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In-Depth Presentation: Telecom
Municipal WiFi: How to draft an "anchor tenant" contract

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Introduction.

Over the past decade the internet and electronic connectivity has changed our daily lives. These changes impact how we communicate, how and where we work, how business is transacted, how we deliver city services, how we are educated, and how we enjoy our free time. Cities have historically played a key role in the development of railroads, highways, sewer and water and other crucial infrastructure. Cities that prosper today will likely be those that actively embrace and invest in communications infrastructure to connect and interact with the World.

Cities that are in the forefront in the provision of broadband capacity will help to provide an infrastructure that will attract and retain business, provide educational opportunities for residents and retain an increasingly mobile workforce dependent on broadband communications. Cities with broadband capacity will also be able to deliver public services at substantially lower rates. Finally, and perhaps most importantly, it is crucial that cities provide broadband infrastructure for the benefit of its residents as society becomes more and more dependent on broadband connectivity.

The telecommunications industry and cable television industry have together invested billions of dollars to improve their infrastructure to provide broadband capacity. Telephone companies began offering residential digital subscriber line ("DSL") service in the late 1990s about the same time many large cable operators began providing cable modem services. Each industry has focused on investing capital in larger, more densely populated markets often to the detriment of midsized and rural communities. The question is whether the existing broadband capacity in your community is sufficient to meet the needs of residents and small businesses and whether the private sector is ready to step up and invest in the necessary infrastructure to meet those needs.

The marketplace for broadband services is largely dominated by the local phone company and the local cable operator vying for customers in each market. The DSL and cable modem products which these companies sell require a hardwire connection to each household or business. However, there is limited availability of wireless broadband service in many markets across the country. In fact, the National Telecommunications & Information Administration ("NIA") estimates that as many as 25,000,000 U.S. homes and small businesses do not have <u>any</u> access to broadband internet options.

Over the past five years elected officials have begun to take notice of the profound impact that broadband capacity has on the local economy. Many officials have introduced proposals to spur broadband deployment and promote competition in the delivery of broadband services. Elected officials have also come to realize that waiting on the private sector to invest capital necessary to provide broadband to more sparsely populated areas may result in lost business opportunities for a region and an overall negative impact on the local economy.

Municipalities are therefore eyeing municipal wireless broadband applications as a way to provide capacity to their residents and businesses and to provide additional competition to wire-line providers whose rates may now exceed the budgets of many low and middle income residents.

This paper will review the considerations which municipalities must weigh in determining whether to pursue a municipal wireless broadband system as well as the key issues to consider when structuring a Wi-Fi Agreement.

Definitions.

Below is a summary of key terms necessary to understand the technologies and standards referenced when discussing municipal wireless broadband services.

1. **3G** also known as "advanced wireless services" is an FCC license radio band spectrum for the wireless transmission of internet service. 3G services typically use a license cellular network architecture that has been upgraded to carry data and voice.

    a. Several wireless companies including Cingular, Sprint, and Verizon now offer mobile wireless broadband service over their cellular networks making it available to approximately 96% of the US population via traditional cellular telephone service.

    b. Typical data speeds in major metropolitan areas are between 220 to 700 Kbps in more rural areas speeds are approximately 40 - 135 Kbps.

2. **Backhaul** means the infrastructure necessary to transmit traffic from a node, or other remote site, back to a central site where a switch may be located.

3. **Broadband** means a general set of transmission capabilities and characteristics, such as always on, high speed internet access with sufficiently robust functionality suitable for evolving, bandwidth-hungry applications.[1]

    a. Broadband generally includes data transmission speeds that exceed 200 or 300 Kbps, or more, in one or both directions.

4. **Mesh Network** is a networking technique that allows data to be routed between various nodes. Mesh networks are considered self healing and can operate even when a given node fails. There is sufficient redundancy in a mesh network so that data is transmitted to other nearby nodes to ensure reliability.

5. **Switch** is a device that filters and forwards packets of information between local area network segments.

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[1] FCC, Connected & On the Go, Broadband Goes Wireless, Report by the Wireless Broadband Access Task Force 11 (2005) ("FCC Report") available at http://hraunfoss.fcc.gov/edocs_public/attachmatch/doc-257247A1.pdf.

6. **Wi-Fi** means wireless fidelity. Wi-Fi is a registered trademark term promoted by the Wi-Fi Alliance, a group of wireless internet hardware and software providers that certify "802.11" products for network interoperability. A 802.11 network refers to a family of specifications approved by the Institute of Electrical and Electronics Engineers ("IEEE") in 1997 for a wireless, over-the-air interface Local Area Network ("WLAN").

a. Computer users can generally access the internet with a high-speed wireless connection if they are within 300 feet of a transmitting antenna and have appropriate receiving hardware installed in their computer.

b. Wi-Fi provides data transmission at speeds of up to 11 to 54 Mbps.

7. **Wi-Max** means worldwide interoperability for microwave access. Wi-Max is a registered trademark term promoted by the Wi-Max Forum, a group of wireless internet hardware and software providers that certify "802.16" for network interoperability.

a. Wi-Max is capable of transmitting network signals covering in excess of 30 miles of linear service area.

b. Wi-Max could provide multiple shared data rates of up to 75 Mbps.

c. Wi-Max is often considered valuable for backhaul purposes or for last mile applications for existing wire infrastructure.

What is wireless broadband internet?

One of first questions which city attorneys generally ask is: how is wireless broadband internet regulated under state and federal law? The short answer is that because wireless technologies use unlicensed radio band spectrum they are subject only to the FCC's rules to prevent interference with FCC licensed services. The question of whether wireless broadband is subject to additional regulation remains unanswered.

The FCC Wireless Broadband Access Task Force considered this same question and recommended that the FCC classify wireless broadband as an "information service."[2] However, the Task Force also noted that because of the services offered over wireless broadband, certain regulatory requirements will likely need to be imposed by the FCC under Title II of the Communications Act with respect

[2] An "information service" is the offering of a capability for generating, acquiring, storing, transforming, processing, retrieving, utilizing, or making available information via telecommunications . . . " 47 U.S.C. § 153(20). *See also Nat'l Cable & Telecom. Ass'n et al. v. Brand X Internet Services et al.,* 125 S.Ct. 2688, 2697-98 (2005) ("Brand X") (upholding FCC declaratory ruling that cable broadband is an "information" not a "telecommunications" service under the 1996 amendment to the Communications Act).

to common carrier requirements for "telecommunications services."[3] Under either regulatory approach, municipal regulation similar to cable franchising is not generally available for a private wireless broadband system.

Public v. Private Ownership

There are approximately four different models to consider regarding the provision of municipal wireless broadband services. Many of these models can be blended together and/or modified to fit the goals of the community and the business model desired.

1. Non-profit. Under this model a major business in a community, charitable organization or local institution takes a leadership role to form a non-profit entity to fund, deploy and maintain a wireless broadband network. The non-profit works with the municipality to obtain access to public rights-of-way including street lights, traffic lights, municipal buildings, water towers and other city owned infrastructure. A municipality's involvement in this type of system is generally limited to its provision of city owned assets with no financial commitment or ongoing management responsibilities.

2. Private Contract. Under this model a municipality generally goes out to bid making available its city assets for the installation of wireless antennas and rights-of-way for backhaul services. For municipalities with significant available assets there is greater opportunity for negotiations with the service provider to secure discount rates for low income residents and/or to negotiate favorable rates for municipal services on the network. Under this model a municipality does not build, maintain or own the network but may maintain a certain level of control over the network depending upon the agreement negotiated for the use of city assets and/or for securing "anchor tenant" bulk services on the network.

3. Public/Private Partnership. In a public/private partnership model, there is a great deal of creativity in how a municipality chooses to structure the arrangement. A municipality may provide access to city assets and anchor tenant obligations and may or may not participate in the design, construction and ownership of the system. In some models a municipality may finance the construction of the network and then make the capacity available on a wholesale basis to other providers. In other scenarios the municipality may enter into an agreement with a private entity to manage and operate the network while the city handles marketing, sales and other functions through a municipally owned utility.

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[3] A "telecommunications service" is "the offering of telecommunications for a fee directly to the public . . . regardless of the facilities used." 47 U.S.C. § 153(46). "Telecommunications" is "the transmission, between or among points specified by the user, of information of the user's choosing, without change in the form or content of the information as sent and received." 47 U.S.C. § 153(43). *See also Brand X* at 2697-98.

Depending on the way in which this model is structured, bidding requirements may be triggered under state law. Funding of the system is also a critical element under this model to the extent municipal ownership is a part of the partnership arrangement. Funding alternatives may include tax revenues, bond financing, grant funding, private capital, as well as operational funding from service access, fees for various applications and advertising revenue.

4. Municipal Ownership Model. The classic municipal ownership model in the United States has been challenging over the past several years. Legal challenges from incumbent operators and unrealistic advertising revenue expectations have doomed several systems. In 2004 Chaska Minnesota was one of the first to construct a municipally owned wireless broadband network. In Chaska the city was able to construct a network covering 95% of its 22,000 residents with approximately 250 toaster size antennas mounted to city light poles covering an area 16 square miles. Broadband service was initially offered for about $17 per month.

A municipal ownership model is attractive not only in metropolitan areas but in smaller rural communities where wire-line broadband services may not be available to residents and businesses. In many rural communities an analysis is undertaken to weigh the costs of constructing a wire-line network against the cost of a municipal wireless broadband network. A pure municipally owned network can present significantly more legal and technical challenges and is likely to be met with greater opposition from private competitors.

Pros and Cons of Municipal Wireless Broadband.

1. Pros

   a. Incumbent telephone and cable operators provide limited broadband services in the community at high rates and a municipal system would improve availability and increase competition.

   b. Municipalities can leverage such networks to obtain lower cost communications services by serving as an "anchor tenant."

   c. Wireless networks are more cost effective than installing wire-line systems.

   d. Installing a wireless system will spur economic development and/or help retain local business and telecommuters.

   e. Political accountability will minimize the risk of wasteful decisions in constructing the network.

2. Cons

a. A government run system will not perform at the level of private enterprise.

b. Once built a municipality may have an incentive to prohibit others from entering the rights of way to maintain a competitive advantage.

c. Wireless broadband is not a "natural monopoly" similar to water and electric service and there already exists competition in the broadband marketplace.

d. Municipalities are inefficient in adopting new technologies demanded in the marketplace.

e. Taxpayers will be forced to finance the system and will shoulder the burden if the network fails to meet estimates.

Bidding Requirements.

There are a number of draft Requests for Proposals ("RFP") available on the internet for review. The main problem which municipalities face in creating an RFP is utilizing a model RFP created for larger cities such as Philadelphia, Minneapolis or San Francisco and trying to modify it for use in a much smaller community. Larger municipalities with a higher level of municipally owned assets and anchor tenant service opportunities will be able to demand far more concessions from companies interested in providing services. A common mistake made by smaller communities is to present an overreaching RFP which presents unrealistic mandates given the size of the jurisdiction.

The first step in determining the proper type of RFP to utilize is to determine the ownership model desired by elected officials. Thereafter a survey of available city assets and infrastructure, as well as services which may be migrated over to the wireless system, must be conducted. Issues regarding available electric capacity on city light poles, aesthetic considerations and availability of backhaul capacity should all be assessed prior to issuing an RFP. Once this information is tabulated the municipality is then in a position to determine what leverage it may have in attempting to obtain concessions from interested bidders through the RFP process. However, mandating concessions in an RFP similar to those found in RFPs issued in the top 20 U.S. markets will likely result in an inefficient process and wasted effort on the part of the city and the prospective bidders. For a copy of the Minneapolis RFP visit:
http://www.ci.minneapolis.mn.us/procurement/docs/wireless-rfp.doc

Drafting a Wi-Fi Agreement.

One problem facing municipal attorneys when attempting to draft a municipal wireless broadband agreement is there is no "form document" from which to start the process. Copies of agreements can be obtained from numerous large jurisdictions including Philadelphia, Minneapolis, Portland, Oregon, and other

cities around the country. However, each of these models is drastically different and varies depending upon the negotiating leverage available to the city. Recently Moss & Barnett assisted the City of Minneapolis in drafting its agreement with wireless service provider US Internet. During this process Moss & Barnett was asked to create an agreement which would:

1. Comply with the city's standard terms and provisions for technology agreements;

2. Incorporate agreed upon SLAs - Service Level Agreement;

3. Include fiber construction requirements to complete required backhaul needs;

4. Incorporate standard pole attachment safe guards;

5. Provide for 10 year fixed pricing for residential services;

6. Mandate a return of the network's profits for various "community benefits";

7. Provide for a long-term bulk agreement for the migration of various city telecommunication services as part of the city's agreement to be an "anchor tenant";

8. Mandate network neutrality;

9. Require the provider to make capacity available on a wholesale basis;

10. Include open access obligations;

11. Clearly provide financial protections for the city in the form of letters of credit, bonds and other financial guaranties; and

12. Provide for quick and straightforward enforcement provisions and termination rights.

What started as a 12 page contract quickly ballooned to 84 pages - most of which was drafted paragraph by paragraph based on the negotiations between Minneapolis and US Internet Wirless(USIW) on each of the above-referenced issues.

Key provisions of the Minneapolis Wireless Broadband Agreement

A. Scope of Work and SLA(s).

1. USIW, at its own expense, must construct a turnkey wireless broadband IP data access network which will include backhaul, tower and access point technologies and all design, hardware, software, installation, content

development, testing, maintenance and support services necessary to provide a fully functioning Wireless Network. The Network will receive a complete technical refresh no later than year five and will be continually updated throughout the contract cycle as software and hardware, supporting desired services, are made available.

a. USIW must also provide a 4.9 GHz network will be available for public safety if the city chooses to use it.

b. USIW must upgrade the network hardware and software including such enhancements as 802.11e, n, r and s (as these are widely adopted and financially viable) on a periodic basis to maintain the highest standard of service reasonably available and economically feasible such that the entire Network will have been totally refreshed within 5 years of its inception.

2. USIW will provide ubiquitous outdoor municipal, commercial, residential and roaming per SLA; and ubiquitous indoor residential coverage per the SLA at a minimum data rate of one to three megabytes per second.

a. 95% outdoor coverage per SLA with no prejudice to demographic area.

b. 90% indoor coverage per SLA including high rise and multi-family locations (assuming building owner cooperation) may be provisioned using best technical means, as long as it meets the coverage requirement and provides equal network access, if fixed connectivity is used a package including a wireless account will be provided for nomadic access (i.e. mobility) to users.

c. 99.9% availability uptime in Wi-Fi layer (wireless access points on poles) and 99.99% uptime in fixed wireless and injection layers (fiber or radio backhaul), exception of power outages outside of our control and scheduled maintenance.

4. USIW must make available all required customer premises equipment (CPE) at a cost plus shipping, handling, taxes to the end user per month with an option to purchase desired devices with a one time payment of $75.00, or to CPE rental at a Monthly charge of $ 5.00 includes service, support and maintenance.

5. USIW must provide 7 x 24 customer and technical support available via telephone, e-mail and web for all municipal, commercial, residential and roaming customers and will implement Multilanguage support services for Spanish, Hmong and Somali languages as well as disability functionality (TDD).

6. USIW must provide a full service wholesale offering with complete technical functionality (IP addresses, location information, etc.) to competitive providers and hot spot locations throughout the City. Wholesale ISP providers

shall be provided with Layer 2 access to the network to obtain diagnostic information for technical customer support services.

7. USIW must designate a dedicated Project Management and Support team and, in addition, must make available all technical and operational information necessary to deploy and operate the network.

8. USIW must provide City with on demand monthly, quarterly and annual reports online to verify compliance with agreed upon service level requirements.

9. USIW must offer standard included and premium optional secure connection options for City usage. USIW uses Standard Based (Ipsec, VPN, 802.1x) security techniques recognized and excepted through the internet. The combination and usage of Standard Based security techniques should allow the fulfillment of all City security needs.

B. Community Benefits.

1. USIW must contribute an advance of $500,000 to the Digital Inclusion Fund (DIF), $ 200,000 upon contract execution and $ 300,000 upon network signoff by the City of Minneapolis to support creation of the Digital Inclusion Fund. USIW will support the Digital Inclusion Fund with a minimum of 5% of net pretax income and 100% of all local community portal revenues that are sold by Digital Inclusion fund agency or its designee. USIW will also contribute 2% of all net profit from network revenues that accrue from other Local Governments that subsequently utilize the expanded network.

2. USIW must provide a “walled garden” as a free level of service and, in addition, offer open Internet limited-time free service with 1 Meg broadband access in defined public locations (Parks, Plazas) not to exceed 5% of the geographic area throughout the City, USIW may limit the service in any reasonable way with online time being the preferential method in order to prevent unauthorized pirating of free bandwidth by customers that would otherwise be required to pay for access to the Network.

3. USIW will develop up to 90 Location based Community Log-in Sites and associated templates for City of Minneapolis neighborhoods that will allow access to selected government sites, community service sites, Neighborhood Associations, and local event calendars; as well as offer a platform for localized advertising. The Community Log-in Sites will include multi-lingual functionality. USIW will provide tools and processes as well as technical support for developing and implementing Community Content.

4. USIW must provide

   a. Residential services at $19.95 per month at 1 Megabit.

   b. Business services at no more than $29.95 per month.

c. Standard City of Minneapolis services (1 to 3 megabit laptop connections) will be provided at no more than $12.00 per month and will maintain a baseline service at 1 Megabit minimum service level for the initial term of the contract.

d. Premium services may be made available as they are developed and deployed. Internet filtering options will be standard for all City and Board users and made available to all other users.

5. USIW is prohibited from Red-lining network services to any area or location in the City by any means except where power infrastructure and hanging assets are not available.

6. USIW agreed to ensure net neutrality defined as not limiting bandwidth, limiting content or otherwise implementing any limitation on use or access to bandwidth in order to create or provide any competitive advantage to USIW or any wholesaler, application or network lawfully accessing or utilizing the Network with the exception of any harmful or malicious traffic, except for the purpose of maximizing the speed and efficiency of the Network and for the purpose of providing the highest standard of services to the largest number of customers on the Network.

C. Use of City Owned Assets/City Commitments.

1. USIW agrees to give first preference to the use of City and Boards (Schools, Park, Library) hanging assets and pay agreed upon use fee to be negotiated, provided that such fees shall be competitive and those assets provide equal or greater network functionality.

2. The City agreed to allow the use of City controlled signalized intersection assets for agreed upon fee to be negotiated, provided that such fees shall be competitive.

3. The City agreed to allow use of Building and Rooftop Attachment for City properties and will support USIW in making arrangements with Boards (Schools, Park, Library) at fees to be negotiated, provided that such fees shall be competitive.

4. The City agreed to make available selected Fiber Infrastructure to support the network. USIW agreed to use City provided, and USIW financed Fiber to provision the network with overall bandwidth required and feed access points as fiber is made available at competitive access rates and network functionality.

5. The City agreed to pay $2.2 million in advance for City acquired services (Advance) and will agree to a minimum annual commitment for the first 10 years of the contract to pay not less than $1,250,000, less credit for a portion of the Advance.

6. USIW agrees to make a grant to the City in the amount of $450,000 to support City technology investments to be addressed further in the contract. USIW will pay $150,000 on award and $300,000 on network signoff.

D. Pricing Tiers (Video, Internet Access, Machine Connectivity, etc.).

1. USIW agrees to unit pricing by service type, per Tiered pricing schedule.

2. An application and professional services rate schedule is included for services to be provided by USIW and partners; Siemens and other providers.

E. Pricing Guarantees and Price Escalation Protection.

1. USIW agrees to escalation limitations on prices for City services other than guaranteed 1 Mg. City Services which shall not exceed increases based upon an index to be determined by negotiation and which will be commercially reasonable. In the event of a default by USIW in the contract to be executed with the City that shall continue unremedied beyond the expiration of any period provided therein to cure such default, City will have the Right to Purchase Network at its fair market value as determined by appraisal.

2. In the event that USIW shall desire to sell the Network to any entity other than an entity in which USIW or its parent holds a controlling interest or a mutual failure to extend the term of the agreement, the City shall have the equal right with any other entity to negotiate and bid for the purchase of the Network, and USIW shall sell the Network to the City if the City offers a purchase price and terms that are equal to or greater than those which USIW may be willing to accept from any entity that is not controlled by USIW.

3. USIW and the City will work together to specify geographic implementation priorities. Such priorities will be established by negotiation based on the priorities of the City and sound technical design. USIW and the City will establish an implementation strategy that is in the City's best interest.

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Brian T. Grogan is a shareholder with the Minneapolis law firm of Moss & Barnett practicing in the firm's communications and business law departments. Since 1988 Brian has worked with governmental entities throughout the country on a variety of cable, telecom, wireless and broadband communications issues. Brian regularly appears before state utility commissions and recently assisted the City of Minneapolis draft its Wireless Broadband Agreement. He has also been actively negotiating cable and telecommunications franchises for cities across the country. In his business law practice Brian focuses on fiber lease agreements, mergers and acquisitions and contract matters in the communications and

technology industries. Brian is a frequent presenter at IMLA, AMC and NATOA and is vice-chair of the Communications Law Section of the Minnesota State Bar Association.

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Appendix 1 – Major Internet Technologies[1]

Technology	Delivery	Speed	Price Per Mo.	Range	Development	Performance	Deployment
Dial-Up Modem	Dial-up via traditional copper wireline telephone connection	Traditional: up to 56 Kbps[2] Hi-speed: up to 280 Kbps[3]	Traditional: $5+ Hi-speed: $10+[4]	Traditional copper wireline telephone connection	Mature	Connection generally consistent	Available via traditional telephone connections
Digital Subscriber Line	Copper wireline telephone connection capable of supporting digital data	Up to 32 Mbps[5] Providers generally offer service of 1.6 to 6.4 Mbps[6]	$13-40+[7]	DSL-ready copper wireline connection; up to about 3 miles without use of "repeater" to regenerate signal strength[8]	Mature	Connection generally consistent; speed depends on distance from provider[9]	Substantial deployment in major cities; lesser deployment in other areas
Cable Modem	Coaxial wireline cable connection	Up to 30 Mbps[10] Providers generally offer service of 1.8 to 6.7	$40+[12]	Cable wireline connection[13]	Mature	Connection generally consistent; speed does not depend on distance from	Substantial deployment in major cities; lesser deployment in other areas

Technology	Delivery	Speed	Price Per Mo.	Range	Development	Performance	Deployment
		Mbps[11]				provider[14]	
Wi-Fi	Unlicensed radio spectrum	802.11a: up to 54 Mbps 802.11b: up to 11 Mbps 802.11g: up to 54 Mbps[15]	$17-30+[16]	Up to 300 feet[17]	Mature, but improvements still expected	802.11b and a standards subject to line of site disruptions from physical objects and interference from other wireless signals; 802.11g uses OFDM to allow non-line of site transmission and to reduce distortions[18]	Up to 150,000 U.S. hotspots,[19] 56+ operational municipal networks, 29+ city hot zones, 42+ municipal or public safety networks[20]
Wi MAX	Licensed and unlicensed radio spectrum	802.16a: up to 75 Mbps[21]	N/A	Up to 30 miles[22]	Emerging technology; 802.16a standard extended to include 802.16d	802.16a uses OFDM to allow non-line of site transmission and to reduce distortion	Limited deployment

Technology	Delivery	Speed	Price Per Mo.	Range	Development	Performance	Deployment
					standard; 802.16e mobile standard also in development[23]	from other wireless technologies[24]	
"3G" Wireless Mobile Broadband	Licensed wireless communication networks	Data transfer up to 2 Mbps, typical download speeds of 300-500 Kbps[25]	220 Kbps-700 Kbps data transfer speed in major cites, 40- 135 Kbps data transfer in other areas: $60-80[26]	Co-extensive with cellular network coverage, 96%+ of U.S. population[27]	Emerging technology	Co-extensive with cellular network performance, subject to line of site disruptions from physical objects	Co-extensive with cellular network coverage, 96%+ of U.S. population; broadband available only in major cities; reduced speeds available in other areas[28]
"4G" Wireless Mobile Broadband	Licensed wireless communication networks	Up to 1 Mbps[29]	N/A	Similar to metro wireless networks; vehicular	In development	In development	No substantial deployment

Technology	Delivery	Speed	Price Per Mo.	Range	Development	Performance	Deployment
				mobility up to 155 mph[30]			
Broadband Over Powerlines	Existing electric power distribution networks	Up to 3.5 Mbps[31]	Up to 500 Kbps: $28.95 Up to 1.5 M bps / 2 Mbps: $40 Up to 2.5 M bps / 1 Mbps $60 Up to 2.5 M bps / 1 Mbps $80[32]	Wireline connection via electrical outlet[33]	Emerging technology	Connection generally consistent, but subject to disruption during electric transmission spikes[34]	Limited deployment[35]
Satellite Internet	Satellite signal received via base station dish and clear line-of-sight to provider's satellite	Up to 1.5 Mbps download / 256 Kbps upload[36]	Up to 500 Kbps / 120 Kbps: $50-60 Up to 750 Kbps/ 128 Kbps: $60-110 Up to 1 M bps /256 Kbps: $70 -	Wireline connection to base station dish[38]	Emerging technology	Subject to line of site disruptions from physical objects or severe weather	Throughout U.S., including Alaska, Hawaii, and Puerto Rico[39]

Technology	Delivery	Speed	Price Per Mo.	Range	Development	Performance	Deployment
			140 Up to 1.5 M bps /256 Kbps: $80 + dish hardware: $300 - 700[37]				
Fiber to the Home	Fiber optic wireline connection	Up to 30 Mbps download / 5 Mbps upload[40]	Up to 5 M bps / 2 Mbps: $35-40 Up to 15 M bps / 2 Mbps: $45-50 Up to 30 M bps /5 Mbps: $180[41]	Fiber optic wireline connection[42]	Emerging technology	Connection generally consistent; speed does not depend on distance from provider	Substantial deployment in major metropolitan areas, lesser deployment in other areas

[1] This chart was created by the Federal Trade Commission in a paper entitled, Municipal Provisions of Wireless Internet, Sept. 2006. Sources used in this paper and Appendix regarding Internet technology characteristics and related market prices are drawn from generally recognized and up-to-date authorities. As technological standards and market conditions continue to evolve, however, such information is subject to change.
[2] *See generally* NETZERO, NETZERO.COM (2006).
[3] *See generally id*.
[4] *See generally id*. *See also* COMPARENOW.NET, DIAL UP INTERNET PROVIDERS (2006), *at* http://comparenow.net/dialup.html.
[5] *See generally* WEBOPEDIA.COM, xDSL (2006), *at* http://webopedia.com/TERM/x/xDSL.html.
[6] *See generally* CNET.COM, TOP DSL PROVIDERS (Feb., Aug. 2006), *at* http://reviews.cnet.com/7020-9031_7-0.html?tag=bbw&sortColumn=speed&ac=.
[7] *See generally* COMPARENOW.NET, BROADBAND INTERNET PROVIDERS (2006), *at* http://comparenow.net/broadband.html.
[8] *See generally* WEBOPEDIA.COM, *supra* endnote 5.
[9] *See generally id*.
[10] Press Release, Cisco Systems, UPC to Test Cable Internet Speeds of up to 30 Mbps (2004), *available at* http://www.cisco.com/global/UK/news/pdfs/2004/20041201.pdf.
[11] *See generally* CNET.COM, TOP CABLE PROVIDERS (Feb., Aug. 2006), *at* http://reviews.cnet.com/7020-9031_7-0.html?tag=bbw&ac=&filter=9032&action=Go%21.
[12] *See generally* COMPARENOW.NET, *supra* endnote 7; EARTHLINK.COM, HIGH SPEED PRICING (2006), *at* http://www.earthlink.net/highspeed/pricing/.
[13] *See generally* WEBOPEDIA, CABLE VS. DSL (2006), *at* http://www.webopedia.com/DidYouKnow/Internet/2005/cable_vs_dsl.asp.
[14] *See generally id*.
[15] *See generally* FCC Report, *supra* note 1, at 19-20; WEBOPEDIA, WIRELESS LAN STANDARDS (2006) *at* http://www.webopedia.com/quick_ref/WLANStandards.asp.
[16] *See generally* CHASKA.NET; Kessler, *supra* note 35.
[17] FCC Report, *supra* note 1, at 3.
[18] *See generally id*. at 19-20.
[19] *See generally id*. at 3, 56. *See also* JIWIRE.COM, *supra* note 31.
[20] *See generally* MUNIWIRELESS.COM, FEBRUARY 2006 LIST OF MUNI WIRELESS NETWORKS POSTED (UPDATE TO THE JULY 2005 REPORT) (2006), *at* http://muniwireless.com/municipal/1035/.
[21] *See generally* FCC Report, *supra* note 1, at 21.
[22] *See generally id*. at 3.
[23] *See generally id*. at 3-4, 20-21.
[24] *See generally id*. at 21.
[25] *See generally id*. at 24.
[26] *See generally* VERIZON, VERIZON.COM (2006); SPRINT, SPRINT.COM (2006); CINGULAR, CINGULAR.COM (2006).
[27] *See generally* FCC Report, *supra* note 1, at 24.
[28] *See generally id*.
[29] *See generally id.* at 26-27.
[30] *See generally id*.
[31] *See generally* COMMUNICATIONS TECHNOLOGIES, INC., COMTEKBROADBAND.COM (2006); Robert Valdes, *How Broadband Over Powerlines Works*, HOWSTUFFWORKS.COM (2006), *at* http://computer.howstuffworks.com/bpl.htm.
[32] *See generally* COMMUNICATIONS TECHNOLOGIES, INC., *supra* endnote 31.
[33] *See generally id*.

[34] *See generally* Valdes, *supra* endnote 31.
[35] *See generally* UNITED POWER LINE COUNCIL, BPL DEPLOYMENT MAP (2006), *at* http://www.uplc.utc.org/file_depot/0-10000000/0-10000/7966/conman/BPL+Map+12_12.pdf.
[36] *See generally* STARBAND, STARBAND.COM (2006); DIRECWAY, DIRECWAY.COM (2006); WILDBLUE, WILDBLUE.COM (2006).
[37] *See generally* STARBAND, *supra* endnote 36; DIRECWAY, *supra* endnote 36; WILDBLUE, *supra* endnote 36.
[38] *See generally* STARBAND, *supra* endnote 36; DIRECWAY, *supra* endnote 36; WILDBLUE, *supra* endnote 36.
[39] *See generally* STARBAND, *supra* endnote 36; DIRECWAY, *supra* endnote 36; WILDBLUE, *supra* endnote 36.
[40] VERIZON, THE SPEED OF FIOS™ WILL CHANGE FOR YOUR LIFE (2006), *at* http://www22.verizon.com/FiOSforhome/channels/FiOS/root/package.aspx.
[41] *See generally id*.
[42] *See generally id*.