CACP Policy Report

Municipal Telecommunications Policy: A Guide to New Technologies

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1. INTRODUCTION

1.1. PURPOSE OF REPORT

This report focuses on the emerging telecommunications technology policy issues facing municipalities today. Many local governments have taken an increasingly active role in the development of telecommunications systems for their residents, businesses, and visitors. The emergence of new technologies and the growth of Internet-enabled services have significantly changed the policy landscape, presenting cities and counties with a variety of complex choices. This report reviews the policy framework that has been and continues to be established in the field of municipal telecommunications, surveys infrastructure investment alternatives, and offers some suggestions for criteria policy makers should consider when evaluating different options.

Historically, telecommunications technologies have provided the infrastructure essential for the growth and vitality of our economy and society. Investments in new technologies, therefore, compose an important part of public sector development. A recent economic development report created for the City of Atlanta identified three broad issues of importance to many municipalities: (1) economic opportunity, (2) healthy neighborhoods and quality of life, and (3) physical infrastructure.[1] Economic opportunity includes improving and maintaining a good business climate, developing the workforce to enable all citizens to take active roles in the economy, and creating jobs that will sustain economic growth. Healthy neighborhoods and quality of life issues include ensuring the availability of quality, affordable housing for the workforce, investing in public schools, protecting public safety, revitalizing underserved areas, and fostering cultural and recreational opportunities for all residents. Physical infrastructure issues include upgrading the municipally-owned utilities and communications networks.

Advanced telecommunications technology can help municipalities with all three strategic areas of improvement. First, better communications networks improve economic opportunity by expanding the resources available to businesses and by enabling citizens to become integrated into the information economy. Second, new telecommunications technologies help improve quality of life by distributing the benefits of technology throughout neighborhoods and schools, improving delivery of city services, enhancing public safety efforts, and lowering barriers to information. Finally, new technologies can improve telecommunications infrastructure as well as serve city officials who manage other critical physical infrastructure. This report examines on a broad scale what new technological advances and applications can help municipalities meet the challenges they face in implementing these goals.

1.2. UNDERSTANDING ADVANCED TELECOMMUNICATIONS TECHNOLOGIES

When the Communications Act was first passed by Congress in 1934, "telecommunications" was a relatively easy concept to define. By the 1970's, however, the use of telephone lines by modems to transmit data (non-voice) over telecom networks began to create regulatory dilemmas, prompting the FCC to release new classifications for voice and data services.[2] Building upon this scheme, Congress recognized the importance of the emerging Internet and created separate regulatory regimes for "information services" (non-voice) and

"telecommunications services" (voice). The Telecom Act of 1996 also created a separate regulatory category for "cable service" (one-way transmission of video).

Determining the array of services and technologies encompassed by the phrase "telecommunications services" can be somewhat problematic, and government regulators have grappled with this task over the past decade. The distinction between "information services" and "telecommunications services" have been challenged and redefined by converging digital technologies. In particular, Voice over Internet Protocol (VoIP) has perplexed regulators and courts alike, with some declaring it to be a telecommunications service, some declaring it to be an information service, and others declaring it to be a hybrid. In June 2005, the U.S. Supreme Court resolved a long-standing regulatory dispute when it upheld the FCC's authority to classify cable modem service as an "information service."[3]

In general, telecommunications technology is moving in the direction of unification—towards a single platform for voice, data, and video transmission. Currently, this unification is occurring over Internet Protocol (IP) on high-speed transmission lines. Consequently, high-speed (broadband) Internet access has become the focus of national telecommunications policy, with initiatives at the federal level initiated by both the Federal Communications Commission (FCC) and the Department of Commerce to make broadband access universal by 2007.[4]

Consequently, this paper focuses on broadband Internet access as the main thrust of telecommunications policy. Although municipalities do face problems specific to legacy systems or entities traditionally separated from Internet or telecom providers, virtually all telecommunications policy issues are now affected by the emergence of IP-enabled services.

Unfortunately, there is no established definition of what constitutes "broadband Internet access." The FCC has adopted a two-pronged classification system for reporting purposes, in which connections that allow transmission speeds of more than 200 kilobits per second (kbps) in at least one direction (upstream or downstream) are classified as "high-speed" broadband lines, while networks with at least 200 kbps in both directions are classified as "advanced services" broadband lines.[5] The Computer Science and Telecommunications Board of the National Research Council has adopted a more complex definition that says broadband services should perform at a level high enough to encourage the development of new applications and should not limit consumer's ability to access content.[6]

The importance of broadband Internet access differs among constituencies. Individuals demand broadband access at home because of the enhanced services that it enables, many of which are focused on entertainment. VoIP is an important application that also makes broadband more attractive to consumers, and streaming video capabilities offer new opportunities as well. Businesses, on the other hand, rely on high-speed connections for their economic success. Broadband Internet access enables more comprehensive data transactions and the enhanced communications that help spur economic development.

Historically, telecommunications services have been divided by the nature of the content provided, such as video, data, or voice. However, convergence has weakened this distinction and focused the telecommunications sector on the differences between the transmission

protocols. There are currently at least seven technological methods available for providing telecommunications services:

DIGITAL SUBSCRIBER LINES (PHONE LINES)

Digital subscriber lines (DSL) are traditional telephone lines that enable high-speed Internet access via special modems that are installed on the premises. Most DSL subscribers in the U.S. have a connection referred to as asymmetric DSL (ADSL), which maximizes download speeds by limiting the upload speeds of subscribers. Download speeds for ADSL range from 256kbps to 3Mbps, but the speed varies based on the distance of the subscriber from the provider's office. At long distances (approximately 18,000 feet), signal quality deteriorates in copper wiring, which means that some phone customers may be too far from the central office to have access to the service. Additionally, DSL signals cannot travel through fiber-optic cables or across bridging or amplifying devices used by phone companies to extend copper wiring, so customers whose phone lines are connected to these devices are not eligible for DSL service.

The FCC reports that in June 2004, 35.8% of "high-speed" broadband lines in the United States were provided by ADSL.[7] This is a sizeable increase from December 1999, when ADSL constituted only 13.4% of high-speed lines. However, because of the asymmetry of the technology, ADSL composes a smaller percentage of "advanced services lines" as reported by the FCC, only 16.1% in June 2004. The majority of users with high upstreaming capabilities have cable modem connections to the Internet (see below).

Because DSL uses traditional phone lines to provide broadband Internet access, nearly all (95%) ADSL lines in the U.S. are operated by incumbent local exchange carriers (ILECs).[8] Furthermore, in August 2005 the FCC exempted DSL service from mandated line-sharing rules under the Telecom Act, which will further enhance the concentration of ILECs in the DSL market.[9]

CABLE

Coaxial cable lines currently offer access to the Internet at speeds usually ranging from 2-4 Mbps to 30 Mbps, although coaxial cable lines transmit data by converting signals into a 6 MHz "channel," a task that is undertaken by cable modems on the customer's premises. The signals may be converted onto a fiber optic line at a later stage of the cable network (creating a hybrid fiber-coax network, or HFC), but the signals are transmitted to the customer's home via coaxial cable. Unlike ADSL, which requires an asymmetric upstream/downstream data flow, cable broadband allows more upstream data capacity.

One of the benefits of the cable systems is that they are nearly ubiquitous, reaching almost all (approx. 97%) of households in the United States, especially in metropolitan areas.[10] Additionally, it has become the dominant technology for provision of broadband. According to the FCC, 74% of "advanced services lines" were provided via coaxial cable in June 2004.[11] Growth in cable broadband has been slower than DSL in recent years[12], possibly due to the earlier dominance of cable over DSL in the broadband market. One additional benefit of cable is that because the majority of cable systems have been upgraded to a hybrid fiber-coax network, an eventual upgrade to an all-fiber network might be easier to complete.

WIRELESS NETWORKS (WI-FI, WIMAX)

There are a number of wireless networking protocols in existence or in development that offer high-speed Internet access. The most common is known as Wi-Fi, a short-range wireless signal that operates under the IEEE 802.11 standard. Wi-Fi signals generally only travel a few hundred feet from their transmission point, which means that Wi-Fi coverage only occurs in "hot spots" unless an extensive network of antennas is constructed. This service, which may be provided free or for a fee, is often offered by restaurants, coffee shops, airports, and other locations that might attract customers with laptops. Wi-Fi signals must be broadcast from a fixed Internet access point, which means that it is not usually an access option for home desktop computer users. Therefore, Wi-Fi has become the dominant Internet access standard for mobile devices, such as laptops and PDAs. Wi-Fi technology is used to create wireless local area networks (WLANs). These are distinct from wireless personal area networks (WPANs), which are typically used at very short range to connect personal devices wirelessly.

According to the FCC, satellite and wireless connections composed only 1.3% of high-speed connections in June 2004.[13] This is primarily because wireless networks require a secondary connection to the Internet backbone. However, the FCC has recognized wireless as a unique broadband solution because of its ability to connect mobile devices and integrate information systems.[14] Furthermore, one of the growth areas in wireless broadband is in the creation of wireless municipal area networks (WMANs), which could deliver broadband access to end users without a secondary Internet connection.

WMANs can span distances of up to 30 miles, which is important for backhaul applications as well as providing last-mile connectivity in metropolitan areas.[15] Most WMAN networks operate under the IEEE 802.16 family of standards. One of the more popular standards is commonly referred to as WiMAX. WiMAX offers speeds of up to 75 Mbps. Unfortunately, WiMAX deployment has been slowed by a debate in the industry over what standards should be used for the technology. Another consideration is whether the radio frequencies used for WMANs involve licensed or unlicensed spectrum. According the FCC's Wireless Broadband Access Task Force, the frequencies most ripe for WMAN deployment are located in the 2.5 GHz band, designated by the FCC as the Broadband Radio Service (BRS) and Educational Broadband Service (EBS) band. These frequencies require licenses from the FCC, which will be held by wireless Internet service providers (WISPs) such as Clearwire.[16] Additionally, the FCC recently released spectrum in the 3650-3600 MHz band for non-exclusive licensing for WISPs that should enable WiMAX deployment.[17]

CELLULAR NETWORKS

Wireless broadband can also be offered through a cellular architecture, upgrading to a third generation (beyond analog and digital) packet service, abbreviated as 3G. These networks, unlike the fixed networks above, are completely mobile because they do not require a customer to be confined to a particular location. The service is targeted primarily at cell phones, personal digital assistants (PDAs), and wireless modem cards attached to laptop computers. Currently, wireless networks in the U.S. use two main digital voice technologies, CDMA and GSM. Each of these has been extended by overlay networks called (1xRTT and GPRS) that enable data transmission services. The maximum speeds of these networks are approximately 110 kpbs and

144 kbps, respectively. These networks are often described as "2.5G" because they are a bridge between the digital voice networks and the high-speed packet service of 3G, which offers speeds at least three times as fast.

Major U.S. wireless companies have begun to roll out advanced 3G services in metropolitan areas. Verizon Wireless, for example, has offered Atlanta business customers access to its 3G EV-DO network, with 300-500 kbps data speeds, since September 2004, and the company also launched a multimedia service (VCAST) targeted at consumers beginning in February 2005.[18] Atlanta-based Cingular Wireless has announced plans to build a 3G UMTS (Universal Mobile Telecommunications System) network that covers most major markets by the end of 2006.[19] The Cingular network is expected to have data speeds of 400-700 kbps.

In addition to the traditional cellular architecture, the evolving IEEE 802.20 standard, described as Mobile Broadband Wireless Access (MBWA), enables peak data rates of over 1 Mbps and combines features of fixed and mobile wireless networks. One transmission technology that has been successfully tested (in a trial in the Raleigh-Durham, NC area) is Flash-OFDM (orthogonal frequency-division multiplexing), developed by Flarion.[20]

FIBER

Fiber optic cables are strands of glass that carry digital information over long distances, much like copper wire or coaxial cable does. However, fiber networks have much more capacity, so they can carry more traffic and handle much larger bandwidth, crucial for high-speed connections. Fiber networks also face less signal degradation, requires less power, and are more flexible than copper networks. For all of these reasons, and due to the fact that fiber material is often cheaper than the current materials deployed, fiber has widely been installed for telecommunications backhaul networks. The data speeds for fiber networks are very large compared to current broadband networks (as much as thousands of times as fast, over 1 Gbps).

When fiber is extended to customer premises (known as Fiber to the Home, or FTTH), the services available to consumers dramatically increase. However, this deployment comes at a high cost, especially in existing neighborhoods with sidewalks, sprinklers, and other local infrastructure. According to AT&T CEO David Dorman, putting fiber into the home can cost as much as $1000-$1500 per unit, which he says makes wireless networks more affordable to deploy.[21] BellSouth CEO Duane Ackerman has acknowledged his company's intention to deploy fiber in new neighborhoods but to provide DSL service in neighborhoods that require retrofitting.[22]

Municipalities have played a role in FTTH deployment. Although less than ten percent of fiber deployments are undertaken by cities, nearly a third of the homes in the U.S. that are passed by fiber are reported to be served by municipal fiber networks.[23] However, only communities with municipal electric utilities (MEUs) that have some previous investment in communications are very likely to deploy FTTH. Fiber-to-the-home does deliver a tremendous potential for an increase in services, so much so that networking experts have called it "future proof"—unable to be obsolesced by future technologies. However, the evidence suggests that there is not currently enough demand for high-bandwidth services to justify broad deployment to residential areas. Some industry observers expect alternative pathways such as wireless networks to drive long-

term demand for FTTH.[24] Nonetheless, some major municipal governments view FTTH as an opportunity for their cities to gain a competitive advantage in the information economy. The City of Seattle, Washington, for example, recently released a Task Force report endorsing fiber as the best long-term solution for broadband access.[25] Seattle hopes to distinguish itself as a leading business incubator for advanced communication technologies and applications; other cities could also use this strategy.

In addition to the residential market for fiber networks, businesses have a high demand for optical networks. Companies such as Level3, XO, and AGL Networks provide access to fiber rings and national networks. Unfortunately, fiber deployment by these providers tends to be highly location-dependent, with service limited to areas near existing infrastructure. All municipalities should carefully consider what level of demand for high-capacity optical networks exists and how private providers are serving that need.

Satellite

Personal satellite systems have been used to provide video content to consumers for years, directly competing with cable companies. In the same vein, satellite transmissions can provide broadband Internet access at speeds of up to 2 Mbps (in the current market). However, these services are usually fairly expensive for consumers. Rates for services comparable to DSL can be as much as three to four times as expensive, although some lower-price packages are usually available.

An additional limitation with satellite broadband, as with all satellite services, is that customers' satellite dishes must have an open look towards the sky. Trees, buildings, or other obstructions can cause unevenness in service eligibility. As such, satellite systems are ideal for rural areas where DSL and cable are not feasibly provided due to physical limitations. Satellite broadband, therefore, is not an attractive candidate for investment by more urbanized municipalities.

Broadband over Power Lines

One emerging potential conduit for high-speed Internet access is electric power lines. Broadband over power lines (BPL) would enable consumers to connect to the Internet through the electric outlets already installed in their homes. The advantages of BPL are that no new wiring is required; users can plug a special modem into electrical outlets to receive their data access. Data speeds for BPL are comparable to those for cable modems, with first-generation BPL technology achieving bit rates of 300-500kbps and later advances nearly double those speeds. However, the speed can increase depending on the quality of the transmission lines and technological advancement. BPL signals will only propagate a few thousand feet along power lines, so connections to the Internet backbone must not be far from customers who are served by it. Therefore, it is currently distance-sensitive, similar to DSL. However, this should not pose a significant problem for urbanized areas. And as with any utility, scale economies apply. Consequently, there is debate over the viability of BPL. According to telecom officials, 25% market penetration is required to keep a technology economical; this may be a problem for BPL.[26]

Another challenge posed by BPL is radio interference that occurs as a result of electromagnetic radiation emitted from power line equipment at BPL frequencies. Certain radio systems, especially those of low-power licensees such as amateur radio or ham radio operators, may be affected. The FCC has required BPL operators to mitigate their interference with licensed operators. However, there are also economic regulatory issues that must be addressed with respect to BPL. Since electric utilities are heavily regulated, what consideration must be given to BPL? Should a "hands off" regulatory approach dominate the landscape, or should BPL be subject to open access requirements similar to the current telephone regulatory regime? The answers to these questions are unsettled and will play a significant role in the development of BPL as an alternative to other broadband technologies.

Currently, BPL deployments in the United States are occurring on a trial basis. A survey of BPL trials was conducted by the National Association of Regulatory Utility Commissioners' (NARUC) BPL Task Force, finding active trials or deployments in at least 18 states as of February 2005.[27] As more utilities experiment with BPL, the costs of providing BPL should diminish and the technology should improve. However, except for municipal electric utilities (MEUs), there is little legal leeway for municipal intervention in the provision of BPL. Most electric utilities are regulated at the state level.

SUMMARY

It should be noted that all of the above offer, at least in theory, the opportunity to access traditional telecommunications services and access to entertainment programming (historically provided by cable). However, a history of universal service principles for plain old telephone service (POTS) has brought basic phone connectivity to the overwhelming majority of dwellings in America, and the problem of access to a basic telephone service is virtually non-existent, especially in urban areas. Additionally, entertainment services have only been effectively distributed via cable or satellite, due primarily to the franchising agreements necessary for content provision. This situation is changing, however, as cellular phone companies and Internet service providers focus increasingly on providing video programming.[28] Some states (most notably Texas[29]), as well as the Congress, are considering eliminating or loosening franchise requirements for the provision of video programming. Additionally, the FCC has indicated that it will consider rulemakings to address the regulatory status of IP-based television programming (IPTV).

2. POLICY FRAMEWORK

2.1. THE ROLE OF MUNICIPALITIES

Historically, telecommunications have been regulated at the state and federal level, leaving local governments almost entirely out of the process altogether. However, three developments have led to an increased role for municipalities in the nation's telecommunications policy. These are (1) local video franchising, (2) the emergence of the Internet and consequent demand for high-speed network infrastructure, and (3) the development of unlicensed wireless networks.

Franchise agreements have long served as legal mechanisms for private monopolies to obtain rights to use public facilities to serve communities. Local franchising for cable services was codified at the federal level in 1984 as part of the Cable Communications Act.[30] Franchising procedures are also regulated at the state level, but most states have given municipalities a substantial amount of leeway to negotiate the terms of service to their community. The emergence of cable broadband Internet service, therefore, gave cities and counties a position from which to bargain for more service provision. With no universal service directive for Internet or video services, local authorities have used franchising power to expand service to the community.

Franchising, however, necessarily entails negotiations between municipalities and outside service providers. A second way in which municipalities' role has expanded is as a service provider itself. The emergence of the Internet and the increase in demand for high-speed networks left many communities underserved by the traditional telecommunications providers. Consequently, a number of municipalities have chosen to become providers of advanced telecommunications services. Many of these services were provided by establishing municipal fiber networks, although other municipalities have simply offered more basic services to compete with local exchange carriers.

Additionally, the rise of unlicensed wireless networks, most popularly Wi-Fi, has allowed any entity to provide relatively low-cost Internet access to large populations. Dozens of municipalities have chosen to offer wireless Internet access to their residents either on a free or fee basis. The wireless nature of these networks makes them especially attractive for municipalities because of opportunities to use them for public safety agencies and other municipally-provided services. Additionally, wireless networks are generally cheaper to deploy than wireline or fiber networks, especially in less urbanized areas.

Municipal provision of telecommunications remains controversial, however, and the national telecommunications policy debate is focusing on this topic more now than ever. Many municipalities were initially encouraged by language in the Telecom Act guaranteeing the right of "any entity" to compete as a telecommunications provider, but the U.S. Supreme Court ruled in 2004 that this language did not apply to local governments. Subsequently, several states have acted to put new legal restrictions upon municipalities' ability to offer telecommunications services, and there continue to be discussions at the federal level regarding rules for municipal involvement. In light of this debate, we must examine next what motivates municipalities to intervene in the advanced telecommunications market.

2.2. MOTIVATIONS FOR POLICY CHANGE

Any evaluation of municipal telecommunications policy regarding investment in new technologies requires a clarification of the goals sought in order to properly assess the present policy situation and future options. There are at least four motivations for policy change expounded by municipalities. Each of these goals incorporates a set of priorities that must be established by policymakers:

GOAL A: INVESTING IN CUTTING EDGE TECHNOLOGIES

One of the motivations for expanding telecommunications services is the desire to be on the cutting edge of modern technology, which affects the perception of cities as they market themselves. Many communities in California's Silicon Valley have used this motive as justification for municipal involvement in telecommunications. Lompoc, California, for instance, cites improved quality of life in the community as one of the driving factors for its investment in wireless Internet and fiber networks and uses phrases like "cool concept!" in its marketing.[31]

GOAL B: CREATING ECONOMIC DEVELOPMENT

Communities often justify investment in telecommunications and information networks based on the impact they will have on small businesses in the region, linking provision of telecommunications services to economic development. Advanced telecommunications services are important for economic development because they enhance flows of information in the market and enable more competitiveness based on innovations from new technologies. Many rural or declining regions have focused on this strategy, not wanting to be left behind by the "new economy." For example, Scottsburg, Indiana reportedly moved ahead with a wireless Internet plan after a 2002 survey indicated three companies were considering leaving the small town because they did not have broadband access.[32]

GOAL C: REACHING UNDERSERVED AREAS

Although the rural communities seeking economic development opportunities from advanced telecommunications services certainly qualify as underserved by the markets, the justification of investment based on potential economic growth is distinct from the justification of investment based on concerns for equity or universal service. For example, the City of Philadelphia has promoted its wireless initiative as beneficial for all of the city's citizens, 60% of which do not have access to broadband Internet.[33] Additionally, broadband Internet access, especially wireless access, can increase the independence of people with disabilities, an often underserved population. The lack of broadband proliferation and use by all segments of society has created competitive problems for the United States, which has fallen in world rankings of broadband use. The inability to reach a broad audience via broadband is an impediment to the delivery of broadband-enabled civic and municipal services.

GOAL D: INCREASING REVENUE FOR THE CITY

Another problem facing the City is the loss of tax revenues from phone bills as customers increasingly rely on cellular phones or Internet telephony for their communications needs. Loss of revenue from technologically driven change has occasionally been a sticking point for telecommunications policy, most recently at the federal level where concerns for state tax revenue blocked a permanent extension of the Internet access tax moratorium.[34]

None of these four problem formulations are mutually exclusive. And each is likely a component of municipalities' decision-making process. As a result, they should be incorporated

into the criteria established for evaluating policy alternatives, which will be discussed later in this report.

2.3. STAKEHOLDERS

Given the wide scope of competing telecommunications technologies today, there are a large number of stakeholders and policy actors involved in this process (see Table 1). Potential policy actions must be analyzed in the context of the framework created by these actors, who have varying influences on the successful implementation of policies selected. Below are descriptions of the various stakeholders, their perspectives, and their role in the telecommunications policy process.

2.3.1. MUNICIPALITY

As the primary decision-making actor in this policy framework, city or county officials are a major stakeholder. Municipal finances will be affected by any investments in new telecommunications technologies, and therefore decisions regarding telecommunications policy may affect other policy arenas as well. Municipalities could also choose to let the market dictate the emergence of new technologies, but this would not eliminate the city or county's role as a provider of services and as a regulator of the public right-of-way. Through departments of public works or information technology, the municipality will also be the primary implementer of new telecommunications technologies. Municipalities stand to benefit from new technological investments through efficiency gains, the ability to expand or add new services, and possible revenues raised. At the same time, there exist potential costs in deploying the services, both in terms of financial losses and administrative support.

2.3.2. ILECS, CLECS, AND TRADITIONAL WIRELINE COMPANIES

Many municipalities are served exclusively by one incumbent local exchange carrier (ILEC). That ILEC owns the telephone lines in the region, although it must make arrangements to lease those lines to other carriers. In addition to providing phone service, ILECs may offer residents broadband Internet connections through DSL, although this service is not available everywhere. Phone companies generally oppose municipal provision of telecommunications services because they perceive cities as competitors, although they would not object to policies that increase private demand for their services. The U.S. Telecom Association, a trade association for telecommunications providers, argued in 2003 that local governments competing with private service providers have at least four unfair advantages: exclusionary control of public rights-of-way, exemptions from taxes, fees, and regulatory requirements levied on private firms, the ability to interfere with state-controlled regulatory regimes, and fundraising powers without the restraints of debt and capital markets.[35] In addition to these concerns, phone companies also service the municipal government, so they have an interest in protecting their contracts. A city or county may also be served by competitive local exchange carriers (CLECs), which operate over ILEC networks leased to them at rates determined by state and federal regulations.

2.3.3. CABLE COMPANIES

Cable companies, which also provide broadband Internet service, have a significant interest in the local telecommunications policy. Cable television service to municipalities is nearly always provided by a single company through a franchise agreement. This cable company has an interest in increasing demand for bundled telecommunications packages, which generally include TV content, voice services, and Internet access. Although VoIP services have often been provided by third party companies such as Vonage, cable companies are beginning to market their own voice plans.[36] Cable companies have an advantage over third-party providers of voice services because they control their own networks, although this does not mean their services will be less expensive. The cable company also has an interest in renewing its franchise agreement with favorable terms.

2.3.4. INTERNET SERVICE PROVIDERS

Internet service providers (ISPs) are companies that provide access to the Internet to customers. Phone companies and cable companies are a part of this group when they offer Internet access, but there are two other kinds of ISPs that are relevant. One type of ISP provides access to the Internet for customers who dial into the network through their telephones via modems. Atlanta-based Earthlink is one such ISP. There are also wireless ISPs, or WISPs, who provide access to the Internet via wireless networks. Generally, ISPs as a group are in favor of increasing demand for Internet services because they will have a greater customer base. ISPs want Internet service penetration rates to be as high as possible, so they generally are supportive of applications that might increase the utility of the Internet. WISPs are in favor of expanded wireless Internet coverage, since they generally benefit from additional subscribers. They may rely on a municipality in two ways, either by leasing public space for wireless network equipment or by contracting with the municipality directly to provide services.

2.3.5. ELECTRIC UTILITIES

Electric utilities are stakeholders because of their role as potential Internet service providers (previously discussed under "Broadband over Power Lines"). There may or may not be any current investments in BPL by the local utility company, but even a utility with no current BPL investments will maintain an interest in creating a widespread demand for broadband Internet service. Unlike phone or cable companies, utilities generally reach the entire population, giving them an infrastructure advantage. Nevertheless, energy company interests in telecommunications policy are relatively small compared to other stakeholders such as the cable or phone companies. This is because BPL has yet to become a significant part of utilities' business.

2.3.6. TELECOMMUNICATIONS NETWORK PROVIDERS

Municipalities may also be served by telecommunications network providers such as AGL Networks, Level3, Southern Telecom, Looking Glass Network, or XO Communications. These firms provide high-speed fiber optic cable network capacity to businesses, universities, and other institutions with high demand for these services. These backhaul networks are concentrated in the business districts are used by large firms. Connections to these networks, which are

underground, require permission from the city or county to dig up streets and disrupt traffic. These network providers are interested primarily in growing their customer base, which is heavily tied to local economic development. Additionally, their cost of doing business is directly affected by public permit fees.

2.3.7. BUSINESSES

The business community generally has a strong demand for advanced telecommunications services. Businesses are mostly served by private telecommunications firms, but they would also benefit from improvements in city services that occur as a result of telecommunications technology investments. Additionally, many businesses are relying on wireless networks for communication via their laptops, PDAs, and smart phones. These businesses would benefit from the expansion wireless networks.

2.3.8. CONSUMERS OF TELECOMMUNICATIONS SERVICES

Consumers of telecommunications services are people who subscribe to telephone, cable, or Internet services, as well as those who take advantage of other telecommunications networks (such as wireless hot spots). Consumers are generally looking for a wide range of choices, quality service, and low costs. They would applaud investments in new technologies if they can take advantage of them and they do not cost too much money.

2.3.9. CITIZENS

Citizens of the city or county have a direct interest in the actions of their local government. They have a myriad of concerns, most of which revolve around concerns that their tax dollars are spent wisely. They may or may not favor municipally-backed or -provided telecommunications services, but they are likely to be skeptical of plans that do not serve the needs of the community as a whole. Additionally, citizens have a demand for more efficient city services and processes, things that increase "customer service" quality. Finally, citizens appreciate an open government, where meetings and records of City activities are easily accessible. These are all goals that might be served by investments in new telecommunications technologies.

2.3.10. EDUCATIONAL INSTITUTIONS

Educational institutions also stand to benefit from new telecommunications technologies. The local public school system would generally benefit tremendously from an increase in broadband Internet use at the homes of its students. Incorporation of the Internet into learning both inside and outside the classroom could help boost achievement of public school students. Additionally, school districts can use advanced telecommunications networks to increase their own internal effectiveness.

Institutions of higher learning also have an interest in becoming more connected with the community through advanced telecommunications technologies. Extensive fiber networks may or may not currently connect to local colleges or universities, and they are better served when more businesses and municipal institutions are also served by these networks. The potential for collaboration also creates a potential for economic development, in addition to the added educational opportunities.

2.3.11. SUMMARY

The table below summarizes the stakeholder interests for a typical municipality's telecommunications policy.

Table 1

Stakeholder	Interests	Importance/Impact
Municipality	Promoting economic growth; balancing its budget; improving internal efficiency; lessening administrative burden.	Major; Decision-maker and primary implementer
Phone companies	Providing voice, broadband, and video services to paying customers.	Major; new policies could directly impact profitability, service relationships.
Cable companies	Providing video, voice, and broadband Internet services to paying customers.	Major; must contract with City for service provision.
Internet Service Providers (ISPs)	Selling access to the Internet; increasing overall demand for Internet services.	Minor; effects are indirect.
Electric utilities	Providing a broadband alternative for underserved areas.	Minor; effects are indirect and in the future.
Telecommunications Network Providers	Attracting businesses with high demand for network services.	Minor; effects are indirect.
Businesses	Increasing productivity; expanding competitive alternatives for telecommunications services.	Major; may enhance business climate, provide funding.
Consumers	Expanding competitive alternatives for broadband, telecommunications services.	Minor; effects are generally indirect.
Citizens	Better City service delivery; enhanced protection of welfare, public safety; proper fiscal management.	Major; may effect all directly; voters play important role.
Educational Institutions	Connecting to peer institutions and creating new collaborations; increasing opportunities for students.	Major; may serve as partners in development, effects for education could be direct.

All of these stakeholders have voices, but two have real and sustained influence on the policy process. The telephone and cable companies play major roles because they are major market forces in the City and rely on government franchises and state regulations to operate; the evolving regulatory structure surrounding Internet-enabled services affects both them and the City's relationship to them. Both of these entities have a substantial capacity to influence policymaking at the Federal and State levels, which may affect the municipality's ability to deploy new telecommunications technologies. Therefore, the interests of these providers must be carefully considered when crafting policy. Internet service providers (ISPs) who are not phone or cable companies have less of a direct interest because they rely on the networks of others to provide their services, although they stand to benefit or lose depending on their access to the underlying telecommunications technologies. The ISPs are also less of a political force simply because they are relatively new players in the telecommunications industry and there are

more competitive firms in the market. Similarly, fiber network providers are only indirectly affected by local policies that attempt to promote economic development.

The business community may or may not be a powerful force in municipalities, depending upon the nature of local industry. However, businesses usually play a significant role in major municipal economic development policy, and they have a general interest in ensuring the city or county is a friendly place to do business. Therefore, advances that help business productivity in general or that increase the quality of life are seen as positive. Consumers of telecommunications services play a much more minor role, since the effects of increasing competition or expanding alternatives may not be tangible to them. Additionally, the benefits might not be universal. Finally, citizens play a major role because they are affected in a myriad of ways and they wield power at the ballot box.

2.4. NEEDS ASSESSMENT

Having analyzed the role that municipalities play in the telecommunications policy framework, examined motivations for intervention in the market for telecommunications services, and surveyed the landscape for stakeholders, we must next move to the most important step a municipality must make when considering investments in new technologies: needs assessment.

There are many reasons why a municipality may want to offer telecommunications services to its residents, business, and/or visitors. But cities and counties must determine the level of unmet need in the community or quantify the opportunity being presented before proceeding with new telecommunications investments. The process by which the needs of individual communities are assessed will vary greatly, but certain questions should be asked by all municipalities:

(1) What are the services currently being offered to the community? Understanding the municipal telecommunications policy framework requires an examination of the current state of investment in telecommunications infrastructure. This includes ascertaining the extent of broadband Internet penetration, the existence of local wireless networks, and any educational technology present in the community. This may be a difficult question to answer authoritatively because private telecommunications providers may be unwilling to disclose information regarding subscribership to Internet or other telecom services.

(2) What demand is there for advanced services, and who is demanding it? Local governments should fully understand the differences between the residential and business markets for advanced telecommunications services. Each is served by different providers, and existing capacity may be sufficient to meet demand.

(3) What is the driving force behind local telecommunications policy? Different areas have different needs. Some municipalities need advanced telecommunications services to attract new businesses to the area. Others simply do not want to be left behind other communities that have attracted new services. Still others are motivated by concerns for public safety. Determining what motivates policy change is essential to the formulation of a successful telecommunications policy.

3. KEY ISSUES & TRENDS

In this section of the report, we will examine the key issues & trends in telecommunications technology policy affecting municipalities. First, we will discuss some of the applications of telecommunications technology for municipalities. Then, we will review recent deployments and policy developments in wireless broadband, fiber networks, video franchising issues, broadband over powerlines, and some alternative policy options that municipalities may come across.

3.1. SPECIFIC MUNICIPAL APPLICATIONS

The following are applications from telecommunications technology of which municipalities may take advantage:

WEB-BASED PROCESSING

There are a number of services managed by the cities and counties for which the Internet and database management systems bring potential for enormous efficiency gains. These services are often what is referred to by the phrase "e-government," which can be defined as the electronic provision of information and services 24 hours a day, seven days a week.[37] However, there is substantial variance in the quality of e-government services provided by cities today. Simply providing basic information online does not constitute effective e-government. There are a broad range of e-government functions that govern various government-client interactions. Below is a list of different transactions that may be achieved through investment in IT applications and staff.[38]

Internal functions: Employee benefit information, payroll systems, funds transfers, interdepartmental filings.

External functions: Providing information about local ordinances, regulations, and services provided; electronic form processing; electronic payment of taxes and fees; electronic bidding for contracts; reservations for use of facilities.

All of these functions, though diverse, involve financial investments for implementation, typically with a department of information technology or comparable agency, which would be responsible for managing these systems. The aim of a truly electronic government is to eliminate the need for paperwork and physical trips to government-owned or -operated facilities. Additionally, database applications may enable information management for data entered through wireless networks, such as readings on utility systems or road maintenance.

PUBLIC SAFETY

Providing effective services during emergencies is a crucial function of municipal governments. New telecommunications technologies can have a dramatic impact on the ability of police, fire, and EMS personnel to serve the public. Many police departments across the country have been able to take advantage of wireless networks by using laptops while on patrol to receive and upload information related to suspected criminal activity. Additionally, emergency medical staff

may be able to use wireless networks to access patient-specific medical information in the field. This could also greatly benefit people with disabilities who may be able to rely on municipal networks for enhanced independence and safety.

ELECTRONIC ARCHIVING & WEBCASTING

In addition to using online information-management systems to handle transactions, local government websites could make more progress in hosting archives of local records and public meeting webcasts. Providing an electronic archive would enable citizens to have more easy access to records that must be provided upon request under the open records laws. Providing access to this information electronically would be beneficial to citizens because it would save them the trouble and cost of filing an open records request, and it could also enable searching capabilities previously unavailable. The cost of archiving materials is relatively low, although it may be administratively difficult. However, making materials available to the public in the long run may reduce the administrative burden associated with complying with open records requests.

LOCATION IDENTIFICATION TECHNOLOGY

Location identification technology involves geography-based systems that enable critical information to be tracked in the context of its location. The two main systems that perform this function are GIS (geographic information system) and GPS (global positioning system). GIS is a software tool that allows complex information to be mapped, searched, and organized in ways that enable an advanced understanding of different systems are geographically related. For example, a GIS map could integrate knowledge about street addresses, sewer systems, phone lines, fiber networks, bodies of water, and green space. An effective GIS system provides a spatial understanding of service delivery, which has the effect of improving efficiency and interoperability between diverse municipal departments.

GPS relies on satellite technology to give precise location coordinates for tracked objects. GPS can be used to track the location of government vehicles, which could result in significant gains for tracking emergency personnel in the course of their duties. The technology could also be used to track other service delivery vehicles and monitor the security of important equipment.

VOICE OVER INTERNET PROTOCOL

Voice over Internet Protocol (VoIP) is an application of broadband technology that allows users to transmit and receive voice messages (similar to traditional telephone communications) over a data transmission network, specifically an IP-based network.[39] VoIP technology groups digital voice data into packets suitable for transmission over an IP network. VoIP services may be, but are not necessarily, deployed across the public Internet. Currently, VoIP service is being provided mostly by third-party companies over broadband networks, although cable and phone companies have begun to offer VoIP services, typically bundled with broadband Internet access. VoIP currently emulates traditional telephony, but it offers advanced capabilities that combine voice, instant messaging, and video technologies.

The growth of VoIP services presents municipalities with a number of challenges. These include the ability to provide emergency 911 service to VoIP subscribers in the region and the ability to

collect local 911 fees from VoIP service providers. Some of these issues are being addressed nationally by the FCC.[40] VoIP also presents opportunities for municipalities to upgrade their own systems and provide enhanced services to municipal employees, clients, and the public.

3.2. WIRELESS BROADBAND

As discussed above, wireless broadband holds enormous potential for municipalities, and a number of cities and counties across the world have deployed wireless networks for a variety of uses, including public safety, education, and economic development. As larger cities such as New York and Philadelphia begin to implement plans for wireless networks, information from existing networks in smaller communities and larger-scale deployments in regional networks is important. Most developments to date have been in rural areas, but lessons can be learned from these initiatives. Below is a review of some major municipal experiments with wireless broadband, along with some best practices.

PHILADELPHIA, PA

The City of Philadelphia has proposed the most ambitious plan for a municipal wireless network in the country, and it has received the most amount of publicity (both positive and negative) as a result. The Wireless Philadelphia initiative has put out a request for proposals (RFP) that seeks high-speed (1 Mbps average) network that can cover 95% of the entire City of Philadelphia (135 square miles).[41] The network will include free access for certain city locations (such as public parks) and pay access for the rest of the network, although some residents will be subsidized.

On February 9, 2005, the Wireless Philadelphia Executive Committee released the business plan for the initiative.[42] The plan calls for a nonprofit organization to oversee the implementation of the wireless network, which will be outsourced to a private company. The startup funding for the nonprofit would not use city sources. The business plan would have the nonprofit sell wholesale access to the network to retail ISPs, telecommunications companies, institutions, and other nonprofit corporations. Service providers would handle the billing, marketing, support, and additional services. The city will act as an "anchor tenant" for the network. The city projects wholesale rates of $9.00/month for fixed residential service and $100/month for a premium business connection. There are seven planned pricing tiers. Whether or not Philadelphia can make this project work is unknown, but the volume of business and government professionals working on the Philadelphia wireless network suggests that the business plan is solid.

CORPUS CHRISTI, TX

Corpus Christi, Texas deployed a municipal Wi-Fi network for the purpose of serving agencies including utilities and public safety departments. Their network, in its first phase, will cover approximately 18.5 square miles. The city will use 300 Tropos Wi-Fi cells to create a mesh network, which will cost the city approximately $600,000 in its first year.[43] The city plans to use the network to facilitate automated gas and water meter reading, which will eliminate the need for manually recorded consumption. Corpus Christi worked with a non-profit technology research company called Public Technology, Inc. The city will use existing city fiber for the

backhaul connections. Police and fire departments will be connecting to the network using Virtual Private Network (VPN) authentication. This has eliminated the need for a trunked data network for secure police uses.[44]

In addition to the public uses, the public has access to the Corpus Christi network, and several ISPs have partnered with the City to offer full Internet service. After the initial phase, which only covers the downtown area, the City has announced plans to expand the network to cover 147 square miles.

CHASKA, MN

Chaska, MN, a suburb of Minneapolis, has built a city-wide wireless mesh network that covers most of the city's 16 square miles. The network, which consists of 250 outdoor antennas, claims speeds of 1.5-3 Megabits per second and operates in the 2.4 GHz range. The project was financed with a private loan, but it is expected to make money after a few years of operation. The city will operate on a cost-recovery basis.[45] Chaska.net has over 2000 subscribers, with the basic residential rate being $16/month. The capital costs of the network were approximately $600,000 for the mesh network and $100,000 for fiber. Services were donated by the private sector. The network is not encrypted, which places limitations on the usefulness of the network for public safety agencies handling sensitive information.

HOUSTON COUNTY, GA

Houston County, GA tried to implement plans for a wireless network beginning at the end of 2003. In May 2004, the Houston County Wireless Committee announced successful completion of tests for the wireless broadband technology.[46] Contracting with Siemens Business Services, test speeds of 5 Mbps were delivered over 12 miles. Houston County also partnered with Intel and Alvarion, and it decided to use 5.8 GHz equipment.

However, plans for the network were largely handed over to the private sector by the end of 2004. Wireless committee chairman Matt Stone said, "I got the message from the committee and from the public in general that there was little if any political will for a publicly funded network even with the cooperative wholesale model."[47] No further advances have been made on the network.

CONCLUSIONS

As part of its initial assessment, Wireless Philadelphia used analyses conducted by Temple and Drexel Universities to come to the following conclusions about municipal wireless networks:[48]

- "There is significant evidence to suggest that efforts to serve underserved groups will only succeed with a comprehensive plan that includes broadband access, computers in the home, training, content, and a process that includes upfront involvement in decision-making and implementation."
- "It is unclear if, when, and at what price the private sector will provide such services and whether the services will provide universal or near-universal access."

- "The best-practices analysis shows that in the majority of cases, city governments have acted as the catalyst for projects to provide broadband access to residents. However, most projects are small or still under development. Although there is much we can learn from others, given the scale of the project in Philadelphia we will have to become leaders in the implementation."
- "Wireless access technology is maturing; however, it is already the most cost-effective solution for implementing broadband access (as compared to cable, DSL, and other technologies)."
- "The challenges of technology and the risks of implementing a project that is not a core competence of the City suggest that private industry should play a major role in the funding, implementation, and ongoing operation."

These conclusions are generally valid for municipal wireless networks as a whole, although Philadelphia is the first large-scale test case for a broad municipal network. Other projects, such as the one in Chaska, MN, are much smaller in scale. And Houston County's experiment demonstrates that establishing a wireless project requires dedication by the community and able leadership. There are a variety of different service options available for municipal wireless networks. Cities with expertise in service delivery have been able to sell service as a utility; others outsource this service to third-party ISPs. Which of these is more favorable depends upon the characteristics of the community, although municipalities without experience in selling services as utilities would be well advised to consider contracting with outside parties for business processing.

3.3. FIBER

Optical fiber networks offer communities the greatest capacity for advanced telecommunications among current technological options. As noted above, fiber has been described as "future proof" because it is unlikely to be obsolesced by newer and more demanding applications. Unsurprisingly, therefore, fiber has proven attractive to a number of municipalities desiring to provide service to their community. As of June 2005, twenty-two municipalities in sixteen states had functioning fiber-to-the-premises projects.[49] Dozens more are under consideration.

However, fiber networks are expensive to deploy, and several experiments have resulted in losses for municipalities. A commonly cited example is that of Atlanta suburb Marietta, Georgia, which created the company Marietta FiberNet to build out fiber to individual businesses and provide advanced services. After spending $35 million to build and maintain the network, Marietta sold the enterprise to American Fiber Systems, a private company, for $11 million. The city had overestimated the demand for the services and underestimated construction costs. Several criticized management of the Marietta project for not appropriately serving the market that existed.

Municipal fiber systems are more complicated projects than wireless networks because they require more construction, more permitting from state regulatory agencies, and longer-term investment models. This is likely the reason why municipal fiber deployments have not increased at the same pace as wireless deployments in the last several years.

As with wireless, municipal fiber can serve different constituencies:

- *Business*. Businesses tend to either have an extremely high demand for high-capacity networks or merely a moderate demand. The businesses that have a very high demand for network capacity will only locate their establishments where access to fiber is inexpensive and reliable. Building a municipal fiber ring could help attract some of these businesses, but a careful development plan would be required in order to lure any of these companies from alternative locations. The second category of businesses have traditionally been served by phone companies, whose networks may have already been upgraded to fiber to accommodate these customers.
- *Residents*. Fiber-to-the-home, or FTTH, offers residents plenty of bandwidth for the next generation of telecommunications services. However, deploying to residents' premises can be expensive, and residents may not be able to afford the entirety of services offered by FTTH.
- *Government entities*. Fiber networks may also serve government institutions such as school districts, municipal office buildings, police stations, or other civic facilities that have a need for advanced telecommunications services.

Another consideration with respect to provision of fiber networks is whether access to the networks would be provided wholesale to third parties (such as ISPs) or retail directly to customers. Selling wholesale access allows other companies to use their own expertise to serve customer needs, whereas retail selling requires specified knowledge about customer preferences and service delivery that may be beyond the scope of municipal project managers.

3.4. VIDEO SERVICES & FRANCHISING POLICIES

Municipalities interact with video service providers primarily through the franchising process described above in Section 2.1. One of the aspects of many franchise agreements is the provision for public, educational, and governmental (PEG) access television. PEG TV channels allow individuals from the general public, educational institutions, and government entities to have access to video broadcast time serving the community. The following subsection describes the current policy framework surrounding PEG access, and the language of this subsection is taken from a report to the City of Atlanta's Telecommunications Policy Advisory Committee, submitted June 28, 2005.[50] The next section will discuss recent policy changes in the landscape regarding video services and the franchising process.

PUBLIC, EDUCATIONAL, AND GOVERNMENTAL (PEG) ACCESS TELEVISION

The PEG model was developed in the 1970s.[51] It was codified into federal regulation in the 1984 Cable Act.[52] The PEG model builds on the model of non-profit radio, which is a very successful regulatory model for community access to mass communication. Funding for PEG access comes from local monopoly franchises of cable television. The PEG model has three dimensions: functions, technology, and institutions.

The *function* of the PEG model is to provide access. It gives the local community access to television (specifically, a local cable television network.) "Community" in this model consists of three things: the local public (P), local educational institutions (E), and local government (G). "Access" consists of two things: production capability and channel capacity. In the PEG model, residents, schools, and the government are given the resources to produce their own programming and to cablecast it on the local network.

The *technology* of the PEG model is, of course, cable television. This technology is changing, but today the salient features of the technology are: "natural" monopoly, real-time communication, and expense. Cable networks are traditionally implemented as local monopolies, because the physical cable network is so expensive to build. The nature of the technology dictates this economic structure. (This is changing as competition begins to arrive from telephone networks and satellite broadcasts.) Video programming distributed over the network is delivered in real time, i.e. it is available only at the time of cable-casting, rather upon the demand of the system viewer. (Today video-on-demand is coming to market, but traditionally that has not been available to television viewers unless they invest in a home recording device.) Finally, television technology is comparatively expensive. Cameras, editing devices, and consoles traditionally cost thousands or tens of thousands of dollars. (Today, expensive equipment is quickly being overtaken by a more accessible, less expensive digital technology.)

The PEG model's greatest strength is its *institutions*. The PEG model creates an exceptionally secure source of funds, and at a generous level. The "natural" monopoly of cable technology allows for a regulatory framework in which cities extract funds from franchisees. In addition to that franchise fee, local governments can negotiate for funds and channel capacity for PEG access. Public access centers in medium to large cities typically have annual budgets between half a million and one-and-a-quarter million dollars.[53] For local, non-profit organizations that is a large amount of funding.

With twenty years of experience, some weaknesses in the PEG model are evident. Two stand out: PEG does not serve viewers very well, and it excessively insulated from external pressures from viewers. The two weaknesses are related: since PEG organizations are so well insulated, they have not been subject to pressure to adapt their operations to better serve viewers. Viewers are not well served by PEG, primarily because of the underlying television technology.

One final problematic aspect of the PEG model deserves attention: its commitment to localism. Localism reflects both a commitment to local community and a philosophy elaborated in response to cable companies' use of local rights of way. Localism gives PEG its producer orientation: PEG exists to give the local community a voice. In theory, localism could also entail a commitment to local viewers, but this has not been the case. Significantly, localism justifies the imposition of limits on the importation of programming from outside the community. In this, PEG diverges sharply from the community radio model, in which local stations regularly air music and public affairs from beyond the immediate confines of the town. Ultimately, the PEG model favors free speech (a producer value) over diversity of information (a viewer/listener value.)

We close with a few words about "E" (educational access) and "G" (government access.) Unlike public access stations, government access is closely connected to local government. Its funding may be subject to annual review, and it may receive strong feedback from elected officials. Also, its mission to cablecast public hearings is well defined and clearly has value to the community. It renders local government more accessible and transparent. Nonetheless, many of the problems described above apply. Given the real-time nature of television cable casting and the rarity of program guides, one must question the actual size of the government access TV audience. Presumably the viewership could be much larger with better promotion and accessibility throughout the metro area. Educational access often consists of little more than making a channel available to a local school or university. Unlike with P or G, often no funding is provided. Perhaps as a result, educational access stations have a greater propensity to provide imported programming. With many community radio stations run by educational institutions (e.g. college radio,) educational access television seems closer to the community radio model.

In summary, the PEG model creates well-funded, very stable local institutions to give the local community a voice on cable television. The technology they employ creates barriers to reaching an audience, while their insulation from outside forces frees them from the need to adapt to external pressures. They serve producers better than viewers.

IPTV and Video Competition

The Cable Communications Policy Act of 1984 established a local franchising process for cable TV services. The rationale for this process was that video programming services would be best provided by a natural monopoly, since it would be impractical to have multiple providers wiring households with coaxial cable. Therefore, communities would negotiate with a single cable provider for video programming services. Satellite broadcast services emerged later but did not have a significant enough impact on the video competition market to change the local franchise framework.

However, the Internet has again changed the policy landscape by allowing video to be transmitted over Internet Protocol, a service that has been dubbed IPTV. IPTV allows anyone with access to Internet networks to provide video programming services in competition with cable companies. The result of this technology shift is that phone companies are heavily investing in IPTV, with services being rolled out across the country.

Telecommunications companies, especially incumbent firms, are desperate to replace revenue being lost from the shift away from traditional phone services. These companies have lobbied for the elimination of the franchise system so as to allow them to roll out their services more easily without going through the difficult negotiation process. Verizon has obtained only six franchises to provide video service over its fiber network, despite its goal to service thousands of communities across the country.[54] Texas-based SBC successfully lobbied for passage of a bill in Texas that would eliminate local franchising and allow video service providers to obtain one franchise for all operations in the state. The legislation passed the Texas legislature in a special session in August 2005.[55]

At the federal level, there are proposals to eliminate franchising altogether. One bill, the Broadband Investment and Consumer Choice Act [S. 1504], introduced by Senator John Ensign (R-NV), would eliminate requirements for video franchising altogether, freeing any provider to service customers. The bill would also prohibit municipalities from providing any telecommunications services unless private entities had been notified and offered the opportunity to pre-empt the offer with their own services. A separate proposal is contained in H.R. 3146, the "Video Choice Act of 2005," which would create a national video franchising system that would preempt local or state franchise agreements. All of these developments would significantly alter the nature of municipal involvement with video programming services.

4. EVALUATIONS & CONCLUSIONS

4.1. CRITERIA FOR EVALUATING TELECOMMUNICATIONS POLICIES

New investments in telecommunications technologies by municipalities must be evaluated according to the needs of the municipality and the potential benefits of the technology. Below are a number of criteria that should be considered when evaluating technology policy alternatives:

INNOVATIVENESS & ADAPTABILITY

One factor that should be considered in the evaluation process is the innovativeness of the technology and the potential future applications that could be gained from investing in the service. Investing in a specific technology may leave a municipality with few options in the future if the need for that technology disappears or is obsolesced by competing technologies. On the other hand, choosing to invest in a broad-based platform that allows for greater flexibility and adaptability is likely to be a better investment, given the rapidly changing telecommunications environment.

It is often difficult to tell, however, which technologies will be flexible and which ones will not. This is particularly the case with standards-based technologies in the wireless industry. Compatibility concerns have made long-term capital investment riskier in the wireless industry than for fiber, for example. The criterion of potential applications and innovation is one that is primarily used to differentiate policy alternatives; the long-term risk that is factored into investment decisions is usually less important for standard, shorter return-on-investment modeling.

AFFORDABILITY

Affordability is a key concern for evaluation of policy alternatives. Sound municipal planning requires staying within a budget, and the budget often does not afford the luxury of expensive investments, even if mitigated by long-term gains. Affordability of a policy alternative is measured in context; large expenditures may be affordable if they result in significant cost-savings or if they replace other large expenditures that would exist without that policy. Therefore, affordability measures more than simply the cost of the policy.

Revenue Potential

Declining revenues from telecommunications contracts and fees due to a shift away from traditional services have a real impact on a municipality's revenue stream. This leads to a hope that new technological investments by can lead to new revenues that fill that gap. Much of this potential will come from right-of-way agreements for telecommunications providers. However, few other avenues for raising revenues exist. This is one factor that plays an important role in the evaluation process.

Feasibility of Implementation

New policies must not only be approved but implemented, and therefore the feasibility of implementation is an important consideration. This criterion has a number of dimensions, all of which are related to the ease or difficulty with which a new technology policy may put into place. Relevant questions to consider include: does the city or county have the adequate expertise to implement the policy? Will the policy have undesirable (spillover) effects on other systems? Will the policy generate significant opposition that will make its adoption less effective? The issues of technical efficiency, administrative capacity, and political viability are all present in this part of the evaluative framework.

Potential Economic Development Impact

Because economic development is an important priority for municipalities, and because the goal of telecommunications infrastructure is to enable growth, the potential impacts of policy decisions on the economy should be incorporated into policy decisions. Although forecasts of economic impacts are often uncertain, some policies have clear economic development goals, whereas others focus on internal savings. There are both qualitative and quantitative aspects to this criterion. The importance of this criterion is a value judgment of the policymaker.

Impact on Local population

This criterion examines the impact that the policy will have on the population of the municipality as a whole as opposed to simply catering to subsections of the community. This criterion is intended to capture to some extent the benefits received by citizens, which may translate into political support or opposition to the chosen policy alternative. Policies that cater to minority interests at the expense of the majority are likely to fare poorly with this criterion.

Relevance to core city functions

There are some tasks that cities and counties are ill-equipped to handle, and there are others that are crucial to their operation. This evaluation criterion favors policy alternatives that serve core city functions, including basic operations and emergency/public safety agencies. Although economic development is an important goal, it is often more peripheral to the municipality's main purpose as a political entity.

LIKELIHOOD OF SUCCESS

This criterion attempts to measure the uncertainty of policy outcomes. Some investments are riskier than others, and this is an important variable to consider in policy evaluation. Risks are evaluated based on judgments about the reliability of technology, possible impact of the technology, and the administrative risks associated with a project.

4.2. EVALUATION PROCEDURE

There are a myriad of ways in which policies can be evaluated. One option we present here is a policy evaluation matrix (scorecard). Once a municipality has generated a series of policy alternatives (e.g., investing in a municipal wireless network vs. investing in a local fiber ring), each alternative is ranked on a scale according to how it meets the various criteria.

Table 2 shows a policy evaluation matrix/scorecard that was conducted for the City of Atlanta's Telecommunications Policy Advisory Committee. On one axis are eight different policy alternatives with their performance on the various criteria along the other axis. In this evaluation matrix, each policy alternative was assessed on a five point scale according to its compliance with each criterion. The points on the scale are low, low-moderate, moderate, moderate-high, and high. The matrix is color-coded according to the ratings for ease of reading.

Table 2: Policy Evaluation Matrix/Scorecard

Policy \ Criterion	Innovativeness	Affordability	Revenue Potential	Feasibility of Implementation	Potential Economic Development Impact	Impact on City population	Relevance to Core City Functions	Likelihood of success
Web-based transactions	Low-Moderate	Moderate-High	Low-Moderate	Moderate-High	Low-Moderate	High	Moderate-High	Moderate-High
Archiving & Webcasting	Moderate	Moderate	Low	Moderate-High	Low	Moderate-High	Moderate	Moderate-High
WLAN (Wi-Fi)	Moderate-High	Low-Moderate	Moderate	Low-Moderate	Moderate-High	Moderate-High	Moderate	Moderate
WMAN (WiMAX)	Moderate-High	Low	Moderate	Low	Moderate-High	Moderate-High	Moderate	Low-Moderate
Upgrade infrastructure	Moderate	Moderate-High	Low	Moderate-High	Low	Low	Moderate-High	High
GPS	Low-Moderate	Low-Moderate	Low	Moderate-High	Low	Low-Moderate	Moderate	Moderate-High
Fiber for APS	High	Low	Low-Moderate	Low-Moderate	Moderate	Low-Moderate	Moderate	Moderate-High
Subsidize broadband	Low	Low-Moderate	Low	Low-Moderate	Moderate	Moderate	Low	Moderate

By examining the scorecard, we can view the strengths and weaknesses of the various policy alternatives and determine what choices are worth pursuing, given different motivations for policy action. The criteria can also be given numerical values and weighted according to the preferences of the decision-making actor.

4.3. CONCLUSIONS

New technologies are changing the telecommunications policy landscape. Municipalities must pay careful attention to the emerging policy framework when considering investments into new telecommunications technologies. The legal constraints upon cities and counties may change

dramatically in the next few years, but this should not be cause for alarm. Municipalities have lots of room to craft policies that maximize the availability of advanced telecommunications services to their community. Careful attention must be paid to the individual needs of residents, businesses, visitors, and other stakeholders. With consideration of the factors discussed above, municipalities should embrace new technologies and use them to their advantage. The opportunities are great.

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[2] The problems created by computers were first raised in the "Computer I" rulemaking (Docket No. 16979, 1966), and was addressed more formally in the "Computer II" rulemaking (77 FCC 2d 384 (1980)).

[3] *National Cable & Telecommunications Association* v. *Brand X Internet Services*, No. 04-277. 545 U.S. ___.

[4] President Bush announced this policy in a speech delivered March 26, 2004. See [http://www.whitehouse.gov/infocus/technology/economic_policy200404/chap4.html] for more information.
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[7] All data in this paragraph are from the FCC, *High-Speed Services for Internet Access: Status as of June 30, 2004*.
[8] FCC, *High-Speed Services for Internet Access: Status as of June 30, 2004*. Page 3.
[9] FCC, *Report and Order and Notice of Proposed Rulemaking*, [FCC 05-150], adopted August 5, 2005.
[10] CSTB. 2002. Chapter 4.
[11] FCC IATD, 2004. Table 2.
[12] FCC IATD, 2004, p. 3.
[13] FCC IATD, 2004. Table 1.
[14] See, for example, *Connected & On the Go: Broadband Goes Wireless*, a report from the FCC Wireless Broadband Access Task Force, released February 2005.
[15] FCC Wireless Broadband Access Task Force (WBATF), 2005. *Connected & On the Go: Broadband Goes Wireless*.
[16] Clearwire [www.clearwire.com] is using proprietary equipment to serve areas in Jacksonville, FL, Daytona Beach, FL, Abilene, TX, and St. Cloud, MN.
[17] See *Report and Order and Memorandum Opinion and Order*, [FCC 05-56], adopted March 10.
[18] *Verizon Wireless Announces 3G Network Now Available to Consumers in Atlanta, Georgia; New VCAST Wireless Multimedia Service Available February 1*. [http://news.vzw.com/news/2005/01/pr2005-01-07c.html]
[19] *Cingular to Deliver 3G Wireless Broadband Services.* [http://www.prnewswire.com/cgi-bin/micro_stories.pl?ACCT=683924&TICK=CINGUL04&STORY=/www/story/11-30-2004/0002555250]
[20] *Nextel Expands Successful Broadband Trial to Include Paying Customers and Larger Coverage Area*. [http://phx.corporate-ir.net/phoenix.zhtml?c=63347&p=irol-newsArticle&t=Regular&id=514459&]
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[27] NARUC, February 2005. *Report of the Broadband Over Power Lines Task Force.*
[28] One example of an alternative entertainment service is the "V CAST" service by Verizon wireless.
[29] The Texas legislature passed a measure (SB5) in August 2005 that, among other things, allows video service providers to obtain a single statewide franchise.
[30] The Cable Act [Public Law 98-549] created a new Title VI of the Communications Act of 1934, which is enrolled at 47 U.S.C. §521 et seq.
[31] [http://www.lompoc.tv/home.asp, http://www.lompoc.tv/faq.asp].
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[35] Brief of U.S. Telecom Association & Verizon as *amici curiae* in support of petitioners, *Nixon v. Missouri Municipal League* (2003), page 7. [http://www.usta.org/filings/2003/05_23_03_amicus_NixonvMO.pdf].
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[37] See Norris and Moon (2005).

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[39] *See*, *e.g.*, Voice on the Net ("VON") Coalition, *White Paper on IP Voice Services*, FCC Report to Congress on Universal Service, No. 96-45. Mar. 18, 1998.
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[41] The Wireless Philadelphia RFP is available at [http://www.phila.gov/wireless/pdfs/WP%20RFP%204-5-05%20rev%20v4-CLEAN.pdf].
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