Local Government Broadband Initiatives

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Abstract

The future for Internet access is broadband. Federal and state policymakers are exploring initiatives to promote the deployment and adoption of broadband services, and in recent years, an increasing number of local governments have joined them. While the first generation of narrowband dial-up access was able to piggyback on the near universal availability of the mature telephone network, broadband relies on communications infrastructure that is both more heterogeneous and less evenly distributed. These local infrastructure differences suggest a greater role for local communities in affecting how next generation access will evolve.

A few case studies of local government broadband initiatives exist, but there is little systematic data or research categorizing the range of activity or assessing the effectiveness of these efforts. This paper represents a first step in an ongoing research effort to better understand the factors that influence a community's decision to act, its choice of what to do, and the effectiveness of its actions. In recognition of the diversity of initiatives observed, the paper presents a taxonomy to classify the range of policies that local governments are adopting, according to four roles of government *vis a vis* broadband: as user, rule-maker, financier, and infrastructure provider.

After discussing examples of each type of initiative within the taxonomy, the paper analyzes a sample of communities – those with municipal electric utilities (M.E.U.s) – that have adopted the role of infrastructure provider.[2] From a match of the sample of M.E.U.

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[2] The database on M.E.U.s and their communications service offerings was provided by the American Public Power Association (APPA), a trade association of public power companies

communities to demographic data from the 2000 Census, we find that on average, these M.E.U.s are more often found in mid-sized communities that are more likely to be in rural counties. Those that provide communications are in the vanguard: although they represent only about a quarter of all M.E.U.s, their number has grown more than 10% annually for the past two years.

Within the subset of our sample of M.E.U.s that offer communication services, our analysis finds two distinct segments. While the average U.S. community has a population of around 8,000 people and the average M.E.U community around 42,000, the average population is around 6,000 in M.E.U communities that offer only consumer services, and around 149,000 in those that offer only commercial services. This size-based split suggests two separate rationales for public-sector interventions in different local contexts. Smaller communities may be less well-served by the private sector because commercial carriers may perceive them to be unprofitable in light of the high fixed costs of broadband technology and low prospects for aggregate demand. Larger communities, on the other hand, may experience an abundance of competitive entry that suggests a coordinating or facilitating role for the local government (for example, to encourage competition but minimize street cuts by bringing fiber installation under city management, while leaving the actual use of the fiber to the commercial sector).

The paper concludes with a discussion of issues to consider for further research. These include a deeper understanding of M.E.U.'s choices with regard to technology (in particular, the advent of workable wireless solutions) and business models (the choice of wholesale vs. retail business models, especially in providing consumer services); and extension of the data set beyond municipal electric utilities.

I. Introduction

The future of the Internet is broadband. Information technology played a critical role in the resurgence in economic growth in the United States in the last half of the 1990s,[3] and a range of industry groups and analysts have stressed the importance of broadband access for continuing the evolution of advanced communication services and overall economic growth.[4] Innovative productive practices in business, government, education, health care

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(http://www.appanet.org). In particular we acknowledge the assistance of Ron Lunt, Director of Broadband Services for the APPA, who provided invaluable help in acquiring and interpreting the data.

[3] See (Jorgenson, 2001) as well as the Net Impact Study, www.netimpactstudy.com.

[4] See (Crandall and Jackson, 2001) or, see the Information Technology Industry Council, a group of high-tech firms, including Intel, Dell and others, that are actively involved in lobbying for pro-broadband policy

and daily life are now critically dependent on the ability to communicate information quickly and inexpensively. With more than two-thirds of adults now on-line in the United States, the Internet is becoming a critical component of our communications infrastructure.[5]

During the first generation of Internet growth, the typical user connected via a low-speed dial-up connection supported over a plain old telephone line. These connections need to be set-up each time a user wishes to connect to the Internet and their low speed severely limits the quality of the user experience and the services that can be supported. Higher-speed, always-on "broadband" is needed to uncork this "last mile" bottleneck, enhance the usability of the Internet, and provide a platform for the development of advanced interactive multimedia services.

The deployment of consumer broadband began in the mid-1990s with the offering of modem services by cable television companies.[6] Since then, the availability of broadband access (through cable modems, DSL and other technologies) has increased substantially, and over a quarter of all Internet-connected homes have chosen to adopt it.[7] However, broadband penetration is not distributed uniformly either geographically or demographically.[8] Furthermore, the quality of broadband and range of consumer choice available also varies substantially and is quite limited in many communities. Given the increasing importance of information technology in our ever more knowledge-based and communications-intensive economy, communities that are unserved or underserved with broadband are increasingly at a competitive disadvantage.

What constitutes "broadband access" is not a precise term, however, for the purposes of our analysis here, we use the term to refer generically to Internet access services that are

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initiatives (http://www.itic.org). These calls are not limited to the U.S.; see also Mayor of London, "Broadband: Connecting to London's Future" at http://www.london.gov.uk/approot/gla/publications/e-london/broadband_nov02.pdf.

[5] According to Harris Interactive Polling data, 67% of adults in the U.S. use the Internet from somewhere, with 57% using it from home. Of those with Internet access, 27% have broadband connections (see "Internet penetration rate slows," *Silicon Valley/San Jose Business Journal*, February 5, 2003 (available at: http://sanjose.bizjournals.com/sanjose/stories/2003/02/03/daily41.html).

[6] See (Gillett and Lehr, 1999)

[7] See note 5 *supra*.

[8] See the FCC Broadband Deployment reports at http://www.fcc.gov/wcb/iatd/comp.html. In particular, data as of December 31, 2002 show that while on average 88% of U.S. zip codes have high-speed subscribers nationwide, only 60% of the least densely populated zip codes have any, vs. 99% of the most densely populated. These data generally overstate broadband availability, for a variety of reasons explained by the FCC in their most recent report; see also www.netmapusa.org for finer-grained and potentially more accurate maps of broadband availability within particular states. Furthermore, the FCC's data do not measure quality (other than a speed threshold) or price, meaning that even in communities where broadband is available, it is not necessarily cost-effective or technically satisfactory. Complementary to the FCC's focus on residential broadband, (Gabel and Huang, 2003) examine the geographic distribution of business-oriented data communications services and find similar disparities: for example, only 28% of U.S. wire centers offered packet switching services (such as ATM and Frame Relay) as of 2001.

technically satisfactory and cost-effective from the perspective of end-users. That is, given the state of applications and infrastructure elsewhere in the Internet, access is "broadband" if it represents a noticeable improvement over standard dial-up access and, once in place, is no longer perceived as the limiting constraint on what can be done over the Internet.[9] In most locales, the current version of broadband access is provided via cable or DSL modems and supports about a factor-of-10 improvement over traditional dial-up modems offering 50Kbps.[10] There are also a number of wireless (*e.g.*, 802.16 WiMax and 802.11 WiFi) and wireline (*e.g.*, FTTC and FTTH) technologies in consideration for residential deployment that also can support much higher bandwidth. Deploying these next generation services ubiquitously will require substantial new investment – on the order of hundreds of billions of dollars nationally – and the economic viability of such services is still unproven.

Because we believe that communities will want these capabilities in time (which implies that substantial new local infrastructure investment will be needed) and because we believe that the optimal technologies/deployment strategies will vary by locale,[11] we expect local policymakers to play a critical role in influencing how local access infrastructure evolves. Local governments have little control over some important factors (such as state and federal policy, and the technical state of the art) that influence the geographic distribution of broadband. However, other key factors are subject to some degree of local influence. These factors include local government policies that bear on communications infrastructure deployment, the business and residential demographics that shape demand, and the nature and quality of existing infrastructure (i.e. history).

The role of local factors in determining local broadband availability has motivated a number of communities to take actions aimed at improving their circumstances.[12] In particular, local governments have gotten involved through their role as stewards of local economic development, their need to improve the efficiency and quality of government service delivery through e-government (including online service delivery to local residents and businesses, as well as intra- and inter-governmental communications), their responsibility for K-12 schooling and other quality of life issues, and in some cases their responsibility for other local infrastructures such as water and electricity. In addressing these issues, local governments have adopted a diverse array of policies to stimulate broadband, ranging from municipal supply of infrastructure to provision of incentives to commercial providers.

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[9] This is consistent with the first definition of broadband provided by the Computer Science and Telecommunications Board of the National Research Council: "Local access link performance should not be the limiting factor in a user's capability for running today's applications." (CSTB, 2002, p. 78).

[10] That is, current consumer broadband services in the U.S. usually provide around 1Mbps downstream and a few 100Kbps upstream.

[11] For example, wireless technologies that work in the arid Southwest may be unsuitable in tree covered New England. Or, the choice of next generation infrastructure for a green-field new development is likely to be different than for a community that is upgrading legacy infrastructure.

[12] See (CSTB, 2002).

Historically, local communications infrastructure has been based on the telephone networks owned and operated by companies that generally offer services over areas that are larger than a single community. These telephone companies are regulated as common carriers by state Public Utility Commissions (PUCs) and the Federal Communications Commission (FCC). Although cable television services are municipally franchised, their role in providing 2-way communication services is relatively new (*i.e.*, cable modem services only began to be offered after 1996 and cable telephony services even more recently). The role of local governments in providing advanced communication services is relatively new, but the number of communities that have considered initiatives has been increasing rapidly, with new announcements occurring daily.

Due to the relative novelty of the phenomenon, comprehensive nationwide data about local broadband policies has not yet been collected or evaluated.[13] This lack of data leaves policymakers with little guidance regarding the role that particular local government policies play in furthering or frustrating federal and state broadband policy goals of competition and universal deployment. The consequences are also unfortunate for local policymakers; lacking a common body of knowledge about what has worked elsewhere, they may expend scarce resources reinventing each other's wheels.

Section II of this paper identifies the range of local government broadband policies under consideration and develops a taxonomy that classifies actions into four types of initiatives, according to the role of government as (1) broadband user; (2) rule-maker; (3) financier; or (4) infrastructure developer. As the examples discussed in this section make clear, local participation in the first three types of initiatives is often driven by or in collaboration with regional, state, or federal programs. Public infrastructure provision, however, appears to be more frequently associated with standalone local efforts. In the U.S., it appears that communities with municipal electric utilities (M.E.U.s), as identified by the American Public Power Association (APPA), have led local efforts to supply communications infrastructure. In Section III we report the results of our analysis of an APPA database identifying which M.E.U. communities were providing communications services as of December 2002. This analysis demonstrates the relative newness of the phenomenon: only about a quarter of M.E.U. communities offer any kind of communication services, although this number has been growing in recent years.

The strategies that M.E.U. communities follow to provide communication services appear to be segmented by size: larger communities are more likely to offer commercial services, while smaller communities offer a wider range of services to residential consumers.[14] This suggests two distinct types of environments in which an M.E.U. may decide to offer communication services. In smaller communities, there may be a need to fill the gap if private sector alternatives leave the community underserved. In larger communities, there may be multiple private service providers that offer both a wholesale

[13] (Clark and Baker, 2003) note that the lack of data hindered their ability to develop a decision-support tool/process model for communities to use in developing broadband strategies vis-à-vis broadband project.

[14] See Table 9 below, and further discussion in Section III.

market for utility-provided commercial services, and an increased need to coordinate infrastructure deployment and access to rights of way.

Section IV concludes with a discussion of issues to consider for further research. These include a deeper understanding of M.E.U.'s choices with regard to technology (in particular, the advent of workable wireless solutions) and business models (the choice of wholesale vs. retail business models, especially in providing consumer services); and extension of the data set beyond municipal electric utilities.

II. Taxonomy of Local and Regional Initiatives

Our aim in constructing a taxonomy of local and regional broadband initiatives is twofold: first, to provide a framework for structuring discussion in communities considering whether to undertake a broadband initiative, and if so, what type of initiative to pursue. Second, this taxonomy provides a foundation for future research directed at tracking the progress and effectiveness of local broadband stimulation efforts.

Our taxonomy is constructed based on data we collected from as many initiatives as we could identify from searches of government reports, academic and trade literature, and contacts with industry, government, and academic researchers engaged in studying or implementing these initiatives.[15] It builds on the classification of supply- vs. demand-side initiatives in (Laudeman, 1999)[16], the discussion of municipal networking and public-private partnerships in (Strover and Berquist, 2001), and the classifications of local government actions in relation to the private sector in (Johnson, 1999)[17] and (NATOA, 2003)[18]. We distinguish four categories of local government action, based on the nature of the government's role:

1. **Government as broadband user.** Government indirectly attracts commercial broadband deployment through demand-side policies. In particular, government uses its local leadership role and/or its role as a major telecommunications customer to assess, stimulate or aggregate demand.

2. **Government as neutral rule-maker.** Government adopts or reforms local ordinances that affect the ease of commercial deployment, such as rights-of-way,

[15] Associations we have worked with to date include the National Association of Telecommunications Officers and Advisors (NATOA's membership consists primarily of local government officials responsible for communications and IT), the American Public Power Association (APPA, a trade association for municipal electric utilities), and the International City/County Management Association (ICMA), which collects data about counties as well as cities with population over 2,500. Numerous other national associations of local and regional governments exist, and as this research progresses we continue to establish such partnerships.

[16] See (Laudeman, 1999).

[17] See (Johnson, 1999).

[18] See (NATOA, 2003).

utility pole attachments, road and building construction codes, zoning policies affecting wireless antenna placement, and cable franchise agreements.

3. **Government as financier.** Government provides subsidies for broadband users or providers, which may be direct or indirect in the form of planning or equipment grants, tax credits, or other incentives.

4. **Government as infrastructure developer.** Government adopts supply-side policies in which a division of local government is ultimately responsible for the provision of one or more components of network infrastructure.

In the following sub-sections, for each category, we explain and provide examples of specific actions that governments can take, and briefly discuss the interaction of local strategies with state and federal policies.

A. Government as Stimulator of Demand (Buyer, Facilitator of Aggregation, or Lead User)

When community leaders find themselves dissatisfied with the level of availability, choice, quality, or pricing of broadband services, a common first response is to begin a dialogue with private-sector communications providers. Through such discussions, communities may come to see their unsatisfactory broadband options as a rational response by commercial providers who do not perceive adequate demand to justify their investment in the community. Local governments may then take a variety of demand-side actions designed to make their community a more attract investment target, as summarized in Table 1.

Table 1: Demand-side Interventions

Type of Government Intervention	**Examples**
Measure Demand	• Demand Assessment (Surveys or online registration)
Stimulate Demand	• "Extension" programs (Training businesses in effective ICT use) • Community technology centers (Training citizens, primarily disadvantaged, in ICT use, e.g. Atlanta); • Sectoral pilots (E-government, distance education, telemedicine etc.) • Community information services (Web pages for local businesses and community groups, e.g. Blacksburg [Virginia] Electronic Village)
Aggregate Demand	• Buying Cooperative (Group pricing) • Anchor Tenant (Government's telecom contract in exchange for broader infrastructure availability, e.g. Chicago CivicNet)

In such cases, governments can play a role in aggregating demand. Aggregation initiatives can create monopsony leverage to bargain for lower rates. They can also be structured to reduce a provider's cost to serve any given volume of demand.

Assessment of existing demand is a commonly taken and important initial stepfor determining whether the problem is too little or overly fragmented demand. [19] If demand is limited, government can help stimulate its growth; if demand is fragmented, government can facilitate its aggregation, thereby reducing an operator's cost of providing service; or if demand is plentiful but not at the price and quality levels presently offered, government may be able to use its monopsony power as bargaining leverage to negotiate more favorable terms.

As a trusted third party, local government may have an advantage in serving as an information clearinghouse for both consumers and providers interested in learning about available options and opportunities. Governments can carry out such assessments directly, or participate in public-private partnerships, or leave them entirely to the private sector. For example, the state of Massachusetts provided seed funding for a survey of demand that was conducted by Berkshire Connect, a public-private partnership begun in 1997 to improve communications infrastructure availability in rural Berkshire County. [20] Administering this survey also gave community leaders the opportunity to educate local businesses about the benefits of broadband. In West Georgia, a similar survey was carried out entirely by a local private-sector-led community group, without the participation of local government (Youtie, 1999). Alternatively, in the U.K., individual users can now register their demand for broadband on web sites run by British Telecom (BT)'s wholesale division, by commercial Internet Service Providers, or by U.K. government-sponsored regional economic development agencies acting as neutral brokers. As of April 2003, BT estimated that "more than 300,000 individuals have registered their interest, and so far 44 exchanges have been upgraded [to support Digital Subscriber Line broadband] as a result." Like Berkshire Connect, such programs have elements of demand stimulation as well; for example, BT now supports local "campaigns" to bring registration levels over the necessary threshold in particular (generally rural) communities.[21]

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[19] (Youtie, 1999, p. 1) describes a 1994 situation in West Georgia where "business and educational institutions could not interest another provider or their local government in spearheading advanced infrastructure deployment, because telecommunications vendors had different account managers for each type of organization – large industry, institutional, educational, government, etc. –which ignored the combined demand for infrastructure in the community."

[20] Public-sector partners included the University of Massachusetts, the Berkshire Regional Planning Commission, the Massachusetts Technology Collaborative, and local community leaders. For further details see, (Gillett, 2001).

[21] See "BT to Launch Broadband for Small Communities" (http://www.btplc.com/Mediacentre/Archivenewsreleases/2003/nr0312.htm) and http://www.bt.com/broadband for more on BT's broadband registration and campaigns , and http://www.demandbroadband.com for similar efforts by the East of England Development Agency (EEDA), a U.K. government-sponsored regional economic development authority.

As BT's registration efforts illustrate, measurement initiatives can cut both ways, revealing latent demand in some communities and confirming perceived weaknesses in others. Where demand is weak, government initiatives that stimulate it – whether as their primary intention or as an indirect side-effect - can be especially effective. For example, the state of Ohio's Broadband Initiative, announced in September 2002, includes eVantage Ohio, a program "to train small businesses in the use of e-commerce … in cooperation with Ohio's Small Business Development Center network."[22] eVantage is typical of numerous local and regionally-based information and communications technology (ICT) outreach and training programs for businesses, representing the next wave of government "extension" programs beyond agriculture and manufacturing. Governments have also undertaken programs to train individual users, typically through Community Technology Centers aimed at closing the "digital divide" among disadvantaged populations. For example, (Kvasny and Keil, 2002) describe Atlanta, Georgia's free training programs.[23]

Other government efforts to stimulate demand are more indirect, and rely on government acting as a lead user to create compelling content and applications to drive adoption. These may be in the domain of education, health care, or delivery of government services. For example, many state legislatures now stream video of their legislative and court proceedings.[24] Similarly, the Town of Blacksburg, Virginia streams video of Town Council meetings, representing one of many such outgrowths of the Blacksburg Electronic Village (BEV), a community ICT outreach program run by the local university, Virginia Tech, since the early 1990's.[25] BEV hosts web pages of local content, as well as encompassing other elements of our taxonomy as described below.[26]

Finally, government leadership can facilitate the aggregation of demand within a geographic area. For example, the Ohio Department of Development administers the Ohio Broadband Link, a program that negotiates volume discounts with providers based on the combined purchasing power of businesses within the state. The state covers the

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[22] See "Governor Announces Broadband Initiative" (http://www.state.oh.us/gov/releases/092602broadband.htm) and (Technet/Analysys, 2003) p. 30.

[23] (Kvasny and Keil, 2002) critique the programs for falling short of participant's expectations. In contrast, (Youtie, 1999, p. 3) describes the success of the West Georgia Telecommunications Alliance, a private-sector led knowledge networking and demand aggregation initiative, at training alliance members in Internet use through weekly sessions at the local library. At the federal level, the U.S. government has also played a substantial role in the establishment of Community Technology Centers in disadvantaged neighborhoods: see the U.S. Department of Housing and Urban Development and the Department of Education (http://www.hud.gov/offices/hsg/mfh/nnw/nnwindex.cfm).

[24] See (Technet/Analysys, 2003, p. 19) and http://www.mediachanneltv.com/shows/emopo9.htm for a listing of programs available.

[25] See http://www.bev.net

[26] It is useful to distinguish efforts such as BEV's to gather and disseminate community information electronically, often referred to as "community networks" by practitioners and in published literature, from community construction and operation of physical networks, which we refer to as "municipal networks" and discuss in more detail below.

administrative costs of running the buying cooperative, and passes the discounts through from providers to participating members.[27] The state thus functions as a kind of reseller for commercial providers, reducing the sales and marketing costs required to serve a large number of smaller customers.[28] Other initiatives, such as the Commonwealth of Pennsylvania's Keystone Communications Project, add geographic cost averaging as an integral element of the buying cooperative, requiring providers to offer similar services at similar prices regardless of the customer's location.[29] Anchor tenancy, which involves government aggregating its own buying power as a strategy to attract provider investments, is conceptually separate from a buying cooperative, but the two strategies are often combined in practice. For example, Pennsylvania combined the networking contracts of multiple state agencies into a single contract, guaranteeing a large volume of state business to a provider willing to make reduced telecommunications pricing available to state and local government offices in underserved rural areas. Anchor tenancy, which requires a level of government scale large enough to attract interest from the private sector, has also been used in the state of Colorado for its Multi-Use Network Project, and proposed in the City of Chicago for its CivicNet initiative.[30]

Compared to other approaches in our taxonomy, demand-side initiatives involve low cost and risk for governments, which helps explain their popularity. To the best of our knowledge, their cost and effectiveness have not been systematically studied. Although most demand-side initiatives are relatively uncontroversial, anchor tenancy in particular can create policy tensions. The contract between the government and the private-sector partner needs to be worthwhile for the commercial provider, but at the same time not be so long and exclusive that the government's goal of stimulating competitive deployment is subverted by the creation of a new *de facto* monopoly for the government's own business.

Policy challenges can also arise if the government wishes to extend the economies of scale it achieves through demand aggregation to private sector customers for economic development purposes. Commercial providers may view this type of development as unfairly undercutting their business. Innovative solutions to such public-private boundary issues can usually be found, as long as the public and private partners maintain a healthy working relationship. In Pennsylvania, for example, where the statewide network ran near (but not to) an industrial park, a public-private joint venture was used to build an on-

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[27] See (TechNet/Analysis, 2003, p. 35) and http://www.state.oh.us/gov/releases/092602broadband.htm.

[28] Initiatives with private-sector leadership have also adopted this role, such as the West Georgia Technology [formerly Telecommunications] Alliance (Youtie, 1999; Laudeman, 1999) and Berkshire Connect (Gillett, 2001).

[29] See http://www.keycomm.state.pa.us/keycomm/site/default.asp. Berkshire Connect also features "all for one and one for all" pricing.

[30] See http://www.colorado.gov/dpa/doit/mnt/ and http://www.cityofchicago.org/CivicNet/ for further details of these initiatives.

ramp, with half the funding coming from the state's economic development budget, and the other half from the private-sector provider.[31]

From this summary of initiatives it is apparent that governments at all levels have attempted to stimulate demand for broadband through a range of roles *vis a vis* the private sector: facilitator, buyer, and lead user. At one extreme, governments have done little more than encourage private-sector-led efforts to measure, stimulate, and aggregate demand. At the other extreme, governments have contributed their own demand to an aggregation, taking on the administrative complexities of combining networks from different agencies and branches of government, and contracting with the private sector for supply. In between, governments have led by example, adopting the best practices of the private sector to provide broadband-enabled content, applications, and training.

While examples of each type of approach can be found at local (i.e. municipal) and regional (i.e. county and state) levels, demand aggregation is more commonly adopted as a regional approach. Few underserved municipalities have enough demand, even in the aggregate, to attract new telecommunications investment by themselves (Chicago, the 3rd largest city in the US, is a notable exception, promising $32m of annual aggregate demand through CivicNet). Most communities that wish to pursue demand-side strategies will need to participate in statewide programs (such as Ohio's eVantage buying cooperative) where available, or partner with others in their region to define a suitably large aggregation of users. In very low density regions, reasonable aggregations may not be geographically possible, and alternative approaches will need to be considered.

B. Government as Rule-Maker: Policy Changes

Another way for local governments to make their communities more attractive to commercial providers is to adopt or reform local policies so as to reduce the cost or shorten the time required for private-sector deployments. Examples of local policies that affect the ease of commercial deployment are summarized in Table 2.

[31] Personal communication, Luc Miron, Executive Director, Key-Net Alliance (http://www.oit.state.pa.us/key-net/site/default.asp).

Table 2: Policy Reforms

Type of Policy	Examples
Access to Local Facilities	• Franchising/Licensing and Rights of Way (Use of streets and other public property) • Utility pole attachment (Rules for adding wires and equipment) • Zoning (Rules for facilities placement, esp. wireless antennas)
Coordinated Planning	• Conduit installation during road construction (e.g. Chicago CivicNet) • Antenna siting (e.g. Dubuque, IA)
Industry-specific Regulation	• Negotiation of cable franchise agreement (Cable system upgrades, deployment of networks for municipal use, schools and libraries, etc.)

Deployment of network facilities to support broadband often requires the use of public property. Wireless antennas may need to be placed on radio towers, water towers or other tall structures. Installing wires or conduits may require digging up roads, accessing sewers, or attaching cables or electronic equipment to utility poles, which in some communities (particularly those with a municipal electric utility) are owned by the local government.

Local governments may find that they are inadvertently driving away commercial communications infrastructure investment through policies that result in cumbersome permit application processes, indeterminate or long periods of time for permit issuance, or excessive fees for the use of public property. If this is the case, then reforming the necessary policies can lower the cost for commercial providers to deploy infrastructure in the community, in some cases tipping the balance enough to attract new investment.

Governments can also simplify deployments for commercial providers by coordinating them with municipal public works planning. For example, Chicago's CivicNet initiative proposes to coordinate commercial telecommunications conduit installation with municipal road repairs and water main installations.[32] (NATOA, 2003, p. 18) reports that the City of Dubuque, Iowa took a coordinated approach to wireless antenna placement, offering the use of city property such as water towers and the rooftops of government buildings in order to reduce the need for new structures. As a result, Dubuque was able to add 24 new antenna sites – serving six mobile telephone providers and one wireless Internet Service Provider – with a net gain of only 3 towers.

[32] For example, such coordination can be accomplished by having the city publicize its plans for roadwork to commercial operators, rather then asking commercial providers to disclose competitively sensitive construction plans. This idea was described by Vitaly Troyan, retired public works director for the cities of San Francisco and Los Angeles, at the 2003 conference of the National Association of Telecommunications Officers and Advisors (NATOA).

A 1999 telecommunications survey conducted by the International City/County Management Association (ICMA) found that 93% of local governments had a franchise agreement with a cable company, with a 12.2 year average term length.[33] Cable franchise renewals, when they happen, can be used by municipalities as a negotiating lever to achieve broadband-related goals. A well-known example is Portland, Oregon, which attempted to compel its cable provider to offer "open access" to the cable network by unaffiliated Internet Service Providers. (NATOA, 2003, pp. 9-12) lists numerous other communities that have included broadband-related goals – such as cable system upgrades and the provision of data networks for town facilities ("I-Nets") - in cable franchise negotiations.

As with demand-side interventions, the effects of local government policy interventions have not been systematically assessed. However, the ICMA survey gives a sense of how widely applicable they can be: nearly half of local governments surveyed had an ordinance for franchising local rights or way, or had developed an ordinance regulating the siting of cellular and wireless communication towers.

Localities are not always independent in setting such policies; they must also conform to the state and federal policy context. Because municipalities are legal creations of the states in which they reside, their ability to set particular policies is generally defined by their state legislature, whether through explicit or implicit permissions or prohibitions.[34] When local policies, such as rights of way, affect regulated telecommunications carriers (such as Incumbent Local Exchange Carriers or ILECs), state telecom regulators (the Public Utility or Service Commission) may also become involved. Finally, the provisions of federal communications policy – as embodied in the ever-shifting regulatory framework that has resulted since the passage of the Telecommunications Act of 1996 – also bear on local and state broadband-related policies.

Right-of-way policies in particular have received intense federal and state attention.[35] (TechNet/Analysys, 2003, pp. 10-13) describes a range of policies that have been adopted by 26 states to make right-of-way management less of a barrier to deployment. These policies typically constrain local authority by imposing limitations on fees, requirements for in-kind compensation, or the amount of time for municipalities to process permit applications, as well as standardizing permit applications statewide.[36] Local pole

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[33] Aggregate survey results are available at http://www2.icma.org/upload/bc/attach/{3056C41E-BEAA-4777-86C6-E0A649802A87}tele99web.pdf. Interestingly, 3.2% of local governments surveyed reported that they had provided incentives to attract competing cable providers. Unfortunately, this survey has not been repeated since 1999.

[34] "Generally" because at times federal laws may pre-empt state laws, as for example several provisions of the Telecommunications Act of 1996 were intended to do.

[35] See (NTIA, 2003) and (NARUC, 2002).

[36] Michigan, for example, created the Metropolitan Extension Telecommunications Rights-of-Way Oversight (METRO) Authority in 2002 to administer common fees and enforce maximum delays statewide. See (TechNet/Analysys, 2003, p. 27) and Michigan Newswire, "Engler: "Fast Lane to Future is Now Open" Governor Signs Bills to Speed Broadband Deployment," http://www.michigan.gov/minewswire/0,1607,7-136-3452_3479-20210--M_2002_3,00.html

attachment policies must also comply with federal and state regulations.[37] Similarly, the options available to communities in cable franchise negotiations may be constrained by the FCC's ongoing efforts, in the wake of the Telecommunication Act of 1996, to classify cable-based broadband as an information service.[38]

C. Government as Financier: Subsidies

A third option for local governments is to use their budgets as sources of financial incentives to stimulate broadband, as summarized in Table 3.

Table 3: Subsidies

Target of Subsidy	Examples
Providers	• Grants • Loans (typically at lower-than-market interest rates) • Tax Incentives
Users	• Equipment • Service (typically for a limited time)
Community Groups	• Planning Grants • Training • Non-profit deployments

Financial incentives can be aimed at stimulating supply, demand, or both. Subsidies to commercial providers may be in the form of outright grants, low-cost loans, or tax incentives. Alternatively, they may take the form of one-time concessions in right-of-way or licensing fees, as opposed to across-the-board changes to these policies as discussed in the previous section.

Subsidies to users are typically temporary in nature, or targeted at disadvantaged groups. For example, LaGrange, Georgia gave away WebTV equipment and service for a 1-year period in an attempt to get more of their socio-economically disadvantaged citizens online.[39] Unfortunately, the attempt was largely unsuccessful, reflecting barriers to adoption that go beyond the cost of access, as well as unpopular limitations of the chosen technology (the WebTV devices used had no print capability, for example).

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[37] See a news update regarding the FCC's pole attachment rules at http://www.appanet.org/legislativeregulatory/broadband/poles/poleattachments.cfm and attorney Jim Baller's guide to state and federal pole attachment rules at http://www.baller.com/library-art-practical.html.

[38] See FCC Declaratory Ruling, March 14, 2002, http://ftp.fcc.gov/Bureaus/Cable/News_Releases/2002/nrcb0201.html. Among other things, in this ruling the FCC chose to exercise forbearance with respect to the U.S. Court of Appeals decision in the *Portland* case. At the time of this writing, the U.S. 9th Circuit Court of Appeals has recently ruled that the FCC cannot classify cable modems as purely an information service (see *Brand X Internet Services v. FCC* at http://www.ca9.uscourts.gov/ca9/newopinions.nsf/58AF00C2122345DD88256DB7005BFAA3/$file/0270518.pdf?openelement), but the issue remains in flux.

[39] See (Youtie, Shapira, and Laudeman, 2002) and (Keil, Meader, and Kvasny, 2003).

Although they have not been systematically studied to date, broadband-related subsidies appear to be more common at state and federal levels, where budgets are significantly larger. Michigan, for example, offers tax credits and low-cost financing to "telecommunications providers who invest in new broadband infrastructure," as well as to users buying hardware and software that will increase the use of broadband.[40] States are often the source of planning grants used by local communities to assess their broadband situation and decide what to do about any problems, as for example the state of Massachusetts did for the Berkshire Connect initiative. States also administer telephone universal service funds, as well as federal social welfare funds that may in some circumstances be used to help close broadband divides. For example, Pennsylvania administers a $3.3m digital divide grant program based on federal funds from the Temporary Assistance to Needy Families (TANF) program. One of their 2002 grants was $457,000 to the Glendale School District (located in economically disadvantaged coal country) to extend wireless broadband Internet access from one school to neighboring schools as well as citizens, and to give laptops to community members who partake of training opportunities (Government Technology, 2002).[41] Federal funds may also be distributed directly, as for example the $1.4B (in FY2003) Rural Broadband Loan and Loan Guarantee Program enacted as part of the 2002 Farm Bill, and administered by the U.S. Rural Utilities Service to provide low-cost loans for commercial deployments in rural areas.

D. Government as Infrastructure Developer: Municipal Networking

The remaining strategy that local governments can pursue to stimulate broadband is to develop one or more aspects of the necessary infrastructure themselves. As Table 4 illustrates, the decision to participate on the supply side is not unitary, but rather a chain of subsidiary decisions about which groups of users to serve, which aspects of the infrastructure to focus on, and what role(s) local government should play. U.S. communities that have adopted supply-side approaches exhibit great diversity across these subsidiary choices.

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[40] See Michigan Newswire, "Engler: "Fast Lane to Future is Now Open" Governor Signs Bills to Speed Broadband Deployment," http://www.michigan.gov/minewswire/0,1607,7-136-3452_3479-20210--M_2002_3,00.html and (TechNet/Analysys, 2003, p. 34).

[41] Another example of a combined national-regional initiative can be found in the U.K.'s "Rabbit" initiative, for "Remote Area Broadband Inclusion Trial." The U.K. government and regional economic development authorities have joined forces to provide a subsidy of £4-700 (or one year of service, whichever is less) for small businesses in geographically underserved areas where DSL and cable modem are unavailable, and more expensive options like satellite broadband are the only ones available. See http://www.rabbit-broadband.org.uk/

Table 4: Modes of Local Government Infrastructure Development

Decision Factor	Options
Targeted Users	• **Government** (including schools, municipal facilities) • **Businesses** • **Residents**
Type of Infrastructure	• **Ducts or conduit** (possibly with dark fiber) • **"First mile" network** (connections to customer premises) • **Interconnection point(s)** (e.g. neutrally administered "carrier hotel") • **"Middle mile" connection** (backhaul links to other locations)
Technology (when applicable)	• **Wireless** (unlicensed or licensed) • **Wired** (copper, hybrid fiber-coax, fiber)
Services	• **Broadband** (Internet access, other data communications) • **Video** (cable TV) • **Voice** (telephony)
Government Responsibility	• **Finance** (bonds: special issue or general obligation) • **Build** (may contract to private sector) • **Operate** (may contract to private sector)
Business Model	• **Wholesale** (local government sells capacity to carriers, or leases dark fiber to anyone but with no associated service, or provides "open access" platform to multiple ISPs) • **Retail** (local government sells higher-level services to end users)

Just as measurement of existing demand is an essential first step for pursuing demand-side strategies, assessment of existing supply is a critical input to formulation of a supply-side strategy. Based on an assessment of the communications needs and existing resources available to different groups of users, government can prioritize infrastructure developments for itself, local businesses, and citizens. It is not uncommon for a local government to deploy a network first for its own needs, and later exploit any excess capacity to offer services to nearby businesses.

A local infrastructure survey also helps a government determine the specific types of infrastructure and services that are most lacking, or that it can most effectively boost. Numerous communities that already have municipally run electricity networks have found it feasible to construct first-mile networks for communications services, and the recent emergence of lower-cost wireless networking alternatives appears to be making this option feasible for more communities as well.[42] Depending on the options provided

[42] (NATOA, 2003 p. 17) describes a municipally driven broadband wireless deployment in McAlester, Oklahoma, a community with no municipal electric utility. Similar plans are reported as being underway in other Oklahoma communities through the facilitation of the Oklahoma Municipal Services Organization (OMSC), a non-profit offshoot of the Oklahoma Municipal League that is focusing on municipal wireless

by the selected technology, communities may also face the decision of whether to stimulate video and voice services in addition to broadband data communications.

Solving the first-mile access problem, however, may expose other problems such as high backhaul costs, particularly in remote locations facing distance-dependent pricing for communications circuits.[43] Blacksburg, VA addressed this issue by setting up a neutral interconnection facility for exchange of traffic among local ISPs, so that intra-town traffic could avoid having to incur back-haul costs.[44] Other communities have elected to participate in regional fiber consortia as a solution to this problem. Examples include the Northwest Open Access Network (NoaNet), which evolved in parallel with the Grant County, WA Public Utility District's fiber-to-the-home network deployment, and the Georgia Public Web, which developed alongside numerous municipally led broadband deployments in Georgia such as Thomasville and LaGrange.[45]

Whichever aspects of infrastructure a local government chooses to develop, a key decision it faces is where to draw the functional boundary between itself and the private sector. Infrastructure construction and operations can readily be contracted out to private companies, following the recommendations of privatization advocates (Savas, 2000, chapter 9). Project financing, however, remains the essence of local government's responsibility.[46] Local financing may consist of special-issue bonds that have to be repaid out of service-related revenues, or of general obligation bonds that can be repaid out of tax collections. Local government's access to funds with a longer-term payback period, potentially lower interest cost, or taxpayer backing has proven to be a lightning rod for controversy. From the perspective of local governments, these financial terms are key to making broadband deployment economically feasible in places where it otherwise would not be. From the perspective of current or would-be private sector operators in a community, however, these terms give municipalities an unfair competitive advantage.[47]

In between these two perspectives lies a compromise whereby local government uses its "unfair" financial advantage only for solving the problem of unfavorable network deployment economics, while leaving the provision of higher-level services to the private

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networking installations. See also (Blackwell, 2002) for a description of municipal wireless systems in Ellaville, GA; Pocahontas, IA; and Buffalo, MN (all of which are municipal electric communities).

[43] "Backhaul" refers to connections that transport traffic in aggregate from between, for example, an access network and an Internet backbone.

[44] Blacksburg's "Multimedia Services Access Point" is described at http://www.bev.net/services/msap.php. Aside from addressing backhaul costs, it also enhanced performance.

[45] See http://www.noanet.net for more information about NoaNet, and http://www.townware.com/site/ for more information about the Georgia Public Web.

[46] When government's role is purely as a financing agent, the resulting strategy may alternatively be viewed as a form of subsidy.

[47] Recourse to general tax revenue may also motivate taxpayers to stop local government from moving ahead with a proposed broadband project See http://www.tricitybroadband.com for a recent example of this phenomenon in Kane County, IL (the cities of Geneva, St. Charles, and Batavia).

sector.[48] In other words, local government adopts the wholesale business models shown in Table 4. Such models have received support from industry as well as state and federal policy makers,[49] and have been used extensively by municipal electric utilities offering business communications services (see discussion below). It appears, however, that very few of the 62 utilities that provided broadband to residential users at the end of 2002 did so with an "open access" model.[50] Like all other local broadband strategies, municipal infrastructure provision takes place within a state and federal context. Sometimes this context encourages municipal networking. Iowa operates a public statewide communications network that municipal networks are allowed to connect to, reducing their backhaul costs. Utah's history of using inter-local agreements led 18 communities to band together into the UTOPIA project, an ongoing attempt to achieve economies of scale in planning, financing and constructing municipal last-mile fiber networks.[51] Municipalities may also consider classifying themselves as "Competitive Local Exchange Carriers" (CLECs) according to the federal Telecommunications Act of 1996, giving them the right to lease elements of the telephone network from incumbent carriers.

More typical, however, are policies that restrict municipal action, which have been enacted in at least 15 states and challenged at multiple levels, increasing uncertainty for municipal planners.[52] These policies range from outright prohibitions as in Texas, which "bars municipalities and municipal electric utilities from offering telecommunications services to the public either directly or indirectly through a private telecommunications provider;" to partial restrictions as in Washington, which prevents county-wide Public Utility Districts (but not municipalities) from offering retail services, but allows them to

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[48] This position is often articulated via the metaphor that "government should run the roads, but leave the taxi services to the private sector." It is interesting to consider what public bus services might imply for this metaphor.

[49] For example, the state of Washington requires Public Utility Districts that offer broadband to offer only wholesale services. The wholesale-only model is an explicit policy recommendation of (TechNet/Analysys, 2003).

[50] Personal communications, Ron Lunt, APPA, based on our definition of "open access" as the M.E.U. providing broadband transport only, and allowing more than one ISP to serve consumers over its network. Three communities that adopted this model voluntarily are Spencer, IA; Ashland, OR; and Tacoma, WA. Grant County, WA is a Public Utility District and therefore prohibited by state law from selling retail services. Many of the newer municipal FTTH deployments have announced their intention to operate in a wholesale-only mode, or to provide retail services in a non-exclusive manner.

[51] Details of the Utopia project can be found at http://www.utopianet.org. This project applies the benefits of aggregation to the supply side.

[52] At the time of this writing, the Supreme Court has agreed to weigh in on one such challenge (*FCC vs Missouri Municipal League*). The root of the challenge is Section 253(a) of the Telecommunications Act of 1996, which stipulates that state and local laws may not prohibit "any entity" from providing telecommunications services. "Any entity" has been variously interpreted as possibly excluding public entities. For further details on legal challenges, see slides 9-11 in http://www.neca.org/MEDIA/JAMESBALLER.PDF.

sell wholesale telecommunications services; to explicit permissions as in Nebraska, which allows municipalities to lease dark fiber, subject to various restrictions.[53]

This heterogeneity reflects different geographic, historical, and political circumstances in each state, as well as controversies over whether municipal entry furthers or frustrates state and federal broadband policy goals of advanced services deployment and local telecommunications competition. On the one hand, municipally-provided infrastructure may further universal service and competition goals by providing additional alternatives to commercial deployments, especially in areas where these are limited by unfavorable economics. On the other hand, government-sponsored deployments may diminish broadband competition by "crowding out" private-sector deployments in the short or long term. Without data and analysis to examine the effect of municipal deployment on broadband policy goals, most such controversies to date have remained in the realm of philosophical debates.

III. Communications Services Provided by Municipal Electric Utilities

As noted earlier, the provisioning of infrastructure represents the most direct way in which a local government may act to promote broadband, and the one option (of the 4 categories discussed above) that is uniquely available to local governments. Municipally-provided broadband appears to represent a growing trend, encouraged by advances in technology (in particular, lower-cost broadband wireless solutions), growing recognition of the importance of broadband services, and frustration with the pace of private-sector provisioning efforts. Because local government infrastructure provisioning efforts are relatively new, consistent data is lacking with which to analyze their prevalence, nature and effects in general (*i.e.* where are they happening, why, and to what effect, across all communities in the U.S.). However, the American Public Power Association (APPA) maintains a database of communities with Municipal Electric Utilities (M.E.U.s) that reports which, if any, communication services are offered by each utility.[54] This section reports the results of our analysis of this database of "early adopters" of municipal communications.

It is not surprising that M.E.U. communities have been in the vanguard of providing municipal communication services, including broadband. For these communities, many of the costs of offering communication services have already been incurred. As the local power company, the M.E.U. already has access to conduit and/or utility poles, a fleet of trucks to provide outside plant and customer premise servicing, and a service relationship with consumers and businesses in the community. In interpreting the analysis of data about M.E.U. communities, such factors must be borne in mind; not all conclusions

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[53] These examples are selected from more complete lists in (APPA, 2002, p. 4), (NATOA, 2003) and updates received in personal communications from attorney Jim Baller and Analysys consultant Michael Kende. Relevant state laws for the states described here are Texas Utilities Code, § 54.201, et seq.; Revised Code of Washington §54.16.330; and Nebraska Legislative Bill 827, approved by the Governor May 25, 2001.

[54] See note 2, *supra*.

drawn from this data necessarily apply to non-M.E.U. communities. Despite that caveat, there is sufficient variety within the database of M.E.U. communities that it is possible to examine whether there are systematic differences between those that have moved into communications, and those that have not.

The APPA directory lists over 2,000 municipally-owned power companies. Although these represent a large share of the 3,152 electric power utilities in the United States, they accounted for only 16% of power sales – the majority of which are provided by much larger investor-owned utilities (Table 5). The public utilities range from tiny companies serving less than a hundred consumers to huge ones serving hundreds of thousands of consumers, and are distributed all over the United States (Table 6).

Table 5: U.S. Electric Utility Statistics, 2000[55]

	Number	Sales (Megawatt-hours)
Publicly Owned Utilities	2,009	516,681
Investor Owned Utilities	240	2,437,982
Cooperatives	894	305,792
Federal Power Agencies	9	49,094
Total	3,152	3,309,549
Share Publicly owned	64%	16%

Because our focus is on community-based initiatives, we exclude utilities that serve multiple communities as an aggregate (*e.g.*, public utility districts and public power districts that serve entire counties). Additionally, we were not able to match all of the utilities uniquely to community-level Census data.[56] Consequently, our working sample includes data on 1,815 of the APPA communities spread out across the U.S. (Table 6).

[55] Source: "2002 Annual Directory & Statistical Report," American Public Power Association, page 13.

[56] We matched APPA communities to Census data aggregated according to Census "place" names, a new aggregate that was created with the 2000 Census. There are approximately 25,000 unique places in the Census data.

Table 6: Distribution of APPA Communities by State
(and mean APPA community population by state)
U.S. Total (1,815 communities): Mean population 16,670

State	# APPA Utilities	Mean Population for APPA communities	State	# APPA Utilities	Mean Population for APPA communities
AK	33	10,197	ND	12	1,604
AL	35	17,819	NE	120	2,745
AR	15	20,163	NH	3	2,830
AZ	10	135,966	NJ	9	13,142
CA	33	214,239	NM	7	13,171
CO	29	24,533	NV	4	125,515
CT	3	16,393	NY	47	6,956
DE	9	10,558	OH	85	20,375
FL	32	51,389	OK	62	6,069
GA	51	11,247	OR	15	12,477
IA	135	2,895	PA	34	4,844
ID	11	7,413	RI	1	4,742
IL	41	11,900	SC	21	8,481
IN	73	5,939	SD	34	6,508
KS	119	3,785	TN	58	32,100
KY	24	11,794	TX	70	31,681
LA	21	10,121	UT	39	11,839
MA	20	24,261	VA	16	17,861
MD	4	13,439	VT	12	4,496
ME	4	3,794	WA	20	51,941
MI	40	34,050	WI	81	5,203
MN	124	5,134	WV	2	4,427
MO	88	8,543	WY	13	3,789
MS	23	10,678			
MT	1	957			
NC	72	13,549			

The APPA database identifies the utility by name, the community in which the utility is located, and what sorts of communication services (if any) were offered as of the end of 2002.[57] The communities in our sample provided a diverse array of communication services that can be grouped loosely into four categories: (1) services for the internal use of the utility; (2) data services for the local government; (3) services provided to consumers; and (4) services provided to commercial customers. The internal-use services

[57] The data on services is based on an APPA-administered survey, with self-reporting by the utilities and review by APPA personnel.

included voice communications and various electricity network metering/monitoring services.

The residential consumer services include telephony and cable TV, as well as Internet access services, including dial-up and broadband modems. The commercial services include leased lines and dark fiber leasing. Tables 7, 8, and 9 show the range of telecommunications services offered, matched against average populations for the communities offering them.

We classified the services offered into "internal" and "external" services. The former include services provided for the utility's internal use, such as automatic meter reading and system control and data acquisition (SCADA) that are intrinsic to the operation of a modern power grid. In addition, we classify data services provided to the municipal government as internal because these likely involve only a few high-speed data connections to a few fixed locations. In contrast, the external services include communication services offered to residential or commercial customers.

While the offering of any type of communication service demonstrates the existence of communications capabilities, the provisioning of external services likely reflects a larger financial and organizational commitment to offering communication services. We hypothesize that some M.E.U.s progress by first offering internal services; however, our data does not allow us to test for such dynamic effects.

Table 7: Breakdown of Utilities Offering Different Communication Services

	Number in sample	Population (mean)
Total Census "Places" in U.S.	24,861	8,019
Total Communities with Municipal Electric Utility	1,815	16,690
Utilities offering at least one communication service	445	42,449
Utilities offering at least one service for internal use:	327	53,423
Internal telephone service	76	124,861
Automated meter reading	129	59,720
System control & data acquisition	281	62,629
Municipal data communications	181	41,123
Utilities offering municipal data or internal services	362	50,172
Utilities offering at least one service to residential/consumer customers[58]:	170	16,436
Cable Television	95	12,238
Local Telephone	35	10,566
Long Distance Telephone	29	15,230
Video on Demand	8	31,850
Wireless services[59]	29	20,231
ISP[60]	118	18,144
Broadband Modem	62	18,104
Utilities offering at least one service to commercial customers:	167	73,011
Leased (Private) Lines	98	35,870
Dark Fiber Leasing	128	88,412
Number offering commercial or residential service	236	53,376
Number offering commercial, no residential	66	148,523
Number offering commercial & residential service	101	23,668
Number with broadband modem & telephone service	19	10,221
Number with broadband modem & commercial service	54	19,796
Number with fiber leasing, no residential or leased lines	52	158,413

[58] We have classified telephone and wireless services as residential, although these may also be provided to commercial customers.

[59] Utility provides a radio frequency based commercial service (*e.g.*, PCS Service).

[60] This includes dial-up access.

Table 8

Communities with Telecom Services
Population (in 000's) & [Number]

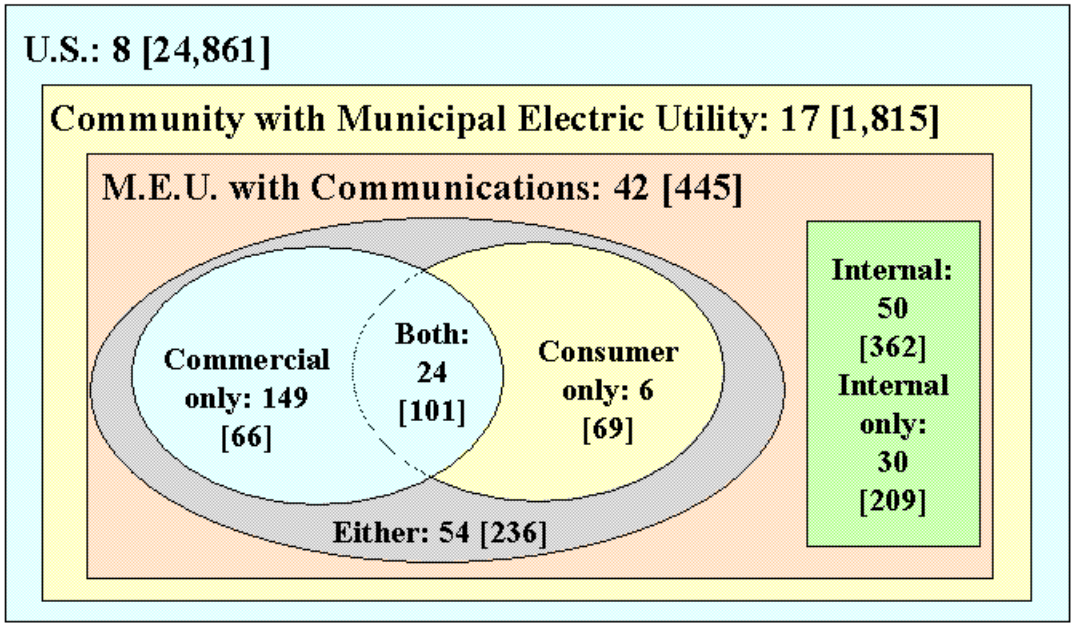

Table 9: Communities with Municipal Electric Utilities
(2000 Mean Population, [number of communities])

	No Commercial Services	Commercial Services
No Consumer Services	11,207 [1,579]	148,522 [66]
Consumer Services	5,852 [69]	23,668 [101]

Of the 24,861 total communities uniquely identified in our database, 1,815 of these (7.3%) are APPA communities. Of the APPA communities, 445 (or 24.5%) offered some kind of communication service at the end of 2002, an increase of approximately 14% over the previous year.[61]

Table 7 illustrates great diversity in the range of services offered. Not surprisingly given the nature of the sample, the most common types of service to offer are communication services for internal use by the electric utility, followed closely by data services offered to the municipal government. Of the utilities providing a communication service, only slightly more than half (236) offer services to either residential or commercial customers, and less than half of those (101) offer services to both. Thus, only a small fraction of the APPA communities offer any substantial range of communication services to end-users. This is not surprising considering the relatively early stage in the development of broadband, and the prevailing assumption, especially prior to the recent meltdown in the telecommunications sector, that competitive markets would assure ample private-sector provision of access alternatives for most communities.

In our sample, there are only 62 communities that provide consumer broadband services, and the majority of these (49) provide broadband via cable modems,[62] while the remaining communities likely use a mix of technologies ranging from DSL modems to FTTH to wireless.[63] Only 19 communities are providing both consumer broadband and telephone services, implying that only a small fraction of even those communities that provide both commercial and residential services are offering the telecommunication services we associate with most ILECs.

As Tables 8 and 9 demonstrate, the sample of M.E.U. communities that offer communication services displays a distinct segmentation by size. Communities that offer only residential services are much smaller on average,[64] while those that offer only commercial services are much larger. One possible explanation for this result is that M.E.U.s are most likely to offer consumer services when alternative private sector

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[61] The APPA reported that 511 utilities offered some kind of communications service at the end of 2002, up from 450 at the end of 2001 (see, "Public Power: Powering the 21st Century with Community Broadband Services (available at http://www.appanet.org/LegislativeRegulatory/industry/TelecomFactSheet5-03.pdf for data for 2002; and http://www.appanet.org/LegislativeRegulatory/Broadband/CommunityBroadbandFact.pdf for 2001 data). These numbers differ from the counts in our database because we have excluded county-wide utilities and other communities that we could not match to Census "place" data.

[62] Because these communities also provide municipal cable TV services, we infer that the broadband offering is via cable modem.

[63] Of the 13 non-CATV communities with broadband, only one of these communities reports offering a telephone service, although 5 report wireless services. One of those that does not report either, Taunton MA, is deploying FTTH.

[64] That the typical APPA community is larger than the typical Census Place community (17K vs. 8K) is not surprising since the smallest communities may be more likely to be served by rural power cooperatives or multi-community utilities and therefore not included in our APPA sample.

services are lacking (*i.e.*, the local cable or telephone company is not already offering services).[65]

Table 10 provides logit regression results that demonstrate the significance of the stratification of communities suggested by Table 9. The apparent bias in favor of offering business services in larger, more urban communities is likely related to demand-side factors (*i.e.*, these markets provide the largest demand base for advanced services and are the most receptive to wholesale services being offered by the utilities).[66] In many of these business-only markets, the M.E.U. is leasing dark fiber, and its customers include private-sector telecommunication service providers in addition to commercial end-users. Urban communities have been growing more rapidly in recent years, and the housing stock is typically newer. These factors indicate larger potential demand for communication services and also may suggest lower incremental costs for deploying communications infrastructure because the facilities are newer.

Table 10: Logit Regressions
Pr(Community offers service X)

Service X =	Residential Service	Only Fiber Leasing
Population (000s)	-0.025	0.018
	[0.007]**	[0.007]*
Urban (Code=1 if in DoA Metro County)	-0.083	0.718
	[0.442]	[0.353]*
Constant	1.894	-0.665
	[0.292]**	[0.225]**
Observations	180	180

Standard errors in brackets
* significant at 5%; ** significant at 1%

IV. Conclusions and Future Research Directions

It is evident from the examples and statistics presented in this paper that local governments have become increasingly involved in broadband in recent years. The deployment of broadband infrastructure is more contingent on local context than narrowband (dialup) has been. As the relevance of broadband Internet access to local economic development and quality of life becomes increasingly evident to communities,

[65] Recall that in 49 of the 62 APPA communities providing consumer broadband, the APPA utility is also a cable TV provider.

[66] Communities in our sample are classified as urban or rural based on the Department of Agriculture's (DoA) classification of their home county. In this 9-level classification scheme, any community in a county with a classification code of less than 4 is identified as urban, otherwise it is identified as rural. See http://www.nal.usda.gov/ric/faqs/ruralfaq.htm for additional information on the Department of Agriculture's rural-urban coding scheme.

we expect their involvement in the development of broadband infrastructure to continue growing.

In spite of the increasing importance of local governments in the evolution of "last-mile" infrastructure, little systematic research is available with which to quantify or evaluate the extent of such activity and its impact. To help remedy this deficit, this paper has presented a taxonomy of local government broadband initiatives, highlighting four roles of government *vis a vis* broadband – as buyer or other stimulator of demand, rule-maker, source of funds, and developer of infrastructure. These roles need not be mutually exclusive; an open avenue for further research is to identify the complementarities among strategies and the systemic mixes of factors that are associated with effective initiatives. Nor do these roles have to be unique to local government. As the examples discussed in this paper illustrate, partnerships with the private sector, with higher levels of government, and with other local governments are common across all four roles.[67] In fact, actions of the first three types appear to be more commonly initiated at higher layers of government, with locals exercising the option to join in. Public infrastructure provision, on the other hand, appears to be much more commonly initiated and executed by local governments, perhaps because key components of the infrastructure – such as wires connecting to homes and businesses – are purely a local issue.[68]

This paper has also presented a preliminary analysis of one sample of communities pursuing one type of approach: a sample of municipally-based electric utilities (*i.e.*, communities which have already identified themselves as actively involved in the provisioning of basic infrastructure), and a sub-sample of those that have chosen to offer some form of communications service. Within that sub-sample, the analysis in this paper has highlighted a population-based split that suggests distinctly different rationales for public sector involvement in broadband infrastructure in varying local contexts. In the smallest communities in the sample, the public sector probably provides broadband – including consumer-oriented services – because no one else does. In the largest communities, public sector involvement may be motivated more by the opposite problem, with the government attempting to minimize the impact on physical infrastructure (such as local roads and aerial wiring) in the presence of abundant private-sector competition. Alternatively or in addition, larger communities may be the ones more likely to have deployed fiber for internal utility and/or municipal use, positioning them to exploit scale

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[67] In particular, the first three roles are commonly undertaken at the regional (e.g. county), state, and federal level. Because government's buying power, authority over broadband-related policies, and funding pools all increase up the political hierarchy, so may the effectiveness of approaches that leverage those factors. Consequently, when an initiative of one of the first three types exists in their region, local governments may find it more effective to participate in the larger-scale initiative than to develop their own.

[68] In some areas, other aspects of the infrastructure have been handled on a regional basis, for example regional planning and network management in Utah's Utopia initiative, and regional fiber networks to solve the "backhaul" problem as in Georgia and the Pacific Northwest. Such regional approaches often arise in a "bottom-up" fashion, when several localities in a region band together to solve a problem at a more efficient scale. Of course, once such a regional approach is in place, the decision for a new community to join in becomes much easier than for the pioneers.

and scope economies in making excess capacity available to other (primarily commercial) users with similar service needs.

An area of particular interest for further research is the community's choice of whether to offer retail services or concentrate on wholesale service provision, both in the business and consumer spaces. We are especially interested in understanding a community's decision to adopt an "open access" approach (*i.e.,* provide basic platform services to multiple retail communication providers) as opposed to vertically integrating into retail services. Although several communities proposing to build fiber to the home have announced plans to adopt an open access model, it appears that only a small number of the 62 communities with operational consumer broadband service have adopted an open access framework to date. It appears to be far more common for a municipal utility that serves consumers to integrate forward into retail services. Given that policy trends in several states are pointing towards canonizing the wholesale-only model, it seems important to understand whether the apparently limited number of working examples of this model is a reflection of technical limitations of first generation systems, scale differences among communities, or idiosyncracies of the small number of communities involved (*e.g.*, the community's history in offering cable television service, or the lack of local private-sector partners willing to operate under the open access model). If local differences are found to be key in determining the viability of the wholesale-only model, this would suggest that decision authority regarding the choice of model should be local as well.

Another interesting question of particular relevance to state and federal universal service policies is the impact of local government efforts on private-sector incentives to provide infrastructure. For example, do municipal efforts to provide broadband serve as a substitute for private-sector services? Does the municipal broadband "crowd-out" private sector investment or does it serve as a spur?

A further area of inquiry relates to the choice of technology. For example, has the further development of wireless technologies (such as WiFi for LANs, and WiMax for fixed wireless loop alternatives) sufficiently reduced the cost of local infrastructure to the point where more local governments now find it financially viable to offer infrastructure? Does the availability of wireless, with its lower impact on physical infrastructure (less need to dig up roads, etc.), make a larger group of communities – including those with no municipal electric utility – more likely to provide communications infrastructure in the public sector? Answering such questions requires the collection of data from a larger sample of communities, beyond those with municipal electric utilities.

The rollout of broadband services is very much a dynamic process. We should not be surprised to find that local governments may play an early catalyst role in stimulating the development of infrastructure, but later, as the market matures, we may find private-sector carriers assuming the principal role for providing services. It is also possible that local governments may extend their role. For example, a utility that initially provides only internal communication services may use the experience and infrastructure as a platform for launching retail services. Finally, we expect local incentives to act to be heavily influenced by ongoing technical trends in wireless and fiber optic technologies

that continue to make alternative infrastructure platforms more cost effective, and by the development of last-mile competition. If cable and telephone duopoly competition turns out to be suitably robust, there may be little need for local governments to intervene; alternatively, if local competition is not adequate, this may provide an increased impetus for communities to self-provision.

In any case, better information regarding what local governments are doing to promote broadband and why they make the choices they do is critical to answering these and other important questions.

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