a mistake to construe the Court's action as a specific endorsement of TELRIC and a rejection of ECPR as a matter of economic policy. The Court was quite careful to reserve judgment over the relative merits of any particular economic approach to setting access rates. Instead, the Court based its decision on the deferential standard of review that gave agencies broad latitude to resolve any interpretive ambiguities that exist in the statutes that they administer by upholding any proffered construction of the statute so long as it is reasonable.[259] It would thus be a mistake to read the Court's decision as foreclosing the adoption of a ratemaking approach based on market prices or ECPR in the future.

More fundamentally, even policymakers reluctant to embrace ECPR can appreciate the importance of modeling network behavior at the systemic level. In fact, the graph theoretical approach that we propose can improve telecommunications policy regardless of the particular ratemaking methodology employed.

Regulators are also experimenting with alternative institutional arrangements that obviate the need to set access rates altogether.[260] The statute made clear that it did not preclude arrangements that waive mutual recovery, such as bill and keep.[261] Indeed, local telephone companies serving the same area, such as Pacific Bell and GTE, have long exchanged

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258. *See* SIDAK & SPULBER, *supra* note 194, at 351-58, 362-63.

259. *Verizon*, 535 U.S. at 497-522. The Court noted that "[a]s a reviewing Court we are, of course, in no position to assess the precise economic significance of [various economic aspects of the incumbent LECs' arguments]. Instead, it is enough to recognize that the incumbents' assumption may well be incorrect." *Id.* at 507. The Court also noted, "[w]e cannot say whether the passage of time will show competition prompted by TELRIC to be an illusion, but TELRIC appears to be a reasonable policy for now, and that is all that counts." *Id.* at 523. *See also*, AT&T Corp. v. Iowa Utils. Bd., 525 U.S. 366, 426 (1999) (Breyer, J., concurring in part & dissenting in part) (noting that in rejecting ECPR, the FCC "did not claim, nor did its reasoning support the claim, that the use of such a system would be arbitrary or unreasonable").

260. Yoo, *Economics of Congestion*, *supra* note 81, at 1866-72; and Christopher S. Yoo, *What Can Antitrust Contribute to the Network Neutrality Debate?*, 1 INT'L J. COMM. 493, 517-21 (2007).

261. *See* 47 U.S.C. § 252(d)(2)(B)(i) (2000).

traffic on a bill and keep basis.[262] The rationale is that the payments one network would receive for terminating traffic from the other network would be largely offset by the payments that network would have to pay for traffic passing in the opposite direction. Whatever slight differences in traffic would not justify incurring the transaction costs needed to account for and bill the interchange of traffic.

The FCC recognized the potential benefits from such alternative institutional arrangements in its initial order implementing the 1996 Act.[263] The emergence of competition in local telephone services made it inevitable that some calls would originate on one company's local telephone network and terminate on another's. Although both the originating and terminating carrier would incur costs, the fact that local telephone service in the United States operates on a "calling party pays" basis, only the originating carrier would receive any payment for the call. The 1996 Act established a system of "reciprocal compensation" to compensate the terminating carrier for its costs through which originating carriers could compensate other carriers for the costs of terminating calls originating on other carriers.[264] The statute requires that reciprocal compensation be based on a reasonable approximation of the costs incurred by each carrier. At the same time, the statute specifically leaves open the possibility of bill and keep arrangements, in which each carrier retains the revenue it receives from its own customers without making any additional payments to the other carriers.[265]

The FCC's initial order implementing the 1996 Act expressed skepticism about bill and keep, largely out of concern that bill and keep might give originating carriers both the ability and the incentive to impose costs onto terminating carriers. For this reason, the FCC concluded that bill and keep regimes were generally "not economically efficient."[266]

That said, the FCC recognizes that circumstances exist under which bill and keep may be economically beneficial.[267] If the traffic traveling in each direction is roughly balanced, any payments made by one carrier to the other would simply be offset by similarly sized payments passing in the other direction. If so, bill and keep would not create any economic harms while at the same time relieving carriers of the administrative burdens and

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262. *See* Developing a Unified Intercarrier Compensation Regime, *Notice of Proposed Rulemaking*, 16 F.C.C.R. 9610, 9634-37 paras. 69-77 (2002).

263. *Local Competition Order*, *supra* note 50, at 16055 para. 1112.

264. 47 U.S.C. § 251(b)(5).

265. *See id.* § 252(d)(2)(A)-(B).

266. *Local Competition Order*, *supra* note 50, at 16055 para. 1112.

267. *Id.*

transaction costs needed to create and implement systems to meter the traffic passing in each direction.[268]

Indeed, bill and keep may be economically efficient even when the traffic exchanged between carriers is not symmetrical. The point is most easily understood through the following example.

Suppose that two local networks operate in the same area, with the incumbent carrier serving ninety customers and the new entrant serving ten customers. Each customer makes ten calls randomly distributed throughout the entire customer base. One would expect the customers of the dominant carrier to initiate 900 calls. Ninety percent (or 810) of those calls would terminate on the incumbent's network, while ten percent (ninety) would terminate on the new entrant's network. At the same time, one would expect the new entrant's customers to place one hundred calls, ten percent (ten) of which would terminate on the new entrant's network and ninety percent (ninety) of which would terminate on the dominant carrier's network. Thus, if originations and termination are symmetric and randomly distributed, ninety calls would pass from the incumbent's network to the new entrant's network, and the same number of calls would pass in the other direction. Under these circumstances, metering actual usage would provide no economic benefits even though the total traffic handled by each network would be far from balanced.

As noted above, GTE and Pacific Bell interconnected on a bill and keep basis when serving adjacent neighborhoods in Los Angeles despite the fact that the size of their customer bases was far from symmetrical.[269] The implication is that the transaction cost economies associated with avoiding metering costs outweighed what little benefit would have resulted from a more accurate accounting of the actual traffic flows. Note that a far different situation holds if one carrier's customers disproportionately make calls that terminated on the other carrier's network. In addition, the symmetry of terminations and originations does not hold if one carrier only terminates calls, as would occur for carriers providing service to paging service providers, call centers, or Internet service providers. In those cases, the resulting asymmetry on a calling party system would lead to substantial distortions.[270]

Economic theory has identified one way in which even last-mile providers without market power in the national market can nonetheless use their terminating access monopoly to harm competition.[271] This market

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268. *Id.*

269. *See supra* note 262 and accompanying text.

270. *Local Competition Order*, *supra* note 50, at 16043 para. 1092.

271. *See* ROBERT CRANDALL & LEONARD WAVERMAN, TALK IS CHEAP: THE PROMISE OF REGULATORY REFORM IN NORTH AMERICAN TELECOMMUNICATIONS 265-66 (1995), JEAN-

failure results from what is in essence a common pool problem stemming from the fact that the United States follows the practice that the calling party pays the long-distance carrier for the entirety of the long-distance call. Long-distance carriers are, of course, not the only carriers that incur costs when a customer places a long-distance call. The LEC for the party originating the call must incur costs to provide a connection between the customer's premises and the long-distance carrier's point of presence in the originating LEC's central office. Furthermore, the terminating LEC must also incur the cost of connecting the call from its central office to the customer premises of the party to whom the call is placed. Long-distance carriers compensate originating and terminating LECs through a series of federally mandated access charges, which under current law must be uniform across all carriers and all customers.[272] In other words, the cost of terminating access is covered by requiring customers to make uniform contributions to a common pool.

The key question is what impact the deregulation of access charges would have on originating and terminating LECs' pricing behavior. The FCC has concluded that the possibility that the originating carrier might charge excessive access charges is effectively limited by the fact that the calling party chooses its local service provider, decides whether to place the call, and ultimately bears the cost of the call.[273] The calling party, either directly or indirectly through its long-distance carrier, is thus well situated to exert price discipline over originating access charges. The same is not true, however, for terminating access charges. Because neither the calling party nor its long-distance carrier has any influence over the called party's choice of LEC; neither can exert any price discipline over terminating access charges. Furthermore, the common pool aspect of the access charge regime means that LEC customers will not bear the full brunt of any increase in terminating access charges. Instead, the impact of the higher prices will be spread over the entire universe of local telephone subscribers. This, in turn, gives terminating LECs both the ability and the incentive to raise terminating access charges above competitive levels in order to draw a disproportionate amount of compensation out of the common pool. The impetus to increase terminating access charges exists regardless of whether competition in local access exists or the terminating LEC is small. Indeed, small carriers may well have the greatest incentive to increase terminating

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JACQUES LAFFONT & JEAN TIROLE, COMPETITION IN TELECOMMUNICATIONS 182-87 (2000). The terminating access monopoly problem is succinctly summarized in Access Charge Reform, *Fifth Report and Order and Further Notice of Proposed Rulemaking*, 14 F.C.C.R. 14221, 14313-14 para. 181 (1999) [hereinafter *Pricing Flexibility Order*].

272. Developing a Unified Intercarrier Compensation Regime, Further Notice of Proposed Rulemaking, 20 F.C.C.R. 4685, 4688-91 paras. 6-11 (2005).

273. *Pricing Flexibility Order*, *supra* note 271, at 14314 para. 181.

access charges because the percentage of the increase to their own customers will be disproportionately small. At the same time, such pricing behavior might give long-distance carriers greater incentive to enter the local access market in order to avoid paying these charges.

A number of mechanisms exist to solve this problem without mandating interconnection. For example, the incentive to increase terminating access charges would disappear if the FCC were to mandate bill and keep. Indeed, any uniform access pricing regime would eliminate the ability for terminating LECs to take advantage of the common pool problem, although economic efficiency would ultimately depend on ensuring that access prices are set at competitive levels. In addition, LECs' incentive to increase terminating access charges could also be eliminated by mandating that terminating access charges be reciprocal, although reciprocity may have implications for entry.[274] Reciprocity is not as effective when LECs do not originate and terminate traffic in a roughly symmetrical manner, as illustrated by disputes over carriers that only serve customers that receive calls, such as Internet service providers, conference call companies, and chat rooms, as evidenced by the recent dispute over "traffic-pumping."[275] Finally, the terminating access charges used by the incumbent LEC with which the new entrant competes can be used as a benchmark for determining the reasonableness of the new entrant's terminating access charges.[276] A complete resolution of this issue exceeds the scope of this Article. For our purposes, determining which of these different mechanisms would best promote consumer welfare is less important than the fact that institutional mechanisms may exist for solving the terminating access problem that do not require imposing an access mandate.

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274. Jean-Jacques Laffont, Patrick Rey & Jean Tirole, *Competition Between Telecommunications Operators*, 41 EUR. ECON. REV. 701 (1997); Jean-Jacques Laffont, Patrick Rey & Jean Tirole, *Network Competition: I. Overview and Nondiscriminatory Pricing*, 29 RAND J. ECON. 1, 8-12 (1998).

275. This dispute arose when a small group of rural Iowa LECs left the uniform tariffs established by the National Exchange Carrier Association and negotiated relatively high compensation rates designed to cover their costs at their historically low volumes. After establishing these rates, these LECs began to solicit customers offering services that only terminate calls, such as conference calling or free adult chat-line services. These customers then advertise their conference calling and chat-line services on the Internet as free services. The result, in one case, was for the terminating traffic of 175 customers to jump from 15,000 minutes to 6.4 million minutes in a five-month span, resulting in a transfer payment of $10 million to $15 million to these small LECs. *See* Virgil Larson, *Big Phone Carriers Say Small Firms Bleed Them*, OMAHA WORLD-HERALD, May 16, 2007, at 1D.

276. *See* Access Charge Reform, *Seventh Report and Order and Further Notice of Proposed Rulemaking*, 16 F.C.C.R. 9923, 9941-50 paras. 45-63 (2001); Noel D. Uri, *Monopoly Power and the Problem of CLEC Access Charges*, 25 TELECOMM. POL'Y 611, 621 (2001).

D. Platform Access

Platform represents the type of access most often granted through regulation. Platform access occurs when the government mandates that a network owner provide nondiscriminatory access to providers of complementary services. Implementation of platform access requires the creation of a standard and the nondiscriminatory provision of network service to anyone presenting data configured in accordance with that standard.[277] For example, the FCC's Part 68 Rules,[278] which can be traced to the FCC's landmark decision in *Carterfone*,[279] have long required the Bell System to open its local telephone networks to all providers of CPE. As a result of MCI's long battle with AT&T, the FCC has also required the Bell System to open its local telephone network to all providers of long-distance services.[280] Furthermore, the FCC's *Computer Inquiries* required local telephone companies to open their networks to all providers of information services.[281] Similar mandates were included in the consent decree breaking up AT&T and the related consent decree regarding GTE.[282] In each case, this regulation is properly regarded as platform access because it involves opening up the network to providers of complementary services.

The 1996 Act essentially left this system undisturbed. With respect to long distance, § 251(c)(2) requires all carriers providing local telephone service to provide interconnection to any carrier for the transmission and routing of long-distance access that is equal in quality to the interconnection the local telephone company provides to itself on rates, terms, and conditions that are just, reasonable, and nondiscriminatory.[283] The FCC construed this provision to apply only to the physical linking of the two networks and not for the charges for transporting and terminating long-distance traffic.[284] Indeed, as the Eighth Circuit reasoned in upholding the FCC's decision, § 251(g) specifies that the preexisting equal access and interconnection requirements would remain in place until specifically

277. For a more complete exposition on platform access, see Spulber & Yoo, *Network Regulation*, *supra* note 10, at 643-45, 657-58, 670-71.

278. 47 C.F.R. pt. 68 (2008).

279. Use of the Carterfone Device in Message Toll Telephone Service, *Decision*, 13 F.C.C.2d 420 (1968).

280. *See, e.g.*, MTS and WATS Market Structure, Phase III, *Report and Order*, 100 F.C.C.2d 860 (1985).

281. *See supra* note 24-35, and accompanying text.

282. Spulber & Yoo, *Mandating Access*, *supra* note 193, at 1901-02.

283. 47 U.S.C. § 251(c)(2) (2000).

284. *Local Competition Order*, *supra* note 50, at 15590 para. 176.

superseded by the FCC.[285] Because the advent of competition would put pressure on any cross-subsidies embedded in access charges, the FCC initiated an access charge proceeding designed to make transport pricing entirely cost-based.[286]

The 1996 Act similarly left undisturbed the mandate that local telephone companies must provide equal access to information service providers.[287] It augmented those requirements with a number of other provisions, including requiring incumbents to allow information service providers to resell local telephone services at wholesale rates and to provide unbundled access to key elements of their networks.[288] The FCC continued to regard information service providers as customers of the local telephone network rather than as long-distance providers that had to pay access charges.[289] Concerns about preserving platform access also underlay the statutory provisions in the 1996 Act prohibiting the former BOCs from offering long-distance service, information services, and alarm monitoring.[290] The idea was that, until competition emerged in local telephone service, these firms would have the incentive to discriminate against nonproprietary, complementary service offerings.

Providing greater accessibility to complementary services and reducing the business risk faced by providers of those services should cause network demand to increase.[291] At the same time, platform access inevitably involves a number of collateral requirements that can become sources of inefficiency and place downward pressure on network demand. For example, local telephone networks give rise to certain technological efficiencies that can only be realized if the same carrier provides both the complementary and the local telephone service. Classic examples include voice messaging services, such as voice mail and advance calling, and vertical switching services, such as caller ID, call forwarding, and call waiting, which are most efficiently provided when integrated directly into the circuit switch.[292] The FCC eventually exempted such innovations from

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285. Competitive Telecomms. Ass'n v. FCC (CompTel), 117 F.3d 1068, 1071-73 (8th Cir. 1997) (discussing 47 U.S.C. § 251(g)).

286. Access Charge Reform, *First Report and Order*, 12 F.C.C.R. 15982 (1997) [hereinafter *Access Charge Reform Order*].

287. *Computer III* Further Remand Proceeding: Bell Operating Company Provision of Enhanced Services, *Further Notice of Proposed Rulemaking*, 13 F.C.C.R. 6040, 6054 para. 20 (1998).

288. 47 U.S.C. § 251(c)(4).

289. *Access Charge Reform Order*, *supra* note 286, at 16133 para. 344.

290. §§ 271, 274-275.

291. Spulber & Yoo, *Network Regulation*, *supra* note 10, at 657.

292. *See Computer III Phase I Order*, *supra* note 32, at 971-73 paras. 17-19, 1109-14 paras. 307-17.

its platform access requirements for the simple reason that failure to do so would have prevented these innovations from emerging.[293]

Platform access also necessarily requires regulators to designate the location within the network to interface with complementary service providers, as well as the format in which the complementary service is configured. The optimal level of standardization depends largely on the magnitude of the demand-side scale economies and the heterogeneity of consumer preferences. If preferences are sufficiently heterogeneous, the value that consumers derive from consuming a service that is a better match with their preferences will dominate the benefits from belonging to a larger network, in which case an equilibrium with multiple standards may well be optimal.

Standardization also inevitably favors applications based on certain architectures. For example, the introduction of digital transmission technologies required the deployment of protocols that were not interoperable with the existing analog network. This necessitated the introduction of computer processing into the core of the network to engage in "protocol conversion."[294] Absent a waiver from the platform access mandate, the interoperability mandated by the *Computer Inquiries* would have obstructed this innovation from being deployed.[295] It is impossible to conclude *a priori* that standardizing on single network architecture represents the optimal solution. The process is rendered even more challenging if the technology is undergoing rapid change. Under the best of circumstances, regulation will lock the existing interface into place at least until the regulatory process can update it. At worst, such technological decisions will be affected by the biases inherent in regulatory processes, in which the concerns of the incumbents tend to be overrepresented.

The standardization implicit in platform access also commoditizes network services and narrows the dimensions along which local telephone networks can compete. Product standardization and price transparency make both collusive and noncooperative oligopolistic behavior easier to maintain. Commoditization also limits networks to competing solely based on price and network size, considerations that reinforce the advantages

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293. *See, e.g. Non-Accounting Safeguards Order*, *supra* note 127, at 21955-58 paras. 100-05; *Computer III Phase I Order*, *supra* note 32, at 1100-09 paras. 289-306, 1112-14 paras. 313-17; *AT&T Waiver Petition*, *supra* note 127; *Protocol Waiver Order*, *supra* note 127.

294. *See, e.g.*, *Computer III Phase I Order*, *supra* note 32, at 979-80 paras. 33-34; *Protocol Waiver Order*, *supra* note 127; *AT&T Waiver Petition*, *supra* note 127; *Protocols Order*, *supra* note 127, at 594-95 paras. 22-25.

295. *See, e.g. Non-Accounting Safeguards Order*, *supra* note 127, at 21955-58 paras. 100-05; *Computer III Phase I Order*, *supra* note 32, at 1100-09 paras. 289-306, 1112-14 paras. 313-17; *AT&T Waiver Petition*, *supra* note 127; *Protocol Waiver Order*, *supra* note 127, at 1060 para. 5.

enjoyed by the largest players. Differentiation can play a particularly important role in industries like telecommunications, in which the presence of fixed costs that are large relative to marginal costs, forces network providers to produce on the declining portion of the average cost curve. As Edward Chamberlin pointed out in his classic work on monopolistic competition, product differentiation can create stable equilibriums with multiple producers each producing on the declining portion of the average cost curve.[296] Thus, smaller players can survive despite cost and size disadvantages by targeting subsegments of the market.

Platform access also gives rise to significant transaction costs, both in terms of establishing the governing standards and in terms of establishing the interface. This includes putting into place processes at those interfaces for monitoring and billing the service provided to existing customers and for provisioning service to new customers. As Justice Breyer has noted, such an interface is likely to be particularly burdensome to police when the interface is complex and embedded in the middle of the network and when the information requirements needed to regulate the interface are high.[297] The breakup of AT&T provides a useful example. Implementing the divestiture decree's equal access mandate required the local telephone companies to redesign their switches so that they could accommodate multiple long-distance providers—a process that entailed considerable cost and delay, as well as close regulation of both the price and nonprice terms and conditions of interconnection. Such oversight is particularly onerous when the interface and the information requirements needed to implement it are complex.[298] Furthermore, like any form of access, platform access requires direct regulation of prices in order to be effective, both in terms of nondiscrimination and in terms of price levels. There is thus little reason to be optimistic that such regulation will prove beneficial.

Most problematic is platform access's long-run impact on dynamic efficiency. As noted earlier, the primary policy goal should be to promote entry in those segments of the industry that are the least competitive. Only if competition in a particular segment proves unsustainable should policymakers pursue the second-best policy goal of promoting competition in complementary services. Once local telephone competition became possible, platform access became counterproductive. Providers of complementary services were the natural strategic partners for new entrants in local telephone service. Platform access short-circuited this natural

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296. EDWARD HASTINGS CHAMBERLIN, THE THEORY OF MONOPOLISTIC COMPETITION: OF RE-ORIENTATION OF THE THEORY OF VALUE 27-33, 50-51, 194-95 (8th ed. 1962).

297. AT&T Corp. v. Iowa Utils. Bd., 525 U.S. 366, 428-29 (1999) (Breyer, J., concurring in part and dissenting in part).

298. Gerald R. Faulhaber, *Policy-Induced Competition: The Telecommunications Experiments*, 15 INFO. ECON. & POL'Y 73, 77, 81, 82-84 (2003).

alliance by obviating the need for any complementary service providers to enter into such partnerships.

At the time most of the platform access mandates discussed above were put into place, competition in local telephone service was believed to be impossible. The FCC recognized, when eliminating the regulatory requirements imposed by the *Computer Inquiries*, that those rules "were developed before separate and different broadband technologies began to emerge and compete for the same customers" and could no longer be justified under contemporary circumstances.[299] In short, it is now clear that wireline competition is feasible with respect to large business customers and that wireless telephony has emerged as a vibrant competitor as well.

Lastly, network owners have powerful incentives to provide platform access voluntarily.[300] The economic consensus is that competition among local telephone providers is sufficient to prevent those providers from engaging in anticompetitive behavior against providers of complementary services. Even if the local telephone market is not competitive, moreover, network owners are still likely to provide platform access voluntarily because opening networks to the broadest possible array of complementary services typically represents the best way for a carrier to maximize the value of its local telephone network. Although economic theorists have identified a narrow set of circumstances under which that would not be true, those exceptions are fairly narrow and require the satisfaction of fairly restrictive conditions.

Unfortunately, policymakers have been loathe to take wireless competition into account when deciding whether to release local telephone companies from platform access mandates. For example, the legislative history of the 1996 Act indicated that competition from cellular telephone companies should not be considered when determining whether an incumbent local telephone company faced sufficient competition to justify releasing it from the prohibition on offering long-distance services.[301] The

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299. Appropriate Framework for Broadband Access to the Internet over Wireline Facilities, *Report and Order and Notice of Proposed Rulemaking*, 20 F.C.C.R. 14853, 14876-77 para. 42 (2005) [hereinafter *Wireline Broadband Order*].

300. Yoo, *Vertical Integration*, *supra* note 93, at 187-202. 253-67; Spulber & Yoo, *Mandating Access*, *supra* note 193, at 1898-99. *See also* Besen & Farrell, *supra* note 107, at 117 ("A firm's strategy toward vertically related firms—the suppliers of complementary goods—normally involves trying to encourage a generous supply of complements, while perhaps also trying to discourage the supply of complements to rivals."); Joseph Farrell & Philip J. Weiser, *Modularity, Vertical Integration, and Open Access Policies: Towards a Convergence of Antitrust and Regulation in the Internet Age*, 17 HARV. J.L. & TECH. 85, 104 (2003) ("[T]he platform monopolist has an incentive to be a good steward of the applications sector for its platform.").

301. H.R. REP. NO. 104-458, at 147 (1996) (Conf. Rep.) (noting that neither cellular service nor resale of a BOC's local exchange services would satisfy the statutory "facilities-based competitor requirement").

FCC would later retreat from this position and acknowledge wireless as a direct competitor to wireline local telephone service after the deployment of PCS.[302]

Over time, policymakers have narrowed the scope of local telephone networks' platform access obligations. With respect to long-distance service, the FCC has ruled that the local telephone companies created by the breakup of AT&T now face sufficient competition to justify permitting them to offer in-region long-distance service in every state except Alaska and Hawaii.[303] As discussed in greater detail elsewhere, the dissipation of the need for platform access to preserve long-distance competition is demonstrated most eloquently by the regulatory authorities' approval of SBC's acquisition of AT&T and Verizon's acquisition of MCI, which reconsolidated local and long-distance services. [304]

In addition, the FCC has eliminated the platform access for information services. As the FCC recognized when eliminating the regulatory requirements imposed by the *Computer Inquiries*, those rules "were developed before separate and different broadband technologies began to emerge and compete for the same customers" and could no longer be justified under contemporary circumstances.[305]

Lastly, the FCC has acknowledged that the increase in competition has weakened the ability of last-mile providers to discriminate in favor of proprietary CPE. For example, in 1992 the FCC abolished the prohibition on bundling CPE with wireless telephone services.[306] The FCC issued this order at a fairly early stage in the wireless industry's development when the evidence of the competitiveness of the wireless industry was "inconclusive."[307] As noted earlier, the FCC initially established the wireless industry in 1981 through a duopoly market structure and had not yet begun to auction PCS licenses. The FCC nonetheless found the possibility that some cellular providers might possess a degree of local market power insufficient to justify prohibiting the bundling of CPE with wireless telephone service because any one cellular provider represented a tiny fraction of the national equipment market.[308] Any CPE manufacturer

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302. *See*, *supra* note 132 and accompanying text.

303. FCC, BOC AUTHORIZATIONS TO PROVIDE IN-REGION INTERLATA SERVICES UNDER SECTIONS 271 AND 272, *supra* note 132 (reporting that the FCC has ruled that local telephone companies are subject to sufficient competition to permit them to offer in-region long-distance service in every state except Alaska and Hawaii).

304. *See* Spulber & Yoo, *Mandating Access*, *supra* note 193, at 1903.

305. *Wireline Broadband Order*, *supra* note 299, at 14876-77 para. 42.

306. Bundling of Cellular Customer Premises Equipment and Cellular Service, *Report and Order*, 7 F.C.C.R. 4028 (1992).

307. *Id.* at 4031-32 para. 27.

308. *Id.* at 4028-29 para. 7, 4029-30 paras. 13-18.

foreclosed from distributing its products in one geographic area remained free to sell its products in other areas. As the Federal Trade Commission's comments during this proceeding note, "'[i]f individual cellular service companies do not possess market power in the sale of cellular service on a *national* level, it is unlikely that foreclosure of the CPE market can be successful.'"[309] The FCC agreed, concluding that "it does not seem likely that individual cellular companies which operate in local markets possess market power that could impact the numerous CPE manufacturers operating on a national and international basis."[310] The proper question is thus, not the number of subscribers that a network controls in any one metropolitan area, but rather the network's market share in the national market. In short, it is national reach, not local reach, that matters. The FCC found that not only is bundling an efficient way to distribute CPE, "the high price of CPE represented the greatest barrier to inducing subscription to cellular service."[311] Bundling wireless service with CPE allows wireless carriers to reduce the up-front cost of subscribing to cellular, which in turn will support greater competition and promote more efficient use of the spectrum.[312]

Similarly, the FCC concluded in 2001 that the growth in competition among local exchange carriers justified abolishing its prohibition of bundling CPE with wireline telecommunications services.[313] Even though local exchange markets were not yet perfectly competitive, the FCC concluded that the growth of local competition and the consumer benefits of bundling—such as the reduction of transaction costs and increase in innovation in services—sufficiently mitigated the risk of anticompetitive harm.[314] The FCC has also abandoned its previous role in establishing the technical criteria for interconnecting CPE, although the FCC stopped short of repealing the interconnection requirements altogether.[315]

E. Unbundled Access

Unbundled access is a right given to competitors using individual components of the incumbent's network.[316] Local telephone networks have

309. *Id.* at 4029-30 para. 13 (emphasis added).

310. *Id.*

311. *Id.* at 4030-31 para. 19.

312. *Id.*

313. Policy and Rules Concerning the Interstate, Interexchange Marketplace, *Report and Order*, 16 F.C.C.R. 7418, 7424 para. 10 (2001).

314. *Id.* at 7424 para. 10, 7436-37 paras. 30-31, 7438-40 paras. 33-36.

315. 2000 Biennial Reg. Review of Part 68 of the Comm'n's Rules and Regs., *Report and Order*, 15 F.C.C.R. 24944, paras. 16-17, 24951-53 paras. 20-23 (2000).

316. For a more complete exposition on unbundled access, see Spulber & Yoo, *Network Regulation*, *supra* note 10, at 645-46, 658-60, 671-73.

long represented one of the central laboratories in which regulatory authorities have experimented with unbundled access as a way to guard against vertical exclusion without foreclosing the benefits of vertical integration. As discussed above, the open network architecture regime created by *Computer Inquiry III* represents perhaps the seminal example of FCC-mandated unbundling.[317] The UNE access provision enacted by Congress constitutes perhaps the most important provision of the Telecommunications Act of 1996, with UNE access prices being based on TELRIC.[318] Other important antecedents include state unbundling initiatives between 1984 and 1996, as well as the unbundling model developed by the U.S. Department of Justice in negotiations to allow Ameritech to begin selling in-region long-distance services.[319]

Unbundled access is the form of access that has the greatest potential to cause economic inefficiency. Like wholesale and interconnection access, the fact that unbundled access simultaneously supports the creation of new services and diverts traffic off of the network renders the impact of unbundled access on network demand ambiguous. Both increases and decreases in network demand change the optimal network configuration, either by making the creation of links in particular locations or cost-reducing, traffic-aggregating technologies economically feasible or infeasible.

At the same time, unbundled access disrupts network management to a far greater degree than other forms of access. Unlike the other forms of access, which generally introduce traffic at the major nodes where customers or providers of complementary services would naturally interconnect with the network, unbundled access can introduce traffic deep within the heart of the network. Unbundled access has the potential to occupy isolated resources at multiple, disconnected points in the network. In contrast, other forms of access involve large, integrated portions of the network to route traffic in patterns that are roughly similar to the traffic served by the network owner.

As we described elsewhere, graph theory reveals how occupying isolated resources in one part of the network can adversely affect the performance of portions of the network located far from the element being accessed. [320] Graph theory thus demonstrates the potential flaw in the idea that the costs of unbundled access are confined to the network elements that are directly involved. Instead, interconnection by competitors is likely to introduce new sources and sinks into the network. Thus, substantial

317. *See* discussion *supra* pages 48-51.
318. *See* discussion *supra* page 112-13.
319. HUBER, KELLOGG & THORNE, *supra* note 2, §§ 5.4.7-8.
320. *See* Spulber & Yoo, *Graph Theory Approach*, *supra* note 9, at 1703-13.

amounts of traffic may originate and terminate at points in the network that differ from the host network's initial points of origin and termination. This will alter traffic patterns. A network that is designed with a maximum flow/minimum cut pattern designed around particular sources and sinks will no longer be appropriate for traffic coming from new sources and sinks. The nodes at which interconnection occurs will not be the only nodes affected. Rather, the effects will be distributed across all nodes and links within the network. This invalidates the notion that only the incremental costs of providing the interconnection should be recovered. The interconnection affects the network's performance and creates costs throughout the network.

Moreover, graph theory shows that one should not expect the effects of UNE access to be confined to those elements. When individual elements are viewed in isolation, the TELRIC methodology seems quite reasonable. Typically, UNE access occupies only a few of the elements of an incumbent LEC's network. Those elements, however, can be critical to overall traffic patterns that connect the network's sources and sinks. The reduction of available capacity on critical links in the network will affect the network's maximum flow. Thus, UNE access can impose costs on the host network that extend well beyond the elements that are affected. [321] In some cases, the costs of UNE access may even exceed interconnection costs. If usage patterns associated with interconnection are similar to those of the incumbent LEC's own traffic, absent any capacity constraints, there will be less of an impact on the network owner's decisions about network configuration. There will be no change in the network elements that comprise the minimum cut and, thus, in the components that constitute bottlenecks. The situation is quite different when usage patterns associated with interconnection differ from the patterns of the incumbent's own traffic. When that is the case, granting access to critical UNEs can create bottlenecks where none previously existed and can have a dramatic impact on the network's maximum flow. Under these circumstances, UNE access can have a dramatic impact on the cost, capacity, and configuration of networks. [322]

These problems are exacerbated by the fact that the 1996 Act obligates the network owner to permit unbundled access "at any technically feasible point."[323] The introduction of traffic flows at disaggregated points chosen by competitors deep in the heart of the network, where such traffic would not otherwise occur, has a much greater potential to cause

321. *Id.*
322. *Id.*
323. 47 U.S.C. § 251(c)(2)(B) (2000).

discontinuous and unpredictable disruptions to the network than other forms of access.

In addition, unbundled access increases transaction costs to a greater degree than other forms of access. For example, a network owner attempting to manage its network will need a great deal of information about the magnitude, timing, and variability of traffic associated with each element to which unbundled access is sought. The fact that much of the traffic will originate and be transmitted, at least in part, on other networks places much of this information outside the network owner's control.

Further, it forces network owners to develop systems for provisioning and monitoring network usage at points that would not otherwise be available to customers or other carriers. As Justice Breyer noted in criticizing the 1996 Act's UNE access requirements in *Iowa Utilities Board*:

> The more complex the facilities, the more central their relation to the firm's managerial responsibilities, the more extensive the sharing demanded, the more likely these costs will become serious. And the more serious they become, the more likely they will offset any economic or competitive gain that a sharing requirement might otherwise provide.[324]

He further observed that unbundled access "can have significant administrative and social costs inconsistent with the Act's purposes."[325] If taken to an extreme, "[r]ules that force firms to share *every* resource or element of a business would create not competition, but pervasive regulation, for the regulators, not the marketplace, would set the relevant terms."[326]

Most problematically, unbundled access delays the emergence of facilities-based competition by deterring investment in alternative last-mile facilities. Justice Breyer's separate opinion in *Iowa Utilities Board* described how unbundled access reduces incumbents' incentives to invest in their own networks when he pointed out that unbundled access:

> may diminish the original owner's incentive to keep up or to improve the property by depriving the owner of the fruits of value-creating investment, research, or labor . . . . [One cannot] guarantee that firms will undertake the investment necessary to produce complex technological innovations knowing that any competitive advantage deriving from those innovations will be dissipated by the sharing requirement.[327]

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324. AT&T Corp. v. Iowa Utils. Bd., 525 U.S. 366, 428-29 (1999) (Breyer, J., concurring in part and dissenting in part) (internal citations omitted).

325. *Id.* at 428.

326. *Id.* at 429.

327. *Id.* at 428-29.

In *Verizon v. FCC*, Justice Breyer reiterated the negative impact that unbundled access on incumbents' incentive "either to innovate or to invest in a new 'element.'"[328] Unbundled access envisions "that the incumbent will share with competitors the cost-reducing benefits of a successful innovation, while leaving the incumbent to bear the costs of most unsuccessful investments on its own. Why would investment not then stagnate?"[329]

Unbundled access reduces the investment incentives of new entrants as well as incumbents. TELRIC bases UNE access prices on the costs of a hypothetical, most efficient network. Justice Breyer observed that this pricing approach essentially guarantees that new entrants will find it more cost effective to obtain unbundled access to elements of the existing network than to build or buy those network elements elsewhere.[330] Furthermore, new entrants must take into account the fact that any future technological improvements will cause UNE access rates to fall still further. Thus, any firm considering building its own facilities faces the real possibility that regulation will place it at a cost disadvantage, as TELRIC ensures that other competitors will be able to take advantage of any cost reductions that take place in the future without having to undertake the risk of making any investments. This will not only harm new entrants who invest in facilities, it will induce firms to compete by sharing the existing network even though lower-cost alternatives exist. Although the FCC claims that unbundled access "will sometimes 'serve as a transitional arrangement until fledgling competitors could develop a customer base and complete the construction of their own networks,'"[331] Justice Breyer asks, "[w]hy, given the pricing rules, would those 'fledgling competitors' ever try to fly on their own?"[332]

Lastly, Justice Breyer acknowledged that unbundled access leads to an extremely thin form of competition:

> That is because firms that share existing facilities do not compete in respect to the facilities that they share, any more than several grain producers who auction their grain at a single jointly owned market compete in respect to *auction services*. Yet rules that combine a strong monetary incentive to share with a broad definition of "network element" will tend to produce widespread sharing of entire incumbent systems under regulatory

328. Verizon Comm. Inc. v. FCC, 535 U.S. 467, 551 (2002) (Breyer, J., concurring in part and dissenting in part).

329. *Id.* (internal citations omitted).

330. *Id.*

331. *Id.* at 551 (quoting *UNE Remand Order*, *supra* note 69, at 3700 para. 6).

332. *Id.*

> supervision—a result very different from the competitive market that the statute seeks to create.[333]

A majority of the Supreme Court would ultimately endorse all aspects of Justice Breyer's reasoning in the *Trinko* decision.[334] As we noted earlier, empirical studies have demonstrated the negative impact that unbundled access has on investments in local telephone facilities.

It is for this reason that the unbundled access provisions of the 1996 Act contain some limiting principles. Specifically, it limits UNE access to elements to which access is "necessary" and without which a new competitor would be impaired in its ability to offer competing services.[335] These limitations recognize that little is to be gained and much to be lost by compelling access to elements available on the open market for other sources.

The FCC has faced nearly insuperable difficulties to construe these limitations in a way that makes economic sense. As noted earlier, the FCC needed four tries to develop rules that could withstand judicial scrutiny. And by this time, the unbundling rules had largely become moot, as the FCC had deregulated unbundling of network elements providing service to large business customers and had deregulated key network elements needed to provide local telephone service to small business and residential customers.

F. Regulatory Arbitrage

Organizing the different types of access into distinct categories inevitably poses significant definitional challenges, particularly in an industry undergoing dynamic technological change. The differences in compensation regimes allow providers to engage in regulatory arbitrage by altering access rates simply by changing the way that service is characterized or by making relatively small technological changes.

Consider, for example, the proper categorization of the first generation of Internet service providers—such as the original services offered by CompuServe, Prodigy, and America Online—which established local offices housing modem banks through which consumers could connect to the Internet through their dial-up modems. It is possible to conceptualize the access provided to these companies in any one of four ways. First, these companies could simply be regarded as end-users simply purchasing business lines from the local telephone company, in which case

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333. *Id.* at 550-51 (internal citations omitted).

334. Verizon Comm., Inc. v. Law Offices of Curtis V. Trinko, 540 U.S. 398 (2004). For a more detailed analysis of *Trinko* and its implications for telecommunications, see Spulber & Yoo, *Mandating Access*, *supra* note 193, at 1864-67.

335. 47 U.S.C. § 251(d)(2)(A)-(B) (2000).

they would be provided service through retail access.[336] Second, these companies could also be characterized as providing complementary services, in which case they would receive service via platform access. Third, these companies could declare themselves to be a specialized local telephone company serving a single customer and seek service through interconnection access. Fourth, these companies could use unbundled access to purchase all of the elements they needed to provide service to their end customers.

These difficulties would be of little concern if a single, consistent pricing regime applied to all of these different types of access. Unfortunately, different types of access are governed by different ratemaking approaches and are often imposed by different regulatory entities. Retail access is regulated by state PUCs employing either cost-of-service ratemaking or price caps. Retail rates often include a wide variety of specialized waivers and reflect a wide range of internal cross-subsidies, through state-wide rate averaging and through differential pricing of business and residential services. The fact that prices are not always set in a way that reflects cost within a single jurisdiction raises the possibility of arbitrage even within retail access.

Wholesale access rates are often said to be constructed from the top down, in that they are typically based on retail rates less any avoided costs, such as marketing, billing, and collection. The fact that these rates are based on rates incorporating implicit cross-subsidies again leaves wholesale access vulnerable to regulatory arbitrage. Further inefficiency may result from difficulties in determining precisely which retailing costs are avoided when another provider invokes wholesale access.

Platform access rates often said to be built from the bottom up, in that they are based on the cost of providing particular services. Platform access rates vary widely depending on the nature of the complementary service being provided. Long-distance providers pay access charges that have historically exceeded actual cost, in order to allow long-distance service to cross-subsidize local service.[337] Information service providers, in contrast, have long been exempt from access charges.[338] Although the FCC is in the

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336. Access Charge Reform, *First Report and Order*, 12 F.C.C.R. 15982, 16132 para. 342 (1997); MTS and WATS Market Structure, *Memorandum Opinion and Order*, 97 F.C.C.2d 682, 715 para. 83 (1983).

337. *See* HUBER, KELLOGG, & THORNE, *supra* note 2, § 6.2.1.2-.3 (recounting the history of the long distance-local cross subsidy embedded in the post-MFJ access charges).

338. *See Access Charge Reform Order*, *supra* note 286, at 16131-35 paras. 341-348 (describing the history of the so-called "ESP exemption" and deciding to retain it). Subsequent orders indicated that the FCC may be willing to reconsider its position some time in the future. *See* Federal-State Joint Board on Universal Service, *Report to Congress*, 13 F.C.C.R. 11501, 11534-36 paras. 69-72, 11571 para. 147 (1998) [hereinafter *Stevens*

process of reforming the access charge regime, the agency has consistently stopped short of embracing full-fledged, cost-based, subsidy-free rates[339] Platform access rates are further distorted by the fact that long-distance providers are required to pay into the universal service fund, whereas information service providers are not.[340]

Unbundled access rates are required to be calculated in a different manner. The statute requires that UNE access rates be "based on the cost (determined without reference to a rate-of-return or other rate-based proceeding) of providing the interconnection or network element."[341]

The FCC implemented this requirement through TELRIC, which is based on the forward-looking incremental costs of a hypothetical network providing service through the most efficient technology at the locations of the existing wire centers. Like platform access rates, unbundled access rates are built from the bottom up. However, the absence of implicit subsidies and the rejection of a methodology based on historical cost in favor of one based on the replacement cost of a network employing the most efficient current technology leads to widely disparate results.

Finally, interconnection access is governed by the reciprocal compensation provisions of the 1996 Act, which mandates that rates provide for "the mutual and reciprocal recovery by each carrier of costs associated with the transport and termination on each carrier's network facilities of calls that originate on the network facilities of the other carrier."[342] The statute specifically does not "preclude arrangements that afford the mutual recovery of costs through the offsetting of reciprocal obligations, including arrangements that waive mutual recovery (such as bill-and-keep arrangements)."[343]

As noted above, the FCC has implemented interconnection access through TELRIC, although it is considering replacing TELRIC with bill and keep.[344]

The result is that different methodologies apply to rates established for each different type of access. The inconsistency raises the possibility

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Report]; Developing a Unified Intercarrier Compensation Regime, *Further Notice of Proposed Rulemaking*, 20 F.C.C.R. 4685, 4707 para. 45, app. C at 4787 n.48 (2005).

339. *See* MTS and WATS Market Structure, *Report and Order*, 2 F.C.C.R. 2953, 2954-55 para. 13, 2957 para. 27 (1987); Federal-State Joint Board on Universal Service, *Report and Order*, 12 F.C.C.R. 8776, 8785 para. 13, 8786-87 para. 17 (1997) [hereinafter *Universal Service Order*]; *Access Charge Reform Order*, *supra* note 286, at 16002 paras. 45-46, 16010-11 para. 73.

340. *See Universal Service Order*, *supra* note 339, at 9179-80 paras. 788-789; *Stevens Report*, *supra* note 338, at 11549 paras. 99.

341. 47 U.S.C. § 252 (d)(1)(A)(i).

342. *Id.* § 252(d)(2)(A)(i).

343. *Id.* § 252(d)(2)(B)(i).

344. *See supra* note 68 and accompanying text.

that firms will attempt to manipulate the categories of access in order to engage in regulatory arbitrage. The most prominent example of this is the controversy over UNE-P. A carrier that wished to compete by reselling the facilities of an incumbent local telephone company has two choices. The most straightforward way is to invoke the resale provisions of the 1996 Act and purchase wholesale access to the entire network at wholesale prices. Regulators set wholesale access rates at fifteen percent to twenty-five percent below full retail.[345] At the same time, wholesale access can be duplicated simply by using unbundled access to purchase all of the elements necessary to provide local service. In contrast to the top-down approach to wholesale access prices, in which wholesale access prices are based on deductions from full retail prices, UNE access prices are calculated from the bottom up based on the long-run incremental cost of particular network elements. Until the deregulation of mass market switching effectively abolished UNE-P in 2005, new entrants were able to leverage the differences in the pricing to obtain wholesale access at rates substantially below what those regulators deemed appropriate.[346]

The opportunity for regulatory arbitrage will remain so long as access mandates remain in place and differences in the methodologies for calculating access rates persist. Eventually, the advent of competition will obviate the need to harmonize these pricing regimes by eliminating the need for imposing access requirements in the first place.

V. CONCLUSION

The telecommunications industry has undergone a fundamental transformation in the years following the breakup of AT&T. Technological progress has continued to open more areas of the industry to competition. Perhaps most strikingly, breakthrough developments in network technology has made it possible for competition to emerge, not only in complementary telecommunications services, such as long distance, CPE, and information services, but also in the basic transportation services provided by local telephone networks. Indeed, the digitization of electronic communications may cause the distinction between basic and complementary services to collapse altogether.

This technological revolution has been accompanied by a conceptual revolution that has been equally transformative. Breakthroughs in the economics of industrial organization have altered our notions of market failure and provided new insights into how private ordering can solve many problems once believed to require regulatory intervention. Particularly when combined with the growing appreciation of the limits of the tools

345. Hazlett, *supra* note 180, at 484.
346. *Id.* at 483-87.

used to implement regulation, these technological and conceptual advances have opened up the policy space in new and exciting ways.

The problem is that our nation's telecommunications policy has struggled to keep up with these changes. Our regulatory regime continues to invoke regulatory justifications and to adhere to cost-based approaches whose relevance shrinks with every passing year. Moreover, many aspects of the current regime are largely the result of the industry's regulatory history. The result is a confused jumble of contradictory policies that are vulnerable to regulatory arbitrage.

Most problematic is that current policymaking has failed to capture what is perhaps networks' most distinctive feature, which is their ability to compensate for disruptions to the network by rerouting traffic along different paths. In short, current policy conceives of networks as aggregations of individual components without taking into account the way that interactions among particular network components can cause them to respond in sharply discontinuous and unpredictable ways.

This Article attempts to address these shortcomings by offering a critical reassessment of the rationales traditionally invoked to justify the regulation of local telephone networks. It also lays out an integrated framework for modeling network behavior that captures the importance of network configuration and the interactions among individual network components. It applies a five-part framework for categorizing different types of access to assess how each type of access has a different impact on network cost, configuration, capacity, and reliability. Lastly, it draws on Coase's theory of the firm to show how mandating access alters networks' natural boundaries and increases their transaction costs by forcing them to externalize functions that would more economically be handled inside the boundary of the firm.

What results is an approach of considerable analytical power. We recognize that we have barely scratched the surface of the insights that graph theory can provide into telecommunications policy. We hope that future work will explore further implications of our approach. That said, even without any further extensions or refinements, the importance of modeling networks as complex systems should be apparent.