MUNICIPAL WIRELESS BROADBAND: HYPE OR HARBINGER?

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ABSTRACT

Municipal wireless is an important trend, but not for the reasons implied by much of the popular reporting that surrounds this topic. Cities are unlikely to dominate the roster of wireless broadband operators that directly serve the residential and business public. Municipalities, however, have been significant early adopters of innovative unlicensed wireless broadband technologies, providing both a market toehold to innovative products and services using those technologies, and an experimental testing ground for novel organizational models. Most cases of municipal wireless involve the use of unlicensed wireless broadband to meet the local government's own needs for ubiquitous broadband services, or to construct public-private partnerships aimed at facilitating broadband wireless services to the business and residential public. These uses express local government interests long recognized as legitimate: provision of efficient city services, local economic development, and equity within the community. Thus, the concern for policymakers should not be whether cities should be involved in wireless broadband; there are legitimate reasons why they should, and why increasing numbers of them will be. Rather, the important public policy concern is how to ensure that, in the process of facilitating the first uses of wireless, city authority does not get subverted to create artificial limits on future broadband wireless

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competition. Doing so will require thoughtful melding of separate legal frameworks governing access to city property and public rights of way into a coherent policy that guides when exclusivity legitimately can or cannot feature in public-private partnership arrangements for communications services.

I. INTRODUCTION

In July 2004, Philadelphia Mayor John F. Street appointed a "Wireless Philadelphia Executive Committee to explore the opportunity for Philadelphia to become the first large city in the United States to provide city-wide wireless access."[1] A barrage of hype followed, promising that municipal wireless initiatives like Philadelphia's would make broadband ubiquitous and free.[2] Predictably, that has not happened, yet the number of local governments involved in broadband wireless has continued to grow rapidly.[3] Are municipalities really the "savior" (or alternatively, the ruin) of wireless broadband in the United States? The intent of this Article is to put the municipal wireless trend in perspective, and in so doing, sort out the public policy concerns that this trend does and does not raise.

Local government[4] involvement in wireless arises within a context of municipal involvement in broadband more generally (including wired technologies) and a broader technical and industry trend toward customer ownership of networks. Municipal wireless is important, but not because cities themselves are likely to become the dominant providers of broadband service to the residential and business public. Rather, the broader value of local government involvement in wireless broadband to date has been its role as a fertile setting for experimentation, both for innovative unlicensed wireless technologies and user response to the services they enable, and for the structure of public-private partnerships and the balance of local, state, and federal policies related to broadband.

1. News Staff, *Philadelphia to Become Wireless*, GOV'T TECH., Sept. 7, 2004, *available at* http://govtech.net/magazine/channel_story.php/91386.

2. *See* Heather Allen, *Councilor Envisions Citywide Wireless Web Access*, BOSTON GLOBE, Sept. 2, 2004, *available at* http://www.boston.com/news/local/massachusetts/articles/2004/09/02/counc ilor _envisions_citywide_wireless_web_access/; Nancy Gohring, *Philly Opened the Floodgates*, WI-FI NET NEWS, Sept. 2, 2004, http://wifinetnews.com/archives/004106.html.

3. *See infra* Part II & figs.2 & 3.

4. Although this Article adopts the commonly used "municipal wireless" label (partly because of its attractive brevity), "local government involvement in wireless" would label the development more accurately. In this Article, "municipal" wireless" should be understood to refer not only to actions by cities, but also to any type of governmental authority below the state level, including counties, towns, school districts, regional planning boards, and public safety agencies.

A central argument of this Article is that the current policy debate regarding that balance is impoverished by focusing on the wrong issues. Currently, the debate is largely framed in polarized terms: municipal wireless is represented by its opponents as government competition against the private sector, and by its supporters as a way to solve market failures.[5] As this Article demonstrates, most of the cases likely to constitute "municipal wireless" in the future represent neither of these extremes. Rather, they reflect local governments' exploitation of synergies with their own facilities and internal networking needs to lower entry barriers for private wireless operators, thereby improving the range of competitive options available to the cities and to their full residential and business public. Such exploitation clearly threatens incumbent interests. From the standpoint of public policy, however, it represents legitimate municipal action, as long as public-private synergies are exploited in a way that creates a level playing field for private competitors. The key issue for public policy, then, is what additional safeguards (if any) need to be inserted into the complex web of federal, state, and local regulations to ensure that local governments and the firms they first choose to partner with do not use their partnership to create, intentionally or not, artificial bottlenecks that become barriers to future broadband wireless entry.

To develop this argument, the Article begins by reviewing the scale and nature of municipal involvement in wireless to date. Although the number of local governments known to be sponsoring wireless broadband is small, it has been growing rapidly.[6] Examination of what communities are actually doing with wireless broadband indicates that their uses are both internal to the local government (such as for public safety) and external to the public (serving hotzones, businesses, and residences).[7] The untethered nature of wireless technology makes it easier than with wired networks to blur these distinctions, if desired. Thus, it is relatively easy to exploit economies of scope among these different types of applications.

Part II also finds that in the United States, most of the cities that provide service directly to the public already had a ready institutional home

5. For an example of how the debate can be caricatured in these terms, see Lawrence Lessig, *Why Your Broadband Sucks*, WIRED, Mar. 2005, *available at* http://www.wired.com/wired/archive/13.03/view/html?pg=5. *See also* ESTHER SCOTT, KENNEDY SCH. OF GOV'T CASE PROGRAM, CASE STUDY 1824.0: WIRELESS PHILADELPHIA 13 (2005).

6. *See infra* Part II & figs.2 & 3.

7. *See* ESME VOS, MUNIWIRELESS.COM, FIRST ANNIVERSARY REPORT (2004), http://www.muniwireless.com/reports/docs/June2004Report.pdf [hereinafter ANNIVERSARY REPORT 2004]; ESME VOS, MUNIWIRELESS.COM, SECOND ANNIVERSARY REPORT (2005), http://www.muniwireless.com/reports/docs/July2005report.pdf [hereinafter ANNIVERSARY REPORT 2005].

for such a structure, in the form of an existing municipal electric utility ("MEU").[8] While MEU communities have remained prevalent among the early adopters of municipal wireless, much recent growth has been fueled by non-MEU communities where it is more common for local governments to develop partnership arrangements with private firms than to become direct service providers themselves.[9]

Part III dissects the push-and-pull forces that drive and constrain municipal wireless. The availability of unlicensed wireless technology creates an external push, while several traditional concerns of local government create an internal pull. These concerns include: financial pressures to provide traditional city services more efficiently using information and communications technology (e-government), promotion of local economic development, and equitable treatment of residents across geographic and socioeconomic boundaries (digital divide). At the same time, public policies at the state and federal levels have erected barriers to municipal action.

Part IV focuses on exclusivity in public-private partnerships as the key public policy issue raised by the municipal wireless trend, because of its potential to create future barriers to entry.[10] What constitutes fair, level-playing-field access to city resources that facilitate private wireless networks? For example, if a city allows one wireless Internet service provider ("WISP") to mount antennas on city-owned traffic lights, water towers, or public school rooftops, is the city also obligated to allow other WISPs to use those same resources? If access by multiple parties is not feasible, should the WISP that gains access to city resources be obligated to provide wholesale service to other Internet service providers ("ISPs")? The presumed need for exclusive access to some city facilities will always be a judgment call that needs to be informed by the nature of the resource in question and the capabilities of the relevant technology. In this regard, the question of access to city resources bears many similarities to the question of access to public rights of way. This observation leads to the proposal that legal frameworks governing rights of way be used as a model for any federal, state, and local statutory framework that governs access by

8. The author's conclusion in Part II is based on her analysis of ANNIVERSARY REPORT 2004, *supra* note 7; ANNIVERSARY REPORT 2005, *supra* note 7; and AM. PUB. POWER ASS'N, ANNUAL DIRECTORY & STATISTICAL REPORT (2002).

9. *See* ANNIVERSARY REPORT 2004, *supra* note 7; ANNIVERSARY REPORT 2005, *supra* note 7.

10. For a summary of state legal barriers to municipal broadband, see MICHAEL J. BALHOFF & ROBERT C. ROWE, MUNICIPAL BROADBAND: DIGGING BENEATH THE SURFACE 137–208 (2005), *available at* http://www.balhoffrowe.com/pdf/Municipal%20Broadband--Digging%20Beneath%20the%20Surface.pdf.

multiple parties to wireless-enabling facilities owned by local governments.[11]

The Article concludes that local government involvement in broadband wireless is legitimate and likely to continue, even as most cities are not likely to become direct providers of service to the residential and business public. Municipalities provide an important forum for experimentation with novel communications technologies and business models. Such experimentation is essential to the dynamic health of the U.S. economy, and should therefore not be cut off through misguided legislative bans on municipal broadband. State and federal legislators who accurately perceive the value of municipal broadband will be more motivated to seek alternative political compromises to address incumbent interests, and more able to focus their attention on the important public policy issues raised by exclusivity in municipal wireless public-private partnerships.

II. WHAT ARE LOCAL GOVERNMENTS DOING?

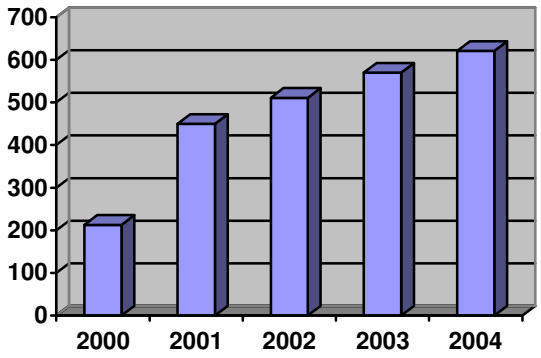
Given that most local government involvement in broadband wireless is relatively recent, the data needed to authoritatively characterize the scale and scope of the phenomenon is scarce. Data from the closest available sources are shown in Figures 1–3. These figures indicate that the absolute number of municipalities involved in broadband, whether wired or wireless, is small relative to the approximately 25,000 localities or "places" identified in the 2000 U.S. Census.[12] On the other hand, the number has grown rapidly over the past few years.[13]

11. *See infra* Part IV.

12. Census 2000 Gazetteer Files, http://www.census.gov/geo/www/gazetteer/places2k.html (last visited Apr. 7, 2006) [hereinafter Census 2000].

13. *See infra* Part II & figs.1–3.

FIGURE 1. U.S. municipal electric utilities doing communications[14]



As Figure 1 shows, among the approximately two thousand U.S. communities with a publicly owned municipal or county-wide electric utility, the number providing some form of communications service nearly tripled over five years, from 213 in 2000, to 621 in 2004.[15] The forms of communications services offered by these electric utilities range from purely internal uses (such as electric system monitoring, load balancing, and automated meter reading) to external services such as municipal government communications (data and voice), dark fiber and leased line services to businesses, and a variety of consumer-oriented services such as cable television, broadband and dial-up Internet access, and telephony.[16] By 2004, over one-third (253) of the 621 utilities doing communications were offering at least one of the services that could be considered as providing broadband to the residential or business public.[17] Only about

14. Figure 1 is based on Carlos Osorio's analysis of annual databases provided by the American Public Power Association, the trade association of U.S. public electric utilities. *See* American Public Power Association, http://www.appanet.org (last visited Apr. 7, 2006).

15. AM. PUB. POWER ASS'N, PUBLIC POWER: POWERING THE 21ST CENTURY THROUGH COMMUNITY BROADBAND SERVICES 2 (2004); AM. PUB. POWER ASS'N, *supra* note 8.

16. *See* Sharon E. Gillett, William H. Lehr & Carlos A. Osorio, *Municipal Electric Utilities' Role in Telecommunications Services*, TELECOMM. POL'Y (forthcoming 2006) (manuscript at 7–9), *available at* http://itc.mit.edu/itel/docs/2004/Municipal_Electric.pdf [hereinafter Gillett et al., *Municipal Electric Utilities*]. *See also* Sharon E. Gillett, William H. Lehr & Carlos A. Osorio, *Local Government Broadband Initiative*s, 28 TELECOMM. POL'Y 551–55 (2004) [hereinafter Gillett et al., *Local Government*].

17. *See supra* note 14 and accompanying text. These services consist of (dark) fiber leasing, broadband transport (leased line service), cable modem, Internet service provider, wireless network, and fiber-to-the-home.

one-fourth (56) of those, however, utilized some form of wireless network.[18] The remaining 184 public utility communities would appear to constitute the bulk of *wired* municipal broadband deployments in the United States.[19]

FIGURE 2. Non-U.S. municipal wireless deployments[20]

Figures 2 and 3 show that local government involvement in broadband wireless is a more recent phenomenon with an even faster growth rate.[21] Worldwide, the number of municipalities already involved in wireless nearly doubled in one year (from 84 to 151 communities),[22] while the number planning initiatives more than quadrupled (from 9 to 38).[23] Because these data are based on a consultant's collection of press reports and self-reporting communities, rather than systematic surveys, they almost certainly understate the actual number of cities involved in wireless worldwide.

18. *See id.*

19. For example, the prevalence of public utility communities among municipal fiber-to-the-home deployments is evident from FIBER TO THE HOME COUNCIL, U.S. OPTICAL FIBER COMMUNITIES—OCTOBER 4, 2005 (2005), http://www.ftthcouncil.org/documents/702104.pdf [hereinafter FTTH COUNCIL] (listing all the U.S. communities served by Fiber to the Home in 2005), where the multicity UTOPIA deployments ongoing in Utah account for the only nonutility municipal entries. *See* Welcome to the Utah Telecommunication Open Infrastructure Agency (UTOPIA), http://www.utopianet.org./corporate.htm (last visited Apr. 7, 2006).

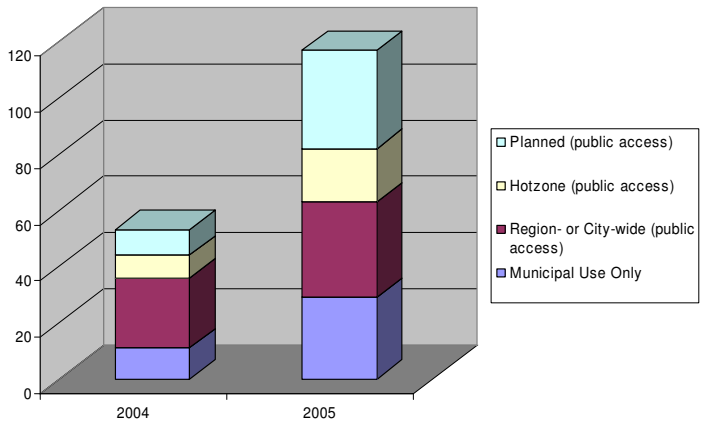
20. *See* ANNIVERSARY REPORT 2004, *supra* note 7; ANNIVERSARY REPORT 2005, *supra* note 7.

21. *See* ANNIVERSARY REPORT 2004, *supra* note 7; ANNIVERSARY REPORT 2005, *supra* note 7.

22. *See* ANNIVERSARY REPORT 2004, *supra* note 7; ANNIVERSARY REPORT 2005, *supra* note 7.

23. *See* ANNIVERSARY REPORT 2004, *supra* note 7; ANNIVERSARY REPORT 2005, *supra* note 7.

FIGURE 3. U.S. municipal wireless deployments[24]



To put these data into a broader perspective, it should be noted that municipal wireless is not the only type of next generation broadband access architecture experiencing rapid growth. Selected telecommunications operators have been deploying fiber-to-the-home ("FTTH") in earnest, particularly NTT in Japan and Verizon in the United States.[25] On October 6, 2005, the Fiber-to-the-Home Council reported that FTTH, whether provided by municipalities, real estate developers, or carriers, had been deployed to 652 U.S. communities in 46 states—a 200% increase (tripling in number) over the previous year.[26] Most of the growth came from communities served by Verizon's FTTH service or independent local exchange carriers.[27] In addition, many private WISPs and community-based groups have availed themselves of the same unlicensed wireless technologies that cities are using to make broadband wireless services available to the public.[28]

24. *See* ANNIVERSARY REPORT 2004, *supra* note 7; ANNIVERSARY REPORT 2005, *supra* note 7.

25. Fiber to the Premises—Wikipedia, http://en.wikipedia.org/wiki/FTTH (last visited Apr. 7, 2006).

26. FTTH COUNCIL, *supra* note 19.

27. *See id.*

28. Again, authoritative data are scarce to document this trend. The WISP Directory lists WISPs in nearly every U.S. state and twenty countries, ranging from Nigeria to New Zealand. Global Listing of Wireless ISPs & Related Organizations, http://www.wispdirectory.com/component/option.com_mtree/Itemid.42/ (last visited Apr. 7, 2006). For brief case studies of a few U.S. commercial WISPs and community-based networks, including those in Champaign-Urbana, Illinois, the San Francisco Bay area, and New York City, see MATT BARRANCA, SPECTRUM POLICY PROGRAM, NEW AM. FOUND., UNLICENSED WIRELESS BROADBAND PROFILES 3–9 (2004), *available at* http://www.

The categories shown in Figures 2 and 3 highlight the different purposes of municipal involvement in broadband wireless. "Municipal use only" encompasses applications aimed at making local governments more effective and efficient.[29] Most such applications involve public safety, enabling mobile broadband connectivity for police, fire, and other emergency personnel.[30] Others involve applications in schools, ports, and other city management functions, such as parking meters and trash collection.[31] In contrast, the remaining categories encompass services offered to the general public, distinguished by a geographic focus that is either narrow (hotzones) or broad (across one or more entire communities).[32]

The remainder of this section provides brief overviews of representative deployments behind these municipal wireless statistics. It is evident from these cases that the categorical distinctions shown in Figures 2 and 3 are not always sharp. Some municipalities are pursuing both internal and public-access strategies, but have been categorized as only one type in the data.[33] Similarly, for cities in the "planned" category, it is not always safe to assume that the offering of service to the public will emerge at the end of the planning process, as some cities inevitably choose to focus their energies, especially at first, on their own needs.[34]

A. PUBLIC SAFETY DEPLOYMENTS

Within the "municipal use" category, public safety applications are common. Consistent with the idea that the nonsurvey data shown in Figures 2 and 3 may well understate deployments, Alvarion, a vendor of unlicensed wireless equipment, estimated in 2004 that sixty U.S. municipalities installed unlicensed public safety networks in their first year of availability.[35] Among them are San Diego and San Mateo Counties in California; Pratt, Kansas; Price and Helper, Utah; Yakima County in

newamerica.net/Download_Docs/pdfs/Pub_File_1547_1.pdf. For a survey documenting the use of unlicensed wireless technologies, primarily in hotspot applications across Africa, see Isabel Neto, Michael L. Best & Sharon E. Gillett, *License-Exempt Wireless Policy: Results of an African Survey*, INFO. TECHS. & INT'L DEV., Mar. 2005, at 73.

29. Author's conclusion based on her analysis of ANNIVERSARY REPORT 2004, *supra* note 7; ANNIVERSARY REPORT 2005, *supra* note 7; and the news reports posted to MuniWireless.com, http://muniwireless.com/topics/municipal/ (last visited Apr. 7, 2006).

30. *See supra* note 29.

31. *See id.*

32. *See id.*

33. *See id.*

34. *See id.*

35. BARRANCA, *supra* note 28, at 17.

Washington; and the city of Midland, Texas.[36] More recent deployments extend the pure public safety network model. For example, in 2004–2005, Granbury, Texas partnered with a local private WISP (Frontier Broadband) to serve the needs of both public safety and public access with a single shared network;[37] and in June, 2004, Spokane, Washington announced similar plans for its downtown area.[38]

The San Mateo Police Department's wireless system was an early public safety deployment that became a model for many that followed.[39] The department purchased and deployed mesh wireless routers from startup vendor Tropos Networks, Inc.[40] The mesh blanketed areas of the city with broadband connectivity, utilizing the 802.11 (Wi-Fi) standard already supported by officers' laptops for unlicensed wireless data transmission.[41] It thus provided low cost, high speed (1–5 Mbps) data connectivity to police officers in the field, replacing slower, more expensive radio systems running at data rates of 9.6 kbps.[42] Instead of having to go back to the office to file reports or gain access to high-resolution information such as mug shots or fingerprints, officers could be more productive by staying in the field while completing paperwork, and more effective by having critical information at the right moments—for example, Amber Alerts, driver's

36. *Id.*

37. TROPOS NETWORKS, PUBLIC SAFETY AND PUBLIC ACCESS: GRANBURY, TEXAS & FRONTIER BROADBAND 4, 6 (2005). *See also* SCOTT, *supra* note 5, at 5.

38. *See* Spokane Launches Dual-use Municipal Wi-Fi Network (June 20, 2004), http://muniwireless.com/municipal/projects/352/; Spokane Hot Zone—FAQ's, http://spokanehotzone.com/faqs.html (last visited Apr. 7, 2006).

39. *See* TROPOS NETWORKS, METRO-SCALE WI-FI FOR PUBLIC SAFETY: SAN MATEO POLICE DEPARTMENT (2004); Wi-Fi Hotzone Helps San Mateo Police (Oct. 8, 2003), http://www.muniwireless.com/municipal/113. *See also* BARRANCA, *supra* note 28, at 18 (describing San Mateo as "the first [mesh wireless] public safety network").

40. TROPOS NETWORKS, *supra* note 39, at 4.

41. *Id*. For tutorial overviews of wireless broadband technologies, see Michael L. Best, *The Wireless Revolution and Universal Access*, *in* TRENDS IN TELECOMMUNICATION REFORM 107 (5th ed. 2003); Marvin Sirbu, William Lehr & Sharon Gillett, *Evolving Wireless Access Technologies for Municipal Broadband*, GOV'T INFO Q. (forthcoming 2006), *available at* http://cfp.mit.edu/groups/broadband/docs/2005/Evolving_Wireless.pdf. Briefly, the best-known standards are the 802.11 series (Wi-Fi) for short-range networks, and the 802.16 series (WiMAX) for metropolitan-area networking. *See id.* at 16–18, 38. Wi-Fi relies on the unlicensed 2.4 GHz and 5 GHz frequency bands, while WiMAX is designed to work over licensed or unlicensed bands. *See id.* at 15–16, 31. Mesh technologies typically link short-range Wi-Fi networks together to provide broader geographic coverage. *See id.* at 18–19, 34. Some broadband wireless equipment also uses the 900 MHz unlicensed band, which is generally more heavily utilized than the higher frequencies, but more applicable in non-line-of-sight situations. *See id.* at 5.

42. TROPOS NETWORKS, *supra* note 39, at 3.

license photos associated with license plates, and the Sex Offender Database.[43]

San Mateo's story highlights the economic appeal of unlicensed wireless networks for a public safety agency on a municipal budget. The police department only had to incur a one-time cost to purchase and install the mesh wireless equipment in order to have a usable network. They did not have to incur additional costs or delays to procure their own spectrum license, nor were they limited to the 19.2 kbps cellular digital packet data radio transmission then typically available (at a recurring monthly cost of about $50 per month per police cruiser) from the commercial wireless service providers who already had such licenses.[44] Finally, the equipment needed to access the network in each cruiser was standardized, meaning that it was inexpensive and broadly available commercially (in many cases, it was already built into an officer's laptop).[45] Thus, the department avoided the need to purchase yet another special-purpose device for each cruiser or officer, and officers had the convenience of one device compatible with both field and office work.[46]

B. HOTZONES

Typically, a hotzone is a small geographic area, such as a public park, downtown shopping district, or city office building, in which wireless connectivity is made available. The type of access varies: some hotzones offer free access, while others require payment; some are provided directly by the city (for example, in public libraries), while others incorporate private resources into the mix (for example, retailers' networks in shopping districts); and some allow access to any type of user, while others are only for use by city employees.[47] In contrast to public safety deployments, hotzones are far from unique to local governments. Commercial hotspots

43. *See id.* at 7.

44. *See* David Berlind, *CDPD Is Nearing Extinction . . . Know Your Wireless Wan Options*, ZDNET, May 11, 2003, http://techupdate.zdnet.com/techupdate/stories/main/0,14179,2913614,00.html; What Is CDPD?, http://www.webopedia.com/TERM/C/CDPD.html%20for%20the%2019.2%20kbps%20speed (last visited Apr. 13, 2006).

45. *See* TROPOS NETWORKS, *supra* note 39, at 4.

46. The use of standardized commercial technologies also makes it easier for public safety agencies to interoperate their radios with each other, should they so desire; this was part of Yakima County's motivation for public safety Wi-Fi deployment. *See* Emily Montandon, *Washington Wi-Fi*, GOV'T TECH., Jan. 18, 2005, *available at* http://www.govtech.net/magazine/channel_story.php?channel=19&id=92 796. Full compatibility, however, requires more than just use of the same frequencies; security systems and other higher-level protocols must also interoperate. *See id*.

47. *See* ANNIVERSARY REPORT 2005, *supra* note 7, at 25–28.

are now familiar in venues such as coffee shops, airports, and hotels.[48] Some enterprises and individual residents also provide free access.[49]

While Figures 2 and 3 indicate rapid growth in the number of hotzones worldwide (from eighteen in 2004 to thirty-four in 2005),[50] significant churn can be observed in the underlying data. Half of the municipal hotzones listed in 2004 were no longer listed in 2005,[51] suggesting that they either ceased operation, or evolved from semipublic to fully-private operations. Such turnover reflects the low startup costs and the experimental nature of the hotzone model.[52]

The hotzone announced by the City of Long Beach, California in January 2003 (supported by a combination of private and city resources) typified early municipal involvement in hotzones, with its focus on a downtown retail district and its rhetoric related to economic development.[53] The value of wireless to shoppers, however, has not proven obvious, and as commercial hotspots have proliferated, recent municipal hotzones have focused more narrowly on public properties.[54] The rationale for municipal hotzone deployments in parks, libraries, city halls, and other municipal buildings is more compelling: enhance the usefulness of public facilities and the services they provide to residents and visitors. This rationale applies especially in public buildings, where the value of wireless access

48. SCOTT, *supra* note 5, at 5; WIRELESS BROADBAND ACCESS TASKFORCE, FCC, CONNECTED & ON THE GO: BROADBAND GOES WIRELESS 30 (2005) [hereinafter TASKFORCE]; Martha Fuentes-Bautista & Nobuya Inagaki, Wi-Fi's Promise and Broadband Divides: Reconfiguring Public Internet Access in Austin, Texas 18–19 (Oct. 4, 2005) (unpublished manuscript), *available at* http://web.si.umich.edu/tprc/papers/2005/445/Fuentes_inagaki_wifiaustin.pdf.

49. For example, guests visiting universities such as MIT can register and use the campus-wide Wi-Fi network for free. *IS Offers Short-term Network Connectivity for MIT Guests*, IS&T NEWSLETTER (MIT Info. Servs. & Tech., Cambridge, Mass.), July–Aug. 2003, http://web.mit.edu/ist/isnews/v18/n06/180602. A study by Bar and Sandvig found many home-based wireless networks left open—apparently intentionally—by their users. *See* Christian Sandvig, *An Initial Assessment of Cooperative Action in Wi-Fi Networking*, 28 TELECOMM. POL'Y 579, 589–91 (2004). The wireless cooperatives studied by Christian Sandvig generally consist of reciprocal access to individual hotspots. *Id*. The Federal Communications Commission ("FCC") provides a chart based on Gartner Dataquest data, estimating that the bulk of hotspots worldwide are provided by retailers. *See* TASKFORCE, *supra* note 48, at 6.

50. *See supra* Part II, figs.2–3.

51. *See* ANNIVERSARY REPORT 2004, *supra* note 7; ANNIVERSARY REPORT 2005, *supra* note 7.

52. *See* Shane Peterson, *Boiling Point*, GOV'T TECH., Nov. 4, 2005, *available at* http://www.govtech.net/ magazine/story.php?id=97156&issue=11:2005.

53. *See* City of Long Beach Offers Free Wireless Internet (Jan. 7, 2003), http://www.m-travel.com/news/2003/01/city_of_long_be.html.

54. *See* Peterson, *supra* note 52.

can typically be realized at low marginal cost by leveraging existing networks for the "backhaul" connectivity beyond the access network.[55]

Although municipalities play a statistically small role in the provision of hotzone-based access, their particular contribution can be quite important in narrowing the digital divide. For example, in a study of the Austin (Texas) Wireless City Project ("AWCP"), an organization promoting free-to-end-user Wi-Fi access, Martha Fuentes-Bautista and Nobuya Inagaki found that free Wi-Fi hotspots offered at commercial venues mirrored the geographic distribution of commercial hotspots—that is, they clustered in more affluent areas of Austin. In contrast, hotspots "located at City facilities and jointly operated by units within the city government and the AWCP . . . are much more widely spread, covering all areas of the city including poorer areas."[56] Given the equitable geographic distribution of city facilities such as libraries and schools, cities are uniquely well-positioned to bring inexpensive or free wireless broadband where it is most needed, if they choose to focus their hotspot efforts on narrowing the digital divide.

C. PROVISION OF CITY- OR COUNTY-WIDE SERVICE TO THE PUBLIC

The category "Region- or City-wide (public access)" in Figure 3 comprises forty-one percent of the wireless systems already deployed by local governments in the United States. A closer look at the cases in this category, however, reveals three distinct organizational models for local government involvement in providing wireless broadband services to the public at scale—that is, to entire communities of mass market (residential and small business) customers. As Figure 4 shows, local governments provide services directly to customers in only a small fraction of cases. As with municipal wired broadband, the majority of local governments that serve the public with wireless do so either directly through, or using critical resources provided by, a nonprofit utility that already existed in the city.[57] Compared to wired broadband, however, public utilities are less dominant, as the flexibility of wireless technologies has engendered public-private partnership models that enable municipal involvement even in communities without preexisting utilities.[58]

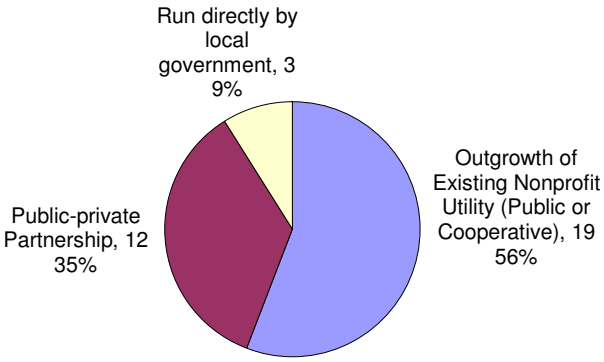
55. *See* Fuentes-Bautista & Inagaki, *supra* note 48, at 29–30.

56. *Id*. at 20 & fig.7.

57. The author's conclusion is based on her analysis of ANNIVERSARY REPORT 2004, *supra* note 7; ANNIVERSARY REPORT 2005, *supra* note 7; and AM. PUB. POWER ASS'N, *supra* note 8.

58. *See supra* note 57.

FIGURE 4. 2005 U.S. deployments serving public (county- or city-wide)[59]



The 2005 data from MuniWireless.com lists only three examples of U.S. cities that are providing service at scale to the public without the involvement of a preexisting electric utility or a private sector partner.[60] All are small communities, and two of the three are geographically remote from urban areas. Waupaca, Wisconsin (population 5700) established a communications utility capitalized by a $320,000 loan from the city's sewer fund.[61] As of January 2004, this newly formed utility had two hundred residential and business customers subscribing to wireless broadband at prices comparable to commercial wired broadband services, and had constructed a $100,000, 192-foot tower and repeating stations with the potential to reach 17,000 people within a thirty-mile radius.[62] Similarly, in late 2004, Marion, Indiana (population 32,600) launched the $12,000 "Marion Enterprise Network" to serve residents and businesses, free at first, but with plans to charge in the future if needed to cover operational costs.[63] By late 2005, city maps of Marion showed Wi-Fi access points installed at City Hall, three water towers, and the local airport.[64] Hermosa Beach, California (population about 20,000), in contrast to Waupaca and Marion, is part of a greater urban area (Los Angeles).[65] Its service to the

59. *See id*.

60. *See id*.

61. Municipalities in Wisconsin Turn into Telco Carriers (Jan. 5, 2004), http://muniwireless.com/municipal/projects/182.

62. *Id*.

63. *See* Marion, Indiana to Offer Wi-Fi Service (June 3, 2004), http://muniwireless.com/municipal/327.

64. *See id*. *See also* Map of Marion, Indiana, Wireless Coverage Area (Dec. 16, 2005), http://www.marionindiana.us/maps/3%20MI.WIRELESS%20AREA1.pdf.

65. Hermosa Beach Loves Wi-Fi (Sept. 23, 2004), http://muniwireless.com/municipal/433.

public grew out of the city's replacement of the $1900 per month it was spending on two T1 (that is, 2 x 1.5 Mbps) lines serving City Hall.[66] The city now spends $600 per month on 6 Mbps of wholesale wireless access from a local ISP, and uses the additional bandwidth to provide service at low incremental cost to thirty-five percent of the city, and to generate additional revenue through advertising, primarily via Google.[67] Proposals are under consideration to use this additional revenue to fund expansion of the network, simultaneously supporting the city's transition to higher speed (for example, 45 Mbps) connectivity for its own needs and the needs of its citizens.[68]

It should come as little surprise that communities with preexisting nonprofit utilities[69] continue to dominate the roster of local governments providing service at scale to the general public. A forthcoming publication demonstrates the importance of economies of scope between a utility's internal communications needs for system-monitoring and control, and the provision of service to the public.[70] Many of the wireless deployments listed as utility-driven in Figure 4 depend critically on attachment to a fiber backbone already run by the utility.[71] For wired networks, the utility's ready access to resources such as utility poles and underground conduits

66. *Id*. For more information, see Wi-Fi Hermosa Beach, http://wifihermosabeach.com/ (last visited Apr. 7, 2006).

67. Hermosa Beach Loves Wi-Fi, *supra* note 65; Wi-Fi Hermosa Beach, *supra* note 66.

68. Hermosa Beach Loves Wi-Fi, *supra* note 65.

69. Public utilities are known as municipal electric utilities ("MEUs") when they serve cities and towns, and as public utility districts ("PUDs") when they serve entire counties, as is common in the Pacific Northwest. *See* AM. PUB. POWER ASS'N, *supra* note 8. In very sparsely populated rural areas, such as northern New England, rural electricity cooperatives are the utility form of choice. *See* National Rural Electric Cooperative Association (NRECA), www.nreca.org (last visited Apr. 7, 2006). Wheatland Electric is one such cooperative utility now serving western Kansas with wireless broadband. *See* ANNIVERSARY REPORT 2005, *supra* note 7, at 11; Wheatland Electric: Utility Delivers Broadband to the Heartland (2004), http://www.alvarion.com/upload/contents/291/CS_Wheatland.pdf.

70. Gillett et al., *Municipal Electric Utilities*, *supra* note 16, at 22. Such economies of scope are not limited to electric utilities. *Id* at 23. For example, Monticello, Florida plans to deploy wireless services to the public based on synergies with remote monitoring and control of Monticello's water and sewer plant. *See* Monticello, Florida Gets Citywide Wireless Network (May 30, 2005), http://muniwireless.com/ municipal/678. The city estimates it will save 650 man-hours, 10,400 miles driven, and $24,400 annually through city ownership of the communications facilities used to monitor wells, sewage lift stations, and other utility resources. *Id*.

71. The city of Dublin, Ohio is included in this category because of its indispensable use of the Columbus Fiber Network for backhaul. *See* ANNIVERSARY REPORT 2005, *supra* note 7, at 20. Dublin is a suburb of Columbus, which has a municipal electric utility. *See* AM. PUB. POWER ASS'N, *supra* note 8. In communities without a public electric utility, city backbone networks are more often provided by the local cable operator through its franchise agreement, which typically does not allow access to this resource for uses beyond the city's own needs. *See* Gillett et al., *Municipal Electric Utilities*, *supra* note 16, at 23.

also provides synergies with the installation of communication links.[72] For wireless, utility poles can help with antenna sites, but a broader range of utility resources (such as water towers) also provide synergies, extending economies of scope from electric to other public utilities.[73] The most important synergy for serving the general public, however, derives from the established customer support capabilities of existing utilities.[74] This synergy applies to any utility regardless of its original service, and the provision of communications regardless of the technology adopted.[75]

The city of Scottsburg, Indiana (population 6000) typifies the experience of a community that has built on the capabilities of its MEU to offer wireless services to the public.[76] In 2002, Scottsburg did not have commercial digital subscriber line ("DSL") service, and T1 services were much more costly than they were in nearby urban areas.[77] Mayor Bill Graham was faced with threatened job losses, in particular from home-based medical transcribers and from a local Chrysler repair shop that would close (eliminating sixty jobs) if its mechanics could not get cost-effective connectivity for the laptops that had become integral to their jobs.[78] Because quick action was clearly needed, solutions with longer lead times, such as development of fiber or licensed-wireless networks, or waiting for commercial providers to prioritize this small, remote community for broadband service, were rejected. Instead, the city chose an unlicensed wireless network operated by Citizen's Communications Corp. ("C3"), which employed equipment from Alvarion and WaveRider that uses the 900 MHz, 2.4 GHz, and 5 GHz frequency bands.[79] C3 is a new utility formed by the city, but it uses resources from the city of Scottsburg's

72. *See* Gillett et al., *Municipal Electric Utilities*, *supra* note 16, at 22–23.

73. *Id*. at 23. *See also* SCOTT, *supra* note 5, at 5.

74. *See* Gillett et al., *Municipal Electric Utilities*, *supra* note 16, at 23.

75. *See id*.

76. *See* BARRANCA, *supra* note 28, at 12–14; Scottsburg, Indiana Wireless Network Saves the Community (Apr. 29, 2004), http://muniwireless.com/municipal/projects/295 [hereinafter Scottsburg, Indiana].

77. Scottsburg, Indiana, *supra* note 76. For example, it cost $1300 per month to lease a T1 line in Scottsburg and only $300 per month to lease a T1 line in Louisville, Kentucky, twenty-nine miles to the south. *Id*.

78. *Id*.

79. *See* BARRANCA, *supra* note 28, at 13. Part of Scottsburg's willingness to opt for this approach came from its understanding of the experience of Owensboro Municipal Utilities, Kentucky's largest MEU and also a wireless broadband provider. *See* Scottsburg, Indiana, *supra* note 76. Owensboro had built out a fiber backbone at a cost of $11 million which enabled them to serve local businesses; however, it would have required much more investment to reach residential subscribers with fiber. *See id*. Once commercial wireless broadband technologies became available, Owensboro was able to leverage its investment in fiber to serve residential customers. *See id.*

MEU, including the MEU's fiber network for backhaul, and its electric and water towers for mounting wireless antennas.[80] Such synergies enabled C3 to build the network over a four month period,[81] at a cost of about $385,000.[82] In the first year of operation, over 350 households and 50 businesses became paying customers,[83] and the school system was saving about $6000 monthly—roughly comparable to the cost of one teacher.[84]

Public electric utilities are relatively rare: only about two thousand U.S. communities are served by an MEU or public utility district ("PUD"), out of about 25,000 "places" listed by the 2000 U.S. Census.[85] These two thousand communities are the most likely to serve the public with wireless communications in the future, with those that have already deployed some form of communications facility (typically a fiber ring for internal system monitoring) likely to be the earliest adopters.[86] Beyond these communities, municipal wireless broadband is far more likely to reach the public through a partnership of the local government with a private WISP.[87] To date, such partnerships have taken many forms.

The public-private partnership developed in Cerritos, California is typical of many.[88] As of 2004, this Los Angeles suburb (population 52,000) still had neighborhoods that were not served by commercial cable modem or DSL service.[89] Cerritos partnered with a private WISP, Aiirmesh, that built an unlicensed mesh network with equipment from Tropos Networks,[90] at a cost estimated below $600,000.[91] Aiirmesh paid for and owns the network, which it uses to provide commercial service to Cerritos residents, businesses, and the city itself.[92] In return, the city provided Aiirmesh with

80. *See* BARRANCA, *supra* note 28, at 13.

81. *Id*.

82. Scottsburg, Indiana, *supra* note 76.

83. BARRANCA, *supra* note 28, at 13.

84. Scottsburg, Indiana, *supra* note 76.

85. *See* AM. PUB. POWER ASS'N, *supra* note 8; Census 2000, *supra* note 12.

86. *See* Gillett et al., *Municipal Electric Utilities*, *supra* note 16, at 9, 23.

87. In fact, even some of the communities listed as utility-driven deployments in Figure 4 are also public-private partnerships. *See* ANNIVERSARY REPORT 2005, *supra* note 7, at 11, 18. Washington state law requires that PUDs offering communications services to the public do so through a private partner. *See id*. The PUDs in Benton and Franklin Counties both partner with private WISPs to offer Internet service to the public. *See id*.

88. For details about the Cerritos deployment, see Michelle Kessler, *City Takes Fast Track to High-speed Access*, USA TODAY, Apr. 1, 2004, at 3B; Cerritos City-Wide Wi-Fi Network Goes Live (Mar. 22, 2004), http://muniwireless.com/municipal/projects/255.

89. *See* Kessler, *supra* note 88.

90. ANNIVERSARY REPORT 2005, *supra* note 7, at 14.

91. *Id*.

92. Kessler, *supra* note 88.

nonexclusive access to city facilities for antenna sites, including city buildings, traffic signals, and streetlights.[93] Both parties benefit from the city's commitment to purchase sixty subscriptions on behalf of mobile city employees, such as building inspectors and maintenance workers,[94] who get higher-speed, lower-cost service than would have been available from traditional cellular providers.

Partnerships between public schools and private WISPs have formed the basis for service to the public in rural counties in western Pennsylvania.[95] These efforts began with the Broadband Rural Access Information Network ("BRAIN") in Somerset County—a partnership between the school district and Sting Communications, a regional WISP.[96] Unlicensed wireless access points were installed on the roofs of two local schools, allowing them to advance beyond 14.4 kbps dialup and shift administrative and classroom functions online as appropriate—for example, making homework available online to students and parents.[97] Sting has also installed additional access points to extend broadband to the community, and the schools have allowed Sting to sell access to the public on the resulting shared network.[98] This type of partnership model also has been replicated in other rural Pennsylvania counties and school districts.[99]

Finally, even some of the largest commercial deployments of Wi-Fi have relied on government involvement to complete their business models. The Wi-Fi network operated by EZ Wireless in Hermiston, Oregon is one of the largest in the United States, covering seven hundred square miles.[100] EZ Wireless was willing to invest $5 million to build this network because of the "anchor-tenant" role played by public sector customers including police, port security, and in particular, the U.S. Department of Defense.[101] The U.S. Army and the Federal Emergency Management Agency's Chemical Stockpile Emergency Preparedness Program needed to develop an effective emergency evacuation plan for the region, given the presence

93. *Id*. The city stated that it will "consider all proposals" if the service is successful enough to attract "competitors [who] want to put their own antennas on Cerritos traffic lights and buildings." *Id*.

94. *See id*.

95. *See* BARRANCA, *supra* note 28, at 18–19.

96. *Id*.

97. *Id*. at 19.

98. *See id*. at 18–19.

99. *See id*.

100. *See* Catherine Yang, *An Oregon Trailblazer: A Wi-Fi Network for First Responders*, BUS. WK., Nov. 21, 2005, at 84.

101. Email from Catherine Yang, reporter for *Business Week*, to author (Dec. 5, 2005, 10:12:00 EST) (on file with author). For further explanation of the anchor-tenant model applied to communications networks, see Gillett et. al., *Local Government*, *supra* note 16, at 543–44.

and planned destruction of chemical weapons at the local Umatilla Chemical Depot; hence, they invested substantial public funds to develop evacuation tools that rely on the network to coordinate first responders.[102] The financial support of these governmental applications has been critical to EZ Wireless's business model, allowing it to provide commercial service to local businesses, including onion farmers supplying the Subway chain of sandwich shops.[103]

D. PLANNED DEPLOYMENTS

From 2004–2005, the number of municipal wireless deployments in the planning stages in the United States quadrupled in number.[104] While many of these planned deployments look like "more of the same"—smaller communities exploiting synergies between meeting the local government's own needs and making service available to the public—this category has also expanded to include two of the nation's largest cities: Philadelphia, Pennsylvania and San Francisco, California.[105] Both of these deployments have been proposed as public-private partnerships, but the details remain subject to change, as both projects remain in the planning stages at the time of this writing.[106]

Compared to deployments in smaller communities, municipal wireless proposals in major cities have featured broader and more ill-defined goals, more complex and more political decision environments, and more unfriendly media and legislative attention.[107] Philadelphia's proposal began attracting public notice in August 2004, when Mayor John Street appointed an executive committee to flesh out a proposal from CIO Dianah Neff that would blanket the city with a wireless mesh network providing "broadband speed at dial-up rates," at an approximate cost of ten million dollars.[108] Objectives for this "Wireless Philadelphia" project were broadly defined to include improving educational and small business opportunities in the city,

102. Yang, *supra* note 100, at 84–85.

103. *Id*. at 85.

104. *See supra* Part II, fig.3.

105. *See* ANNIVERSARY REPORT 2005, *supra* note 7.

106. *See* San Francisco TechConnect, http://www.sfgov.org/site/tech_connect_index.asp?id=33899 (last visited Apr. 7, 2006); Wireless Philadelphia Non Profit Organization, www.wirelessphiladelphia.org (last visited Apr. 7, 2006).

107. *See* SCOTT, *supra* note 5, at 6.

108. *See id*. For more information, see generally Matt Richtel & Ken Belson, *To Battle the Telephone Giants, Small Internet Providers Choose Wi-Fi as a Weapon*, N.Y. TIMES, Oct. 31, 2005, at C4; Grant Goss, *Update: EarthLink Selected for Philadelphia Wi-Fi Network*, INFOWORLD, Oct. 4, 2005, http://www.infoworld.com/article/05/10/04/HNearthlinkwifi_1.html.

reducing the city's telecommunications costs, bridging the digital divide, and, in essence, increasing the city's sex appeal.[109]

The Wireless Philadelphia business plan was made public in April 2005. It featured the establishment of a nonprofit organization that would rely on grants, loans, and private investment to build and operate a wholesale wireless network, selling low-cost service to multiple retail ISPs who would in turn offer service to the public at rates well below commercial wired broadband, with even deeper discounts for low income customers.[110] The city would play an anchor-tenant role for the wholesale network, and provide access (on unspecified terms) to its light poles for the thousands of wireless transmitters expected to be needed to cover the city's 135 square miles.[111]

Along with the business plan, a Request for Proposals was issued, and on October 4, 2005, EarthLink was announced as the winning bidder.[112] EarthLink agreed to pay the entire cost of construction and operation of the network, obviating the need for city investment or a grant-funded nonprofit, and to provide wholesale "open access . . . at reasonable rates to qualified ISPs."[113] In return, EarthLink gained street light pole attachment rights, at terms yet to be determined, and access to other public rights of way needed to construct the network.[114] As it currently stands, in other words, Philadelphia's partnership model bears some similarities to Cerritos's, albeit on a much larger scale.

Building on Philadelphia's experience, Mayor Gavin Newsom of San Francisco launched the "TechConnect" initiative and committee on August 16, 2005, "to bring universal, affordable wireless broadband internet access to all San Francisco's residents and businesses."[115] The Request for Information/ Comment ("RFI/C") issued by the city generated over two dozen responses by September 30, outlining widely varying visions for the city's role in a public wireless network, including operating an open-access fiber backbone,[116] an Internet exchange (interconnection) point,[117] and

109. *See* SCOTT, *supra* note 5, at 6–7.

110. *Id*. at 1.

111. *See* Richtel & Belson, *supra* note 108.

112. *See* Goss, *supra* note 108.

113. Wireless Philadelphia Wi-Fi Project Update (Dec. 2005), http://www.phila.gov/wireless/pdfs /WP_Update_Dec_2005.pdf [hereinafter Philadelphia Update].

114. *Id*.

115. *See* San Francisco TechConnect, *supra* note 106.

116. *See* Comments to the County and City of San Francisco's Request for Information and Comment (Aug. 16, 2005), http://muniwireless.com/reports/docs/BARWN-SF-RFI.pdf; Media Alliance's Comments on SF's Wireless Initiative (Sept. 30, 2005), http://action.media-alliance.org/

offering wireless directly or through a private partner.[118] A Request for Proposal ("RFP") was then issued on December 22, 2005, with responses pending at the time of this writing.[119]

Google's response to San Francisco's RFI/C is especially noteworthy, as it embodies Google's original public-private partnership proposal to the city that is said to have initiated the RFI/C process.[120] Google proposed to provide free Wi-Fi access throughout the city at data rates up to 300 kbps, both for the general public and, on a separate virtual network, for public safety and internal city uses.[121] Higher data rates could be provided through paid services offered by Google and other companies to whom Google would sell wholesale connectivity.[122] In turn, Google would rely on receiving rights from the city to mount wireless transmitters on thousands of lamp posts, as well as on selected buildings.[123] Potentially underlying this proposal is the premise that the costs of providing free access would be more than offset by the additional advertising revenues generated for Google by having more San Franciscans online for more of the time.[124] If this premise proved true (and it is far from clear that it would), such a system could prove quite difficult for other companies to compete against.

III. DRIVERS AND BARRIERS

The cases examined in the previous section highlight several common motivations for local governments to get involved in wireless broadband, as well as some of the challenges they face. Clearly, a key enabler in all of the

article.php?id=94; Response to San Francisco RFI: Bay Area Wireless Research Network (Oct. 11, 2005), http://muniwireless.com/municipal/bids/862 [hereinafter Response].

117. Response, *supra* note 116; SFLan, Response to Request for Information and Comment 2005-07 (2005), http://muniwireless.com/reports/docs/ sflan_rfi_response.pdf.

118. *See* SF TechConnect: Responses to the TechConnect RFI/C, http://www.sfgov.org/site/tech_connect_page.asp?id=35214 (last visited Apr. 7, 2006).

119. Press Release, Office of the Mayor, City of S.F., San Francisco Issues Request for Proposal to Create Universal, Affordable Wireless Broadband Network (Dec. 22, 2005), *available at* http://www.sfgov.org/site/tech_connect_page.asp?id=36615. For the text of the RFP, see City and County of San Francisco, Request for Proposals 2005-19: TechConnect Community Wireless Broadband Network (Jan. 17, 2006), http://www.sfgov.org/site/uploadedfiles/dtis/tech_connect/TechConnectRFP_2005-19_12-22-05Rev1-17-06.pdf.

120. *See* GOOGLE, COMMUNITY WIRELESS BROADBAND NETWORK—VOLUME 1: COMPANY EXPERIENCE (2005), *available at* http://www.sfgov.org/site/tech_connect_page.asp?id=35214 (responding to "the RFI/C regarding our experience and capabilities to provide a broadband wireless network throughout the City and County of San Francisco").

121. *Id.*

122. *Id.*

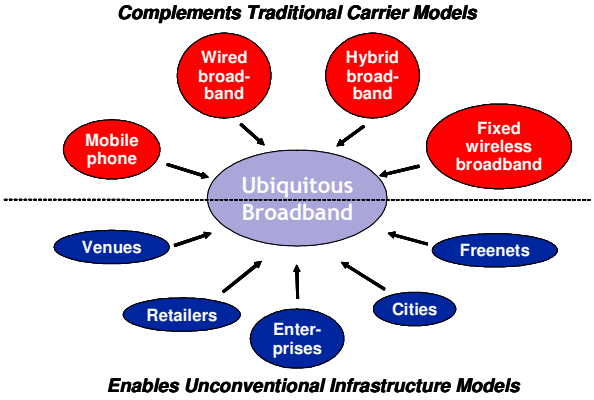
123. *Id.*

124. *Id.*

cases examined above is the ready availability of commercial-grade, sometimes standardized equipment to transmit data over unlicensed spectrum bands, utilizing sophisticated, military-inspired digital-signal-processing technologies that Moore's Law now has made cost-effective.[125] To transmit and receive data over unlicensed frequency bands, users need only purchase equipment that is certified as "friendly" to other equipment sharing the same bands; no further permission is required.[126]

Barriers to municipal adoption of wireless technologies are clearly lower when a license to use the airwaves does not have to be procured first from the federal government. In addition, the standardized nature of at least some unlicensed wireless equipment, such as the ready availability of Wi-Fi in laptop computers, has led to lower costs and fewer vendor lock-ins for municipalities adopting these solutions.[127] Especially in public safety markets, where dedicated frequencies and vendor-specialized equipment have been the norm for voice communications, customers adding wireless data communications capabilities have welcomed the standardized, commercial off-the-shelf equipment options enabled by unlicensed wireless technologies.[128]

FIGURE 5. Unlicensed spectrum as driver of new business models



As Figure 5 illustrates, municipal exploitation of unlicensed wireless can be viewed in a broader context of institutional experimentation with the

125. *See* Sirbu et al., *supra* note 41, at 2, 15.
126. *See* Sandvig, *supra* note 49, at 585–87.
127. BARRANCA, *supra* note 28, at 17–18.
128. *Id.*

low barriers to entry offered by this family of technologies. Traditional telecommunications operators are experimenting with unlicensed wireless as a supplemental offering. For example, both cellular and fixed-line carriers have added Wi-Fi-based hotspots to their networks.[129] But the unlicensed model, by vesting federal permission to use the airwaves in precertified, user-purchased equipment—that is, "at the edge of the network"—instead of in-spectrum licenses that are expensive and time consuming to obtain, also enables "operator-free" networks.[130] In addition to cities, other nontraditional actors such as airports, merchants, university campuses, traditional business enterprises, and user cooperatives are experimenting with offering broadband (whether for a fee or not) in this manner.[131]

Aside from the unlicensed push, three traditional concerns of local governments have pulled them into broadband wireless. Foremost among these is the municipality's role as the manager of local public services, from high profile activities such as public safety and schooling, to more mundane concerns like parking meters, traffic signals, and trash collection. With the advent of e-government and sensor-based applications (for example, using radio-frequency identification ("RFID") tags), many such services can benefit from better broadband, where "better" may mean higher speed at lower cost (desirable for schools and city offices), or available everywhere (desirable for meters, lights, and trash bins), or both (desirable for police cruisers).[132] Municipal wireless deployments are desirable not only because of their relatively low cost, but also because of their potential to save a city money and improve the delivery of city services through these types of applications.[133]

The second concern pulling local governments into wireless broadband is their role as stewards of local economic development. Clearly, the experimentation with hotzones in retail, tourist, and other business districts reflects this motivation.[134] So does the development of

129. *See* Fuentes-Bautista & Inagaki, *supra* note 48, at 18–19.

130. *See* Gillett et al., *Municipal Electric Utilities*, *supra* note 16, at 3–4.

131. TASKFORCE, *supra* note 48, at 30 & fig.7.

132. For examples of how wireless communications can help make trash collection more efficient, see Jim Rendon, *Garbage Disposal Firm Cleans Up with Wireless Apps*, SEARCHMOBILE COMPUTING.COM, Mar. 10, 2004, http://searchmobilecomputing.techtarget.com/originalContent/0,289142,sid40_gci954498,00.html?bucket=NEWS.

133. *See id*. In addition, the City of Corpus Christi, Texas has deployed a wireless network to support RFID-based water and gas meter reading. *See* TROPOS NETWORKS, PIONEERING MULTI-USE METRO-SCALE WI-FI: CITY OF CORPUS CHRISTI, TEXAS 4, 6 (2005). The idea is to avoid problems like fences and dogs that slow down meter readers. *See id.* at 3.

134. *See supra* Part II.

more general offerings of service to the public in response to threatened job losses, as in Scottsburg, Indiana.[135] The rapid response required by this type of threat makes wireless a particularly attractive option.

Even without immediate threats of job loss, all local governments are concerned with attracting and retaining businesses and quality workers. This concern is especially compelling to community leaders in more remote areas, where broadband infrastructure is often more marginal.[136] Many communities perceive a link between broadband infrastructure and the economic health of their communities. A recent empirical study funded by the Department of Commerce bears out their perception, finding that even when other economic factors are controlled for, U.S. communities that had broadband by 1999 experienced a one percent higher rate of job growth from 1998–2002 than communities that did not.[137]

Finally, local government involvement in wireless can express a community's concern for the socioeconomic welfare of all its citizens, and the equitable distribution of infrastructure and opportunity.[138] Bridging the digital divide is almost always part of the rhetoric surrounding municipal involvement, but it is also part of the reality in many cases, such as in the Austin and BRAIN examples discussed in the previous section.[139] Municipal wireless differs from community-based wireless initiatives and WISPs in this regard, in that local government involvement typically dictates that services be made available to the entire community, not just in more privileged areas.[140]

Despite these legitimate motivations, local governments also face barriers to their involvement in wireless or any other form of broadband.[141] Somewhat paradoxically, public policy is one of the most significant

135. *See* Scottsburg, Indiana, *supra* note 76.

136. *See* Sharon Strover, *The Prospects for Broadband Deployment in Rural America*, 20 GOV'T INFO. Q. 95, 98–99 (2003). *See also* Broadband Availability Map: Cable: Vermont Department of Public Service, http://publicservice.vermont.gov/cable/broadband-availability-map.html (last visited Apr. 7, 2006).

137. SHARON E. GILLETT ET AL., U.S. DEP'T OF COMMERCE, MEASURING BROADBAND'S ECONOMIC IMPACT 5 (2006). A one-percent difference in the growth rate is quite large, relatively. Across the entire United States, jobs grew by only five percent during the 1998–2002 period. *Id*.

138. *See* SCOTT, *supra* note 5, at 6–7.

139. *See supra* Part II.B–C.

140. In contrast, Sandvig's investigation of Wi-Fi cooperatives found that "co-ops were not particularly sensitive to public-interest concerns in practice, although in their stated goals they often claimed to be." Sandvig, *supra* note 49, at 597.

141. *See* AM. PUB. POWER ASS'N, PUBLIC POWER: POWERING THE 21ST CENTURY THROUGH COMMUNITY BROADBAND SERVICES 2 (2005).

barriers.[142] As of March 2004, thirteen states had enacted statutory limits on municipal involvement in communications, ranging from outright prohibitions in Texas, to more narrow restrictions on services, business models (for example, wholesale versus retail), approval processes, and financial considerations such as treatment of imputed costs and cross-subsidies from other services.[143]

In March 2004, in *Nixon v. Missouri Municipal League*, the Supreme Court upheld the right of states to legislate such restrictions.[144] The Court's decision was based not on public policy considerations, but rather on its determination that the language of section 253(a) of the Telecommunications Act of 1996 was insufficient to overrule the rights of states to regulate municipalities—their political subdivisions—as they saw fit.[145] Effectively, the Court's decision punted the issue back to Congress and the states.

In the wake of *Nixon*, five more states—Pennsylvania, Colorado, Florida, Louisiana, and Tennessee—have passed restrictions on municipal entry.[146] Pennsylvania's law, introduced shortly after the first Wireless Philadelphia announcement, is particularly egregious, essentially requiring cities to get permission from local telephone companies before offering advanced communications services for a fee to the public.[147] Not to be outdone, Congress began a game of ping-pong on this issue, with a series of rapid-fire bills introduced since May 2005 taking opposing approaches to municipal entry.[148] With many other priorities competing for attention in

142. *See id*.

143. *See id*.

144. Nixon v. Mo. Mun. League, 541 U.S. 125, 128–29 (2004).

145. Section 253 of the Act is entitled "Removal of barriers to entry." Section (a) reads, "No State or local statute or regulation, or other State or local legal requirement, may prohibit or have the effect of prohibiting the ability of any entity to provide any interstate or intrastate telecommunications service." 47 U.S.C. § 253(a) (2000). A question posed to the Court was whether "any entity" should encompass public entities, such as municipalities, as well as private entities. *Nixon*, 541 U.S. at 133.

146. James Baller, Baller Herbst Law Group, Proposed State Barriers to Public Entry (Mar. 14, 2006), http://www.baller.com/pdfs/Baller_Proposed_State_Barriers.pdf.

147. AM. PUB. POWER ASS'N, *supra* note 141, at 2.

148. Briefly, in May 2005, Representative Sessions introduced H.R. 2726, which would ban municipal communications when a private-sector carrier already has offerings in the same geographic area. H.R. 2726, 109th Cong. (2005). In June, Senators Lautenberg and McCain introduced S. 1294, which would prohibit state bans on municipal broadband, and require nondiscrimination from any municipal operator. S. 1294, 109th Cong. (2005). In July, Senators Ensign and McCain introduced a broadly deregulatory telecommunications bill, including a clause similar in spirit to the Sessions bill, requiring municipalities to defer to private operators. S. 1504, 109th Cong. § 15 (2005). In September and November, Senators Dingell and Barton introduced a lengthy draft telecommunications bill (the so-called "BITS bill") which, like the Lautenberg-McCain bill, would prohibit state and federal bans on publicly provided broadband transmission as well as voice- and video-over-Internet-Protocol services.

Washington, none of these bills seem likely to make it out of the 109th Congress.

IV. PUBLIC POLICY CONSIDERATIONS

From the discussion in the previous section, it is evident that the primary focus of public policy action vis-à-vis municipal broadband to date has been "who decides?" or in other words, which level of governmental authority is relevant to determining what cities can or cannot do with communications. This framing of the issue ignores the much more fundamental and important question of what cities should or should not be able to do as a matter of public policy. As lawyers and judges (to whom this nonlawyer author will happily defer) wrestle with the finer points of jurisdictional questions, surely some consideration of the broader public policy implications of their decisions is also in order.

Cities clearly have several legitimate interests—efficient city management, local economic development, and equitable distribution of opportunity—in ensuring that the local government itself, as well as all of the citizens and businesses in the community, have access to ubiquitous broadband services at prices and quality levels that those users consider attractive. Attractive price and quality levels are widely recognized as more likely where there is more, rather than less, vigorous broadband competition.[149] It should therefore be considered good public policy for local governments to use local resources—whatever these may be (and as the variety in Part II illustrates, they will differ across locales)—to foster more, rather than less, vigorous broadband competition.

Local government involvement in broadband should therefore be judged by whether it fosters opportunities for competition, not by whether such competition is good or bad for incumbent providers of telecommunications—or in the case of Pennsylvania's statute, specifically telephone—services. To judge whether a local government's involvement fosters broadband competition requires consideration of the particular competitive situation of each community, and the specific nature of the government's involvement. Because community situations are diverse,

STAFF OF HOUSE COMM. ON ENERGY & COMMERCE, 109TH CONG., DRAFT BILL ON BROADBAND INTERNET TRANSMISSION SERVICES (Comm. Print 2005); Press Release, House Comm. on Energy & Commerce, Committee Releases Draft Broadband Legislation (Sept. 15, 2005), *available at* http://energycommerce. House.gov/108/News/09152005_1642.htm.

149. *See* Lessig, *supra* note 5.

blanket federal bans against municipal involvement in broadband are much too crude an instrument to be considered good public policy.

Even if municipal wireless proves to have served no other important function, which seems unlikely, cities will have been important early adopters of unlicensed wireless technologies.[150] Experimentation with these innovative technologies and the novel organizational forms they enable is critical to the ongoing evolution of communications infrastructure, which in turn is a key enabler of national economic growth. Such experimentation is also critical to the establishment of new entrants in wireless broadband. Without reasonably established vendors, it is difficult for private sector operators to commit to novel technologies. As key early adopters of mesh wireless and other innovative technologies in the United States, cities have provided key markets for establishing new vendors and system integrators in this space.[151]

While blanket bans are clearly a poor idea, narrowly tailored limitations on the nature of local government involvement may be reasonable if needed to ensure that such involvement invigorates, rather than impoverishes, local broadband competition. Particularly in the case of wireless, public-private partnerships are likely to dominate the structure of future local government involvement in broadband. Such partnerships will exploit synergies with the city's own networking needs, and with wireless-enabling facilities owned by the local government, such as traffic lights, water towers, and the rooftops of schools and other municipally owned buildings—all suitable sites for placement of wireless broadband antennas. The public policy challenge for cities is how to exploit such synergies with their private-sector partners without tilting the playing field in such a way that future wireless broadband competitors are shut out of the community.

This consideration is particularly important given the relatively low barriers to entry that characterize wireless networks, particularly unlicensed ones.[152] Cities that have been pleasantly surprised by the interest of WISPs in partnering with them today should not blind themselves to the even more pleasant possibility that more WISPs may wish to serve their communities

150. Matt Barranca cites an estimate from Alvarion (a major vendor of unlicensed wireless equipment) that, as of 2004, municipalities represented "10% of the overall market for commercial grade equipment." BARRANCA, *supra* note 28, at 12. Municipalities played a similar early adopter role for fiber-to-the-home in the United States, representing a disproportionate share of the first homes passed with this technology. *See* Gillett et al., *Municipal Electric Utilities*, *supra* note 16, at 4–5.

151. Interview with Patrick Leary, Assistant Vice President, Marketing, Alvarion Corp., in Cambridge, Mass. (Feb. 2004).

152. *See* Sharon Gillett, William Lehr & Marvin Sirbu, *Wireless Is Changing the Policy Calculus for Municipal Broadband*, GOV'T INFO. Q. (forthcoming 2006).

in the near future. Wireless deployments do not justify the same kind of exclusive franchise agreements that made sense for minimizing the public disruption related to the installation of cable television.

A reasonable strategy is to limit the potential for excessive exclusivity in agreements between the city and its commercial partner. An arrangement like Cerritos's, in which only one segment of the city's communications business is guaranteed to the private partner, and the city promises to give fair consideration to proposals for access to city fixtures from later-arriving WISPs,[153] appears fair. On the other hand, Anaheim, California recently voted to award EarthLink "an exclusive franchise to mount, install, operate and maintain certain of its equipment in areas approved by Anaheim on certain streetlight poles and traffic signal poles."[154] The danger inherent in such an approach is captured well in a comment posted on MuniWireless's Anaheim blog:

> Many of the RFPs I've read include de facto, implicit, or explicit promises about access to facilities that might otherwise not be available on either the same terms (de facto franchise) or at all (implicit franchise) to other companies that might later want to install a broadband network without the city's imprimatur.
>
> . . . .
>
> . . . [In order not to reduce competition,] non-discriminatory access may need to be a principle of municipal networks which will have other natural advantages, such as the city's telecom business.[155]

Three layers of exclusivity are important to consider when evaluating the overall fairness of a public-private partnership for wireless broadband. The most fundamental layer is physical access to facilities: does the private partner gain exclusive access to city facilities, such as light poles and rooftops, for placement of wireless equipment? Above that is network access: is the private partner required to offer wholesale access to other firms wishing to provide retail services, as, for example, EarthLink has been required to do in both Philadelphia and Anaheim?[156] The final layer is access to the city's business: are other firms allowed to serve some of the city's wireless communications needs?

153. *See supra* text accompanying notes 89–93.

154. Anaheim Considers Citywide Wi-Fi (Oct. 24, 2005), http://muniwireless.com/municipal/878 [hereinafter Anaheim].

155. Posting of Glenn Fleishmann to MuniWireless Blog, http://muniwireless.com/municipal/878 (Oct. 26, 2005, 15:35 EST).

156. *See* Anaheim, *supra* note 154; Philadelphia Update, *supra* note 113.

Some degree of exclusivity will always be desirable from the private partner's perspective, but agreements involving exclusive arrangements at more than one of these layers make for limited competition in the dynamic sense, that is, through new entry over time, and therefore, make for poor public policy. In particular, exclusive access at the physical layer is most important to avoid; as the lowest-layer bottleneck, such exclusivity has the strongest potential to shut out additional facilities-based entry. If cities remain truly open to competitive facilities-based entry, their partners will have much less temptation to skimp on quality once they become established service providers.

On the other hand, physical facilities like light poles are not inexhaustible resources able to accommodate huge numbers of wireless transmitters. The boundary line between a physical limitation and unnecessarily restricted access to a municipal resource will always involve an exercise of judgment. Because this type of judgment is very similar to decisions regarding access to public rights of way, it is fruitful to consider the applicability of principles and statutes governing rights of way to the question of access to the wireless-enabling facilities owned by local governments. While such facilities are not typically public rights of way in the same sense as roads, access to them can make a private deployment much more economically viable. This observation is particularly pertinent in mesh networks that require placement of many small antennas, for which no private equivalent to a ubiquitous city resource, such as traffic signals, is readily available.

V. CONCLUSION

Municipal wireless is indeed important, but not for the reasons that are most commonly implied by press reports. Cities are unlikely to dominate the roster of wireless broadband operators that directly serve the residential and business public. The majority of U.S. communities that have followed this model to date have done so by drawing on the resources of an existing public utility.[157] For example, cities have linked wireless nodes through fiber backbones previously deployed by a municipal electric utility.[158] Because public electric utilities are found in under ten percent of U.S. communities, and the other ninety-plus percent appear much less prepared to get into the direct customer service business,[159] the role of city as direct

157. *See supra* Part II.C & fig.4.
158. *See* ANNIVERSARY REPORT 2005, *supra* note 7, at 20; Scottsburg, Indiana, *supra* note 76.
159. *See* Gillett et al., *Municipal Electric Utilities*, *supra* note 16, at 22–23.

service provider does not appear poised to spread far beyond the subset of cities that already operate public utilities. Within that subset, however, there is still plenty of room for growth.

In addition, municipal experimentation with wireless broadband to date suggests that local governments are playing important roles in facilitating the provision of wireless broadband to the public through the formation of public-private partnerships. Often these partnerships evolve out of synergies with a city's use of wireless for its own needs. Unlicensed wireless technologies are providing cities with a cost-effective means to meet burgeoning internal demand for communications, with applications in public safety, schools, and efficient city management (for example, wireless-enabled parking meters).

The review of municipal wireless activity in this Article highlights its ability to complement four traditional functions of local government:

(1) *Efficiently delivering city services*. Broadband wireless enables cities to apply e-government techniques that let them maximize the value of the taxpayer's dollar. By deploying their own networks, cities can make police more productive, schools more cost-effective, and maintenance workers more responsive. In this regard, cities are following a trend toward customer ownership of communications networks that is evident in corporations and nonprofits, such as hospitals and universities, as well.

(2) *Ensuring equity among local residents*. Even in communities where commercial wireless broadband services are available, such services are rarely equitably distributed geographically. By leveraging local government facilities, such as libraries and schools that are geographically distributed within their communities, cities can supplement private sector offerings to ensure equitable access in traditionally underserved parts of town.

(3) *Promoting local economic development*. This concern has been manifested in two distinct forms of municipal involvement in wireless broadband. First, cities have experimented with the sponsorship of hotzones intended to draw shoppers and tourists. High churn among the cities involved in such efforts reinforces the experimental nature of these efforts. Second, cities have taken steps to lower barriers to WISP entry, to ensure the availability of broadband services that have become essential to many forms of economic activity.

(4) *Managing public rights of way*. This function takes a somewhat different form with wireless infrastructure, which imposes a physical requirement for the placement and powering of radios (boxes that can

transmit and receive wireless signals), rather than street cuts. Many different types of city facilities can be helpful or necessary in this regard, ranging from water towers (typically used for longer-range, line-of-sight technologies) to traffic signal poles (used for dense mesh architectures).

Despite the widely recognized legitimacy of local government involvement in these four functions, municipal involvement in wireless has attracted a great deal of controversy and legislative attention. Outright bans have been proposed at the federal level, and at least eighteen states have enacted varying restrictions.[160] Blanket bans on city involvement in broadband are a bad idea. For cities, such bans obviously limit the local government's ability to use available technology to fulfill the legitimate roles outlined above. Blanket bans are bad for industry as well, because they cut off a necessary source of experimentation with emerging technologies, thereby denying critical early-adopter markets to fledgling innovative vendors.

While it may be economically rational for existing communications providers to use the legislative process to slow down the adoption of new technical and organizational paradigms that threaten their existing revenue base, the nation's economic well-being is clearly better served when legislators allow "creative destruction" to proceed apace. Given that it is also politically rational for legislators to respond to the pressures placed on them, political compromises should be considered—for example, providing financial support to the incumbent industries and workers actually dislocated by the advent of municipally supported wireless broadband—rather than completely blocking experimentation and its potential ensuing benefits.

The rhetoric surrounding proposed legislative initiatives focuses on the "unfairness" of the public sector competing against the private: "[T]here is the question of how fair it is to other competitors in the field when governments gets [sic] involved in the provision of service. In particular, when government becomes a market participant, it can have a 'crowding out' effect on private sector competition, innovation, and investment."[161]

The closer examination in this Article of what cities are actually doing with wireless broadband suggests two flaws in this rhetoric. First, it portrays one segment of municipal wireless offerings, primarily those

160. *See* AM. PUB. POWER ASS'N, *supra* note 8; Baller, *supra* note 146.

161. *See* ADAM D. THIERER, PROGRESS & FREEDOM FOUND., RISKY BUSINESS: PHILADELPHIA'S PLAN FOR PROVIDING WI-FI SERVICE 2 (2005).

offered by MEUs, as unduly representative of the whole; most cities are not likely to provide service to the public directly, and therefore do not compete directly with the private sector. Second, it glosses over a much more important issue, namely, the structure of the public-private partnerships that are likely to make up a much larger segment of so-called municipal wireless offerings. If structured with too much exclusivity, such partnerships, like cable franchise agreements, can indeed disadvantage entrants. If properly structured, however, such partnerships can in fact encourage private sector competition, innovation, and investment, not "crowd it out."

Wireless technology is unique in its low barriers to entry. Little public disruption is required (generally, streets do not have to be dug up), and, when unlicensed spectrum is available, the transmission medium is free. Therefore, we should expect that multiple wireless broadband providers could be supported in many locales, especially as demand grows.

Therefore, the legitimate public policy concern with the local government's role in wireless should focus on the degree of exclusivity inherent in the public-private partnership. The right question is not whether cities should be allowed to deploy broadband wireless networks—there are many legitimate reasons why they should and they will—but rather what types of state and federal oversight are necessary to ensure that city wireless initiatives do not lead to corruption of the local government's role.[162] Given the many general legal safeguards that states and the federal government already have in place regarding local government action, any additional oversight should be as narrowly crafted as possible. The goal is to ensure that cities do not, intentionally or inadvertently, foster the first WISP while hindering later entrants. If a light pole or a water tower can physically support multiple operators' antennas, contractual arrangements should not prevent the installation of the second, third, or fourth.

Of course, there are many situational subtleties to distinguishing a technical or physical limit from a legal or political one. Because management of access to public rights of way involves judgment calls of exactly this nature, this Article argues that rights of way statutes could provide a productive template for dealing with the issue of nonexclusive access to wireless-enabling facilities such as city building rooftops, light poles, and water towers. Most such facilities are city property, not traditional public rights of way. Yet for wireless networks, they serve the

162. This thought was articulated by Doug Lichtman, professor of law at the University of Chicago, as part of a panel at the Symposium where this Article was presented in October 2005.

equivalent enabling function. Thus, a useful next step for legal scholars would be to consider how to meld the separate legal frameworks governing nonexclusive access to city property and public rights of way into appropriate checks on the ability of cities to exclude additional wireless competitors. In the future, those additional competitors might even include today's wired incumbents.

In sum, the real public policy issue raised by municipal wireless is not whether cities should be involved in broadband wireless deployments. There are many legitimate reasons why they should, and strong economic drivers that ensure they will continue to be. The real question that needs to be addressed in this debate is how to ensure that city authority does not get subverted to create artificial limits on future wireless competition. Doing so will require thoughtful melding of separate legal frameworks governing access to city property and public rights of way into a coherent policy that guides when exclusivity can or cannot legitimately feature in the public-private partnership arrangements that will increasingly be adopted by local governments to foster broadband wireless networks and services in their communities.