

MAINE STATE LEGISLATURE

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September 11, 2006

Hon. Senator Philip L. Bartlett II
Hon. Rep. Lawrence Bliss
Members, Joint Standing Committee on Utilities and Energy
Maine Legislature
Augusta, ME 04333

RE: Report on Municipal Capabilities to become Internet Services Providers, enclosed

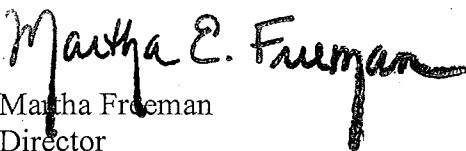
Dear Senator Bartlett and Representative Bliss,

P.L. 2005 Private and Special Law, Chapter 19, required the State Planning Office, in conjunction with the Public Utilities Commission and the Department of Economic and Community Development, to study and report to the Joint Standing Committee on Utilities and Energy our findings on municipal capabilities to become providers of Internet services.

The State Planning Office convened a small group consisting of a representative from the Public Utilities Commission, Department of Economic and Community Development, and the Office of the Chief Information Officer and received input from the Town of Brunswick, IDEXX, TDS Telcom, and Verizon.

Should you have any questions regarding the enclosed report please feel free to contact Tony VanDenBossche at 287-1474 or email at tony.vandenbossche@maine.gov.

Sincerely,


Martha E. Freeman
Director

Report on Municipal Capabilities to become Internet Service Providers

to
Joint Standing Committee on Utilities and Energy

Prepared in accordance with P.L. 2004, Private and Special Law, Chapter 19

by
Maine State Planning Office

in conjunction with
Maine Department of Economic and Community Development
Maine Office of Information Technology
Maine Public Utilities Commission

September 2006

Acknowledgements

The Maine Department of Economic and Community Development, Maine Public Utilities Commission, and Maine Office of Information Technology advised the office throughout the process and offered valuable insights and sources of information.

The State Planning Office established a working group to help prepare this report consisting of the following individuals:

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Jody Harris, Maine State Planning Office
Phil Lindley, Maine Public Utilities Commission
Peggy Schaeffer, Maine Department of Economic and Community Development
Ralph Van Den Bossche, Maine State Planning Office

In addition, we would like to thank the following individuals for their input: Pat Harrington from the Town of Brunswick, Bill Davis of IDEXX, Dan Breton of Verizon, and Reggie Palmer of TDS Telecom.

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Background

“Broadband service is critical to the ability of Maine citizens, businesses, and institutions to participate in our global economy, to create, enhance, and preserve local economic development and employment opportunities, and to retain our human capital.”

–Maine Broadband Access Infrastructure Board

The Legislature’s Joint Standing Committee on Utilities and Energy hopes to stimulate educational and economic development opportunities by expanding the availability of wireless Internet access throughout Maine.

During the Second Regular Session of the 122nd Legislature, the committee directed the State Planning Office to study and report on municipal capabilities to become providers of Internet services, specifically wireless service. The State Planning Office submits this report in accordance with P.L. 2004, Private and Special Law, Chapter 19 (see Appendix A).

This law directs the State Planning Office to look at three questions:

1. the long-term educational and economic benefits that could be derived from municipalities becoming Internet service providers.
2. the technology available for creating wireless Internet access throughout rural and urban municipalities in the state and its estimated cost; and
3. the various funding sources and strategic partnerships that may be available to municipalities to deliver wireless Internet service.

These questions provide the framework for our report.

Under current home rule provisions, Maine’s state constitution provides municipalities with the authority to offer and fund wireless Internet service within their communities. This report does not look at the question of legal authority. Nor does it look at the question of whether municipalities should provide this kind of service. That is a question for each municipality to decide on its own. The report does, however, identify options and resources for towns that might be considering this question. It also describes the considerations necessary for a municipality to successfully plan and implement a wireless Internet network.

Considerable work has preceded this report focusing on expanding broadband service throughout Maine. In January 2005, Governor John Baldacci launched his *ConnectME* initiative with the goal of providing universal broadband access by 2010.

By Executive Order, the Governor created three boards to advance the goals of *ConnectME* including:

1. Maine Broadband Access Infrastructure Board –to examine ways to expand the availability of broadband services throughout the state to private homes, businesses,

public and private education institutions, research centers, and other entities that would benefit from such services;

2. PK-20 Telecommunications and Technology Infrastructure Board –to address connectivity and interoperability solutions surrounding the types of infrastructure being implemented by Maine’s education community; and
3. Maine Wireless Telecommunications Infrastructure Board –to develop and lead the implementation of an expansion plan to provide universal wireless telecommunications coverage by 2008.

The Governor also created a Telecommunications Infrastructure Steering Committee to review and synthesize the purposes, goals, and common elements of all three of the boards and coordinate each board’s recommendations to identify priority items and actions to be implemented.

Based on the work of these boards, Governor Baldacci submitted legislation to the 122nd Legislature (LD 2080) that resulted in the creation of the ConnectME Authority to stimulate investment in advanced communication technology infrastructure and encourage expansion of broadband and wireless services in unserved and underserved areas of the state. To fund the Authority, the Legislature established an assessment on communications service providers.

Three earlier reports contain recommendations for ways the state might expand broadband services across Maine that might be of interest to the committee:

1. Maine Broadband Access Infrastructure Board. Draft Report, November 2005.
2. Maine Public Utilities Commission. Expanding High-speed Internet and Advanced Communications Services Statewide, December 30, 2004.
3. Sunrise County Economic Council and Eastern Maine Development Corporation. Washington County Telecommunications Infrastructure Assessment and Plan, May 2005.

The recommendations from these reports are attached as appendices (Appendices B-D).

All of these efforts are helping to advance the goals of Chapter 19. As a result, this report will focus on the options available to municipalities to become wireless Internet service providers in the context of expanding telecommunications service across Maine.

Introduction

Many cities want to offer wireless Internet service as they do other public utilities, like water, sewer, or electricity. Even at a cost, they believe it serves the public good. For example, they say it helps to narrow the “digital divide” by providing low-cost or free access to those who would not be able to afford it otherwise. Universal access enhances municipal service delivery, provides business competitiveness advantages, and generates nontax revenue. Advocates say that municipalities are more accountable and that consumer citizens can influence a government service more easily than a large remote business.

Critics argue that tax-subsidized wireless service puts municipalities in an unfair competitive position with private business and hampers investment and innovation. While large telecommunications companies can likely compete with government-provided services, small Internet cafes and coffee shops cannot. To set up and maintain a municipal Internet service requires continuing technology upgrades and systems for billing, collection, and repairs, which may put a strain on local governments. Lastly, municipally-governed wireless services constitute a monopoly that leaves customers with no choices and, some say, with a government utility that is less responsive than a private business.

There are other social questions to consider as well:

- *Public safety issues.* How will the municipality protect its users from fraud, criminal activities, or predators? Public Internet systems provide open access to online predators trolling for targets.¹ For example, a municipality could decide to block some sites within a radius around a school.²
- *Privacy issues.* Who has access to data generated from use of municipally-operated Internet systems? How will a municipality protect the privacy of users and secure information transmitted by users? The private sector may offer greater safeguards than government in protecting customers’ personal information. It does not face freedom of access and freedom of information laws. Recent concerns about the federal *Communications Assistance for Law Enforcement Act*, which permits law enforcement officials to tap public communications networks, raise additional questions, not only about access, but also the cost to comply with this law.³
- *Free speech issues.* How will the municipality ensure freedom of expression of its users? Free speech includes the right to explore what the Internet has to offer without fear of surveillance or intrusion. The example above of blocking certain sites in response to public safety issues raises free speech concerns for its public Internet users. Public systems need to balance between protecting children and other patrons and abiding by privacy and freedom of speech statutes.⁴
- *Urban sprawl.* How will universal access affect development patterns and property taxes? Universal access makes it possible for people to live and work outside of traditional downtown and business parks. This contributes to sprawling patterns of land use development that demand duplicative public infrastructure and drive up taxes.

Regardless of the pros and cons, there are today 91 cities or counties in the U.S. that have wireless broadband networks in operation for public access or that have “hotspots” (i.e. wireless access in airports, cafes, hotels, libraries, etc.) or “hotzones” (i.e. wireless areas citywide or in city downtowns). Thirty-two operate city or county networks for municipal use only. Another 121 (as of June 2006) have issued RFPs or are in the deployment phase of establishing municipal Internet services.⁵

Cities across the country are testing a number of business models. Here are a few:

- The municipality owns and operates the network as a public utility.
- The municipality owns and operates the network, but contracts with a private service provider to build and run it.
- A private company owns and operates the network and provides free or low-cost service to the city and/or its residents by selling on-line advertising to cover its costs
- A non-profit organization is created by the community to provide access at below market rates.
- A municipality contracts with a private company that owns and operates the network and charges users a subscription fee.⁶

Internet service provided as a public utility does not seem to be that common. Most local governments are working with vendors that build and own the networks using a variety of incentives and mechanisms for recouping costs. Below are some examples of municipal wireless services in US cities and in Maine.

The city of *Corpus Christi, TX* is building a citywide WiFi network for the general public’s use. The city will maintain ownership and control of the projected \$7 million system. To recoup its capital investment and to avoid having to run the customer service, the city expects to sell access at wholesale rates to local Internet service providers who, in turn, would sell the service to consumers.⁷

In Pennsylvania, state law permits cities to offer wireless service, but, if they do, they must do so for free. If a city decides to charge for municipally-provided Internet service, it must first determine if any local private company wants to offer the service. Philadelphia created an independent nonprofit organization, called *Wireless Philadelphia*, to administer its citywide wireless network. A private company, EarthLink, will build and operate the WiFi network at its expense and provide free or low-cost service to city workers and low income families. In addition, EarthLink will provide the city with part of their revenues to buy computers for low income families.⁸

In 2005, a group of public and private sector partners in Rhode Island created the *Rhode Island Wireless Innovation Network* to create a statewide, border-to-border, wireless broadband network, primarily for enterprise users (meaning users with very high bandwidth requirements,

such as large companies, hospitals, universities, and government agencies). IBM has been contracted to be project manager. A pilot program was slated begin in January 2006.⁹

Manchester, NH was one of the first cities of its size to create a free downtown wireless hotzone. The Greater Manchester Chamber of Commerce put the project out to bid to its high-tech members requiring that the successful bidder pay the cost of installing and running the system. They had approximately 10 bidders. Wireless Internet service was launched in July 2004 and covers a four square mile area in the downtown.

In Maine, the *Town of Hermon* has provided everyone in town with free dial-up Internet access for the past 10 years, one of the first municipalities in the nation to do so. Nearly all of Hermon residents have access to free dial-up service through the school department. The town also offers fixed wireless access to 35% of the town. The town council recently voted down a proposal to expand its town-offered wireless Internet service citing the high costs.¹⁰

A recent project by *Bowdoin College* would have made Brunswick Maine's first community to offer municipally-funded wireless Internet access in its downtown. The college would have administered the service and charged the city a fee for service. A private provider would have run the network. Recently, however, a pilot of the project was put on hold due to questions about whether the network would have to comply with federal wire tapping rules under the *Communications Assistance for Law Enforcement Act*, which is designed to enable law enforcement officials to access phone lines whenever they need to tap them. An off-campus wireless network is still being constructed by the college for students.¹¹

In the meantime, local businesses in downtown *Waterville* are moving forward with setting up their own downtown wireless hotzone. Arcus Digital (<http://www.arcusdigital.com/>), a downtown high-tech consulting firm, is supplying the Internet connectivity and some of the hardware for Jorgensen's Café on Main Street. While access is currently only available at the café, and on the road outside of it, there are plans to expand this service into other businesses in Castonquay Square and in the downtown area in the spring.¹²

Mainly Wired, LLC (<http://mainlywired.com/>) recently installed a wireless system in *Swanville*. By having access to the municipal building for its antenna, town personnel will leave slow, unreliable dial-up connections and be able to complete tasks faster and more efficiently. Mainly Wired's commitment to community service means that all fees are being waived for the town hall.¹³

Chebeague islanders brought wireless Internet access to their island using an antenna on top of the Chebeague Island Inn. In 2006, they formed chebeague.net (a Maine subchapter S corporation) (<http://www.chebeague.net/>), assembled a group of local investors, and enlisted Mainly Wired, LLC to set up the network and keep it running. Users will pay for the cost of service at about \$40 per month, plus installation.¹⁴

Three communities in the *Rockland area* are served by low-cost wireless "mesh" networks set up by private companies. Mesh-Air (<http://www.meshair.com/>) serves Camden and Appleton for \$15 per month, which is about one third the price of competing DSL or cable service. Redzone

Wireless (<http://www.redzonewireless.com/index.html>) serves Thomaston for \$19.95 a month.¹⁵ Redzone will also assist communities in the planning and deployment of municipal wireless systems.

Whether a hotspot or hotzone or a wireless municipal network, cities and towns across Maine and the US are working to meet the needs of the unserved and underserved areas in their communities.

Educational Benefits

To move all students to high levels of learning and technological literacy, all students will need access to technology when and where it can be most effectively incorporated into learning.

–Task Force on Maine’s Learning Technology Endowment

Increased use of Internet access enhances educational achievement, adult learning, and the every day lives of Maine citizens.

Increased Use of Internet in Education

The Internet is increasingly being used as an educational tool.

- According to US Dept of Education study, *Distance Learning*, nearly half the rural public school districts in the U.S. are providing some form of on-line education.
- 90 percent of public two-year institutions offered distance learning.¹⁶
- Nearly 60% of all 2-year and 4-year Title IV-eligible, degree-granting institutions offer distance education courses.¹⁷
- Research by the Pew Internet & American Life Project documents teens’ use of the Internet as a study aid. Teens and parents report that the Internet is vital to completing school projects and has effectively replaced the library. 71% of students report using the Internet at their primary source for their last major project¹⁸

According to Pew, students employ five different metaphors to explain how they use the Internet for school: the Internet as virtual textbook and reference library, as virtual tutor and study shortcut, as virtual study group, as virtual guidance counselor, and the Internet as virtual locker, backpack,¹⁹ and notebook.

Enhanced Student Achievement

Studies show that Internet access enhances student achievement. Demonstrated benefits of technology in education include increased performance on standardized tests,²⁰ improved literacy skills,²¹ improved understanding mathematical concepts,²² and improved attitudes towards learning and increased self-esteem.²³

In Maine, early studies of the effectiveness of Maine’s laptop program show that:

- Over 70% of the teachers surveyed reported that the laptops helped them to more effectively meet their curriculum goals, and individualize their curriculum to meet particular student needs.
- More than 4 out of 5 teachers surveyed reported that students are more engaged in their learning, more actively involved in their own learning, and produce better quality work.
- More than 70% of the students surveyed reported that the laptops helped them to be better organized, to get their work done more quickly, and with better quality.

- A sample of ninth grade students who no longer have laptops reported that they get less work done without the laptops, and the quality of their work has declined without the laptops.²⁴

In fact, students are much further ahead in their use of technology than schools and teachers. According to Pew research, students rely on the Internet to help them do their schoolwork. They found that,

Students say they face several roadblocks when it comes to using the Internet at schools. In many cases, these roadblocks discourage them from using the Internet as much, or as creatively, as they would like. They note that quality of access, heavy-handed filtering, and the inequalities in home access among students constitute major barriers to Internet use in and for school.²⁵

More Effective Adult Learning²⁶

According to a study conducted by the Pennsylvania State University, the Internet holds promise for adult learners. They estimate that traditional classroom programs for adults needing work-related training reach only 3-5% of those who need it. Even distance learning has limitations because of competing work schedules or lack of transportation or child care. Researchers say, “The emergence and rapid evolution of the Internet and World Wide Web as vehicles to deliver education at a distance has opened up new possibilities that make it more suitable for [adult] learners needing to improve basic skills.”

Use at Work and in Communities²⁷

Many communities see wireless as a way to increase social networks, volunteerism, and public interaction with local government and expand citizen participation in local governance. A series of studies by the Pew Foundation found that:

- People with high-speed Internet connections tend to be more productive at work and become more involved with their communities;
- Significant numbers of Americans are turning to the Internet for news coverage and images they cannot find in the mainstream media. 72% of America’s Internet users – or some 92 million people – have used the Internet to get news.
- One in four Americans has used the Internet to look for information about prescription drugs.
- Internet users are increasingly turning to e-government sites to carry out their business with government.
- Wired Americans increasingly go online for political news and commentary. The Internet contributed to a wider awareness of political views during the 2004 campaign season.
- 60 million Americans say that the Internet helped them make big decisions or negotiate their way through major episodes in their lives, such as coping with a major illness, making major investment or financial decisions, deciding on a college, buying a new car.
- Over a three-year period, Internet use grew by 50% among those who said the Internet played a major role as they pursued more training for their careers.

Economic Benefits

In the 21st Century, affordable broadband access is no longer simply a competitive advantage to a region's economy, but infrastructure that will dictate its viability.

–Washington County Telecommunication Infrastructure Assessment and Plan

The Maine Department of Economic and Community Development identified the top economic benefits that towns would see from providing free wireless service:

Attract or Retain a Younger, More Computer Savvy Workforce

Universal wireless service helps attract entrepreneurs who do (and are used to doing) business from anywhere. It also attracts and retains young workers who are accustomed to instant fast communications networks for both work and play.

Enhance Existing Businesses

Many companies have mobile work crews –including utilities, construction, delivery services, etc. Wireless allows for instant communications between field personnel and the home office. Service and maintenance personnel have the ability to update files, send invoices, and pick up new service visits –all without returning to the home office, saving time, miles, and money.

Provide New Business Opportunities

Wireless access offers existing companies easier ways to communicate with prospective customers, both locally for retail, and globally for other companies. It also attracts new business opportunities based on the rapid and inexpensive access to major communication systems and networks.

Enhance Tourism

Faster connections help tourists find eating, lodging, historical sites, and other services. It helps them make reservations for restaurants, get tickets for movies and theaters, or locate art museums. Also tourist and visitors are able to connect to their own E-mail and use their Blackberry™ and other wireless devices.

Improve Municipal Service Delivery

Public safety is identified as most communities' top beneficiary from wireless networks. This includes rapid access to patient records for EMS and more effective communications between fire, police, and other public safety people who are able to coordinate actions and share information across a seamless network. It also provides GIS systems for street lights, trash removal, traffic jams, road construction and maintenance, and other municipal services that could be monitored or tracked via a wireless network. Inspectors, social workers, police, environmental monitors, and transportation workers can update records, file reports, access files remotely, and communicate with co-workers directly from the field. More effective and efficient public services lower costs and enhance business climate.

Technology and its Estimated Cost

One of the major concerns is how do you know you're not buying an 8-track tape.
–Rashid Ahmed, Senior Project Coordinator, Portland Development
Commission, Portland OR

Current Technology

The four most common kinds of Internet service available are: low-speed dial-up and three types of high-speed service – cable modem, telephone Digital Subscriber Line (DSL) and wireless. Dial-up, cable, and DSL services require fiber or copper cables to carry data. For wireless technologies such as WiFi, WiMAX, or mesh networks, data is transmitted using radio waves instead of data cables or telephone lines.

Of these, the high-speed services are typically referred to as “broadband.” The FCC considers broadband any service providing transmission speeds in excess of 200 Kbps (although the Maine Broadband Access Infrastructure Board considers this standard woefully out-of-date). The new ConnectME Authority will annually determine what constitutes “broadband service.” Initially, the bandwidth requirement will be at least 1.5 Mbps in one direction.

The Public Utilities Commission has identified all the available broadband delivery modes in Maine and compared their advantages and disadvantages (see Appendix E).

Broadband over Power Lines (BPL) is on the horizon. The idea is to make broadband available through existing power lines (i.e. providing high speed internet access through an ordinary wall socket).²⁸ Some states and companies are doing tests, but the only successful project is in Manassas, VA (<http://www.manassascity.org/index.asp?NID=118>). About two years ago, Kennebunk Power and Light District initiated a pilot, but results have not been published (see <http://www.powerline-plc.com/>). Last year, Central Maine Power Company said that they were forming a team to look at BPL pilots. Technological issues and interference from ham-radio operators still need to be resolved.

Cost

Wired networks can cost hundreds of thousands of dollars to install, because each residential or business location needs cable lines and network equipment. As a result, most Internet service providers focus on populated areas where there are a sufficient number of subscribers to pay for the investment needed to bring service to that area.

Wireless networks however can be less expensive, requiring one or more wireless antennas, a location for them (some owners of facilities or towers charge a fee for hosting an antenna), and connection to the Internet.

According to the Broadband Wireless Exchange, a wireless network can be built that will provide high-speed wireless Internet connections to 25-50 users for under \$15,000.²⁹ Mesh-Air, a wireless Internet service provider in Appleton, whose specialty is the unserved areas of Maine, states that a modest investment of \$10,000 to \$80,000 (depending on the topography and size of a community) is all that is needed to set up a mesh wireless network.³⁰

For the consumer, a typical dial-up service using providers like America On Line for example costs approximately \$25 per month. The average cost for high-speed service is about \$40 per month. Verizon now offers a monthly DSL service for \$19 per month, but it is not available everywhere and is lower bandwidth than “broadband” as defined by the ConnectME Authority. Cable modem service usually is more expensive than DSL. Wireless services can range from \$15-40 per month depending on the location, and the provider may charge installation costs for equipment.

Providers

In a report to the Utilities and Energy Committee in December 2004, the Maine Public Utilities Commission outlines the growing number of service providers in Maine, from one dominate, incumbent telephone company in 2002, to 20 independent telephone companies, two cable companies, and six fixed wireless service providers.³¹ A description of the type and number of providers can be found in their report at http://www.maine.gov/mpuc/staying_informed/legislative/2005legislation/2005reports.htm.

Level of Service in Maine Today

In 1997, Maine became the first state in the nation to have all K-12 schools and public libraries connected to the Internet through the Maine School and Library Network. The service is free, funded by a surcharge on in-state telecommunications bills and support from the federal universal service fund.

According to the Public Utilities Commission, Internet availability in Maine has increased dramatically since 2002. Both the number of towns where service is available and the number of providers and varieties of service have increased. Today, 86% of Maine communities have broadband Internet service of some kind. Maine, like rural areas nationally, has a higher percentage of Internet access by dial-up compared to the broadband access available in urban and suburban areas. As of July 2004, only 15% of Maine households subscribed to high-speed cable or DSL service (compared to 21% nationally).³²

Nevertheless, 14% or some 75,000 Maine households do not have access to basic broadband service. These households tend to be in sparsely populated areas. Some Maine towns still have no Internet service at all, such as Somerville, Northport, Georgetown, Orland, Penobscot, Eastbrook, Lebanon, Industry, Weld, and Athens (as of September 1, 2005).³³

In general, says the Public Utilities Commission

...it is fair to say that market forces are already achieving significant improvements in broadband availability in Maine; but it also seems clear that, for the many rural areas of Maine, market forces alone may be insufficient to achieve full availability and coverage in the near term.³⁴

State Funding Efforts

The Legislature has created three programs to help expand telecommunications services to rural Maine: the Maine Telecommunications Educational Access Fund, Maine Universal Service Fund, and the ConnectME Fund.

Maine Telecommunications Educational Access Fund

Currently, the Public Utilities Commission assesses the 0.7% surcharge allowed by law on the in-state revenue of all telecommunications carriers, which produces approximately \$4.2 million per year. This surcharge pays for approximately 40% of the cost of connecting all Maine schools and libraries to the Internet. Federal E-Rate funds pay the remaining 60%. In 2004, the Public Utilities Commission explored expanding the Maine Telecommunications Educational Access surcharge for broadband Internet coverage and found this approach problematic. (Please see the PUC's December 2004 report in Appendix C for a full explanation.)

Maine Universal Service Fund

The Maine Universal Service Fund helps make phone service affordable and available to all Mainers, including rural and low income consumers. Its revenues come from an assessment on every telecommunications carrier that has intrastate revenues of more than \$12,500. Currently, only telecommunications companies pay into the Fund. The Maine Broadband Access Infrastructure Board recommended that the Fund be bifurcated; with one section to support rural incumbent telecommunications companies and the other to provide funding for cellular tower construction, direct broadband facility construction, and debt service on broadband development bonds.³⁵ Last year, the Legislature considered this option, but instead, created the ConnectME Authority and a separate assessment fund.

ConnectME Authority

In 2006, the Legislature created the ConnectME Authority (35-A MRSA § 9204(2)) to stimulate investment in advanced communications technology infrastructure in unserved and underserved areas of the state. The Authority, through the use of grants, direct investments, loans, demonstration projects, and, in some cases, reimbursement of sales and use taxes, can:

- expand the availability of broadband to residential and small business customers in unserved or underserved areas;
- expand the availability of broadband with bandwidth, synchronicity, reliability, and security adequate to serve business, education, and enterprise consumers in unserved or underserved areas; and
- otherwise enhance the state's communications technology infrastructure in unserved and underserved areas.

Funding is generated from a .25% surcharge on all instate communications services.

Municipalities as Internet Service Providers

Municipalities and cooperative groups should be encouraged to develop broadband technology projects, especially using wireless technologies.

–Maine Broadband Access Infrastructure Board

Instead of relying on the state or private sector, municipalities have the option of building and operating their own networks using their own funding or through grants or working with a variety of partners. There are number of considerations for municipalities considering this option.

Funding Sources

Municipal Funding

There are relatively few funding options for municipalities that want to establish their own wireless service.

Municipal Property Taxes and Fees

Current law gives municipalities authority to assess taxes, levy fees, and raise general obligation or revenue bonds. Municipalities are limited in their ability to raise new property tax revenues, however, as a result of the cap imposed by *Public Law 2005, c. 2*, commonly referred to as LD 1. This law caps the property tax levy such that the base municipal commitment may not exceed the prior year's base commitment, with adjustments for growth in real personal income, increases in property values attributed to new development, and net new funding from the state.³⁶ Within these parameters, municipalities could raise local taxes to support a new service.

Fee revenues are exempt from the spending cap. Towns have the ability to charge a fee-for-service to cover the costs of installing and running a wireless service. Often referred to as user fees, the chief advantage is the fee is paid by the individuals using the service, rather than spread across and subsidized by all taxpayers in a community. The disadvantage is a sometimes costly billing, collection, and financial management system is required.

Municipal Loans and Grants

With the exception of the USDA, funding for municipal telecommunications infrastructure is not a primary purpose of many of the existing grant and loan programs. There are a few programs, however, that might be applicable if proposals are structured in the right way.

USDA Rural Development provides programs for financing rural America's telecommunications infrastructure. The Community-oriented Connectivity Broadband Grant Program makes grants to eligible applicants, which will provide currently unserved areas with broadband transmission service, to foster economic growth and deliver enhanced education, health care and public safety services.

Status: Current USDA/RUS low-interest loan programs are available, but little used in Maine. In their report, the Broadband Access Infrastructure Board recommended that the

state increase awareness of these program and use state funds to help meet match requirements.³⁷

For more information: <http://www.usda.gov/rus/telecom/>

Maine's Community Development Block Grant (CDBG) program provides funding and technical support for projects that achieve local community and economic development objectives, while principally benefiting low-moderate income persons. Funding for the CDBG program is provided by the U.S. Department of Housing and Urban Development. Projects need to benefit low-moderate persons, eliminate slum and blighting influences, or address an urgent need.

Status: Funding is available annually through a competitive application process. The primary focus of the CDBG program is to benefit low-moderate income persons.

For more information: <http://www.meocd.org/>

The Public Service Grant Program provides funding for operating expenses, equipment, and program materials for public service programs. Past activities funded include dental clinics, job training, literacy training, welfare-to-work programs, senior center programs, and day care programs. Maximum grant award: \$40,000.

Status: Funding is available annually through a competitive application process. 100% of beneficiaries of public service programs must be low-moderate income, and applicants must demonstrate how their project meets that benefit. Total funding per year is \$200,000.

For more information: <http://www.meocd.org/grants/>

The Downtown Revitalization Program provides funds for communities to implement comprehensive, integrated, and innovative solutions to problems facing their downtowns. These projects must target downtown service and business districts and lead to future public and private investment. A community must have completed a comprehensive downtown strategic plan or updated an existing plan within in the past five years.

Status: Funding is available annually through a competitive application process. Applicants must demonstrate how the project addresses either the elimination of slum and blight, or provides direct benefits to low to moderate income citizens. Total funding is \$500,000 per year, which provides one grant per year.

For more information: <http://www.meocd.org/grants/>

The Municipal Investment Trust Fund provides communities with grants or loans to help meet public infrastructure or downtown improvement needs. It is intended to act as an incentive for local governments to implement programs which:

- are part of a long range community strategy;
- minimize development sprawl consistent with the State of Maine Growth Management Act
- support the revitalization of downtowns;

- foster partnerships and encourage social and financial investments between groups of municipalities, state and federal entities, public and private development organizations to address common community and economic development needs, and
- improve deteriorated business districts and local economic conditions.

Status: In 2004, voters approved a \$6 million bond to capitalize the Fund. All of the funds from that bond have been obligated and there are no monies available at this time.

For more information: Mike Baran, Technical Director, Maine Office of Community Development at mike.baran@maine.gov

The Fund for the Efficient Delivery of Local and Regional Services provides competitive grants to municipalities, counties, and regional governments to develop cooperative approaches to delivering local services. The projects must demonstrate intergovernmental cooperation and property tax savings. Funding is available for:

- Collaboration as a means of delivering governmental services;
- Enhancement of an existing (or development of a new) regionalized system for delivery of governmental services;
- Consolidation of administrative services or functions directly related to delivery of governmental services;
- Creation of broad-based alliances for purchase of goods and services directly related to delivery of governmental services; or

Status: The Legislature allocated \$500,000 to the Fund in Spring 2006. A competitive application is currently underway. Grants are expected to be awarded in October 2006. Legislation provides for 2% (approximately \$2 million) of state municipal revenue sharing funds to be deposited in the Fund annually. Projects must be cooperative ventures between one or more municipalities, counties, or regional government subdivisions.

For more information: <http://www.maine.gov/dafs/fund.htm>

Business Loans and Grants

According to the *Washington County Telecommunications Infrastructure Assessment and Plan*, the most important need to fill the gaps in broadband service in rural areas is funding for initial capital costs for start-up businesses.³⁸

Some federal and state financing programs available for businesses include:

The USDA-Rural Development Telecommunications Program assists the private sector in developing, planning, and financing the construction of telecommunications and broadband infrastructure in rural America. The Farm Security and Rural Investment Act of 2002 provides loans and loan guarantees for the construction, improvement and acquisition of broadband facilities and equipment to bring broadband service to rural communities.

For more information on the Broadband Program, including a copy of the Notice of Funds Availability: <http://www.usda.gov/rus/telecom/broadband.htm>

The Finance Authority of Maine offers several programs that might assist a business to provide wireless Internet service in rural communities.

- **Loan Insurance Program:** This program insures a portion of a loan made by a financial institution. The program is designed to help businesses in Maine access commercial credit. It is available for any prudent business activity (some restrictions apply).
- **Economic Recovery Loan Program:** This program provides subordinate (gap) financing to assist Maine-based businesses in their efforts to remain viable and/or improve productivity. There is a \$200,000 maximum loan amount at a fixed rate; Prime plus 2%. Businesses must exhibit a reasonable ability to repay the loan and demonstrate that other sources of capital have been exhausted.
- **Maine Seed Capital Tax Credit Program:** This program is designed to encourage equity and near equity investments in young business ventures, directly and through private venture capital funds. FAME may authorize state income tax credits to investors for up to 60% of the cash equity they provide to eligible Maine businesses. Investments may be used for fixed assets, research, or working capital.
- **Regional Economic Development Revolving Loan Program:** This program is designed to make loans through regional economic development agencies for the purpose of creating or retaining jobs. FAME makes disbursements to a specific set of agencies and the agencies, in turn, make loans to eligible borrowers. Businesses must have sales under \$5,000,000 or employ 50 or fewer employees. Advanced information systems is one of the categories eligible.

For more information: <http://www.famemaine.com/html/business/index.html>

Partners

Municipalities may want to consider working with another public or private partner to provide wireless broadband coverage in their community.

Large Private Sector Providers

The large providers of Internet services such as Verizon, TimeWarner, and others often are willing to work with community officials to help their residents access the Internet. According to company officials, part of the economic calculation for determining where to install new infrastructure is the expected return based on the expected take rate. (A take rate is the number of individual subscribers to the service divided by the number of potential subscribers). At least a 10% take rate is needed to be viable.

Communities may want to help assess interest and potential response to a local service offering. Vermont rural communities, desiring affordable broadband service for their areas, are conducting surveys and urging residents to help document the demand for service by identifying the location of the homes or offices where broadband is wanted. “Demonstrating the demand will enable us to find private companies offering the affordable, speedy Internet access our towns deserve,” they said.³⁹

Local Telephone Companies

Local telephone companies have much of the hardware and financial systems in place to offer wireless service. Oxford Networks, Mid-Maine Communications, and other local phone companies provide DSL high-speed Internet in many areas. They would be a natural partner to look towards for community wireless service.

Small, Internet Service Providers

Many municipalities in Maine have turned to small wireless Internet service providers for service. They are often low-cost and are willing to work on a smaller, more grassroots scale.⁴⁰ One company, Redzone Wireless, in Rockland has taken advantage of a niche to provide “soup-to-nuts service to municipalities.”⁴¹ Local governments can play a critical role in attracting wireless service providers by acting as the anchor tenant –that is agreeing to purchase services for their own use.⁴²

Local Merchants

According to their Web site, “Pioneer Wireless (<http://www.pwless.net/corporate/default.htm>) was developed by Northern Maine businessmen to serve the needs of other businesses and residents seeking a solution to the seemingly everlasting problem known as the Digital Divide.”⁴³ High speed Internet access is important to business operations and local chambers, business associations, and downtown merchants are key players. Many local hotels and motels already provide wireless service for customers. In Manchester, NH, the local chamber of commerce got their downtown hotspot up and running. Similarly merchants in Waterville, ME launched that city’s Main Street service.

Educational Institutions

Most colleges and universities have wireless for students and faculty and make ideal partners for college towns (i.e., Bowdoin’s wireless project for downtown Brunswick). All Maine schools and libraries are connected to the Internet through the Maine School and Library Network (MSLN). The state’s Distance Learning Network (DLN) also has sites throughout Maine. The advantage of DSL and the MSLN is that both bring advanced technology infrastructure to all parts of Maine.

Collaborative efforts among municipalities

Municipalities working together may provide economies of scale that would increase take rates and decrease local costs to administer services. Worcester and Middlesex have joined other central Vermont area towns to support a wireless system using a private service vendor.⁴⁴

The connection between the growing use of wireless technology to enhance public safety and the regionalization of much of Maine’s emergency dispatch services, may be an avenue for collaborating on the delivery of municipal wireless Internet

Utility Districts

The Village of Morrisville, VT obtained a municipal charter change in 2001 that allows the municipal power and water utility to offer telecommunications services. To date, the village has not actively pursued this option.⁴⁵

State Government

Maine state government has regional offices throughout the state, works with partners in local communities, and communicates with workers at home or in the field. The state's public communications needs may provide an opportunity for partnering with communities that share those needs.

Considerations for Success

There is no doubt that wireless networks for use by citizens, businesses, and public employees will provide tremendous educational, economic, and public safety benefits. For communities that want to provide wireless broadband, there are number of considerations.

What are the communities' goals?⁴⁶

- Enable efficiencies and improvements in the provision of government services
- Fill in the gaps in access to broadband services
- Provide service to local businesses
- Make services more affordable for low-income residents
- Support economic development
- Make access to services more convenient for residents
- Improve educational services

What level of subsidy does the town want to provide?

- Municipally-funded through local property taxes
- Municipally-funded through user fees
- Partially-subsidized (i.e. contract service where the municipality might generate volume discounts from a private service provider for its citizen subscribers)
- Subsidize capital funding (i.e. help pay for construction of a network that will be operated by a private service provider either under contract with the town or through subscription rates charged to users)
- No subsidy (i.e. privately-operated service where the users are charged the going rate)

Who will have access to the service?

- Residents
- Visitors and tourists
- Businesses
- Select areas or hotspots (downtowns, schools, libraries, business parks)
- Municipal employees

What will be the town's business and marketing plan?⁴⁷

- An assessment of telecommunication services and providers in the area and average users' bills
- An assessment of number of users and estimated take rates
- An assessment of the location and ownership of buildings, towers, light poles, traffic lights, and other potential sites for antennae
- A budget and financing plan – projections of capital and operating expenses and revenues including sufficient revenue to hire staff, pay off loans, make repairs, and invest in new technology and upgrades every 2-3 years
- A capital improvements plan for maintaining and replacing capital equipment
- An assessment of staffing needs including infrastructure maintenance, billing and collection, and customer service
- A marketing plan – strategies for sustaining and increasing take rates
- A technical plan – an outline of the design of the system and how it will be deployed
- An assessment of how the system will be deployed for municipal service delivery (i.e. in-the-field capabilities for building inspectors, police, and public works employees; on-line payment of taxes and fees, on-line licensing and voting, distance learning, library renewals) and an assessment of municipal savings, efficiencies, and productivity gains as a result
- An ongoing system to track costs and savings – an annual public report

What local actions might help marketing efforts?

- Work to increase awareness of the need for and uses of a broadband connection at home. Consider newspaper articles, web site, workshops, cable TV shows, newsletter, and printed materials
- Stimulate business by requiring municipal business be conducted on line
- Provide a discount if property owners pay taxes on-line

What technology is needed?

- Power requirements
- Levels of security
- Data rates
- Type of equipment

What local policies are needed?

Locally, communities need to establish policies for wireless companies to operate in their jurisdictions.⁴⁸

- Whether or not to allow telecommunications equipment on public buildings, church steeples, lighthouses, water towers, street lights, traffic signals, etc.
- Ordinances that balance the communities' wireless access needs with protection of views
- How much to charge for access to public rights of way
- Whether or not to require a bond that would finance the removal of equipment should the vendor go out of business
- Procedures for identifying and resolving signal interference disputes
- Whether or not to provide incentives to an operator to serve the community at below market rates

If the service is municipally-operated, policies are needed to establish:

- Whether or not to put liens on property for nonpayment of user fees
- Policies to protect privacy of users, secure personal information, and permit freedom of expression

What to look for when selecting a vendor?⁴⁹

- Is the vendor financially secure?
- Will the company provide reliable support services?
- Does the company have an up-to-date IT infrastructure
- Will the service reliably provide special quality of service levels for emergency response personnel during a crisis?
- Does the vendor have sufficient privacy and security procedures?

Additional Resources

Wireless Municipal Networks: A Guide for Decision Makers

SkyPilot Networks, Inc., Santa Clara, California

http://www.redzonewireless.com/SkyPilot_Networks.pdf.

The Dollars and Sense of Government-led Wireless Internet: A Guide for Government Employees and Community Activists.

Intel and MRI

http://www.muniwireless.com/reports/docs/Intel_dollars_and_sense_of_government.pdf

Building Wireless ISPs in Rural Towns, Outlying Suburbs and Inner City Districts
Broadband Wireless Exchange Magazine

http://www.bbwxchange.com/howto/1_broadband_wireless_isp_overview.asp

MuniWireless

<http://www.muniwireless.com/>

Digital Communities

<http://www.govtech.net/digitalcommunities/>

Appendices

Appendix A – P.L. 2004, Private and Special Law, Chapter 18

CHAPTER 19 S.P. 392 - L.D. 1128

An Act Directing the State Planning Office To Study Municipal Capabilities To Become Providers of Internet Services

Be it enacted by the People of the State of Maine as follows:

Sec. 1. Study and report of municipal capabilities to become providers of Internet services. The Executive Department, State Planning Office, in conjunction with the Public Utilities Commission and the Department of Economic and Community Development, shall study the following: the technology available for creating wireless Internet access throughout rural and urban municipalities in the State and its estimated cost; the various funding resources and strategic partnerships that may be available to municipalities to deliver wireless Internet services to their communities; and the long-term educational and economic benefits that could be derived from municipalities' becoming Internet service providers and the benefits to the State. The State Planning Office shall submit a report on its findings to the Joint Standing Committee on Utilities and Energy no later than September 12, 2006. The joint standing committee of the Legislature having jurisdiction over telecommunications matters may report out a bill to the First Regular Session of the 123rd Legislature in response to the report.

Effective September 17, 2005.

Web Link: http://janus.state.me.us/legis/ros/lom/LOM122nd/PandSL4-28/PandSL4-28-15.htm#P344_88797

Appendix B – Recommendations from the Maine Broadband Access Infrastructure Board, November 2005

1. Provide incentives and funding for broadband infrastructure
 - Provide “gap” funding to providers in rural areas of the state and fund programs that increase the visibility and demand for broadband
 - Increase the awareness of USA/RUS low-interest loan programs and use state funds to help meet the match requirements.
 - Create new state low-interest loan programs for broadband investment
 - Provide a mix of state tax credits and direct state funding for capital investments to provide broadband service to unserved and underserved area
 - Revise the existing high-technology tax credit program to allow telecommunications and cable companies and broadband service providers access to the tax credit
 - Better promote the high-technology tax credit program to increase its use
 - Allow broadband providers access to state towers, facilities, and rights-of-way
 - Bifurcate the Maine Universal Service Fund and target one section to fund cellular tower and broadband facility construction,
2. Increase awareness and demand for broadband services
 - Increase the public’s awareness of the need for and uses for a broadband connection at home
3. Develop expansion projects
 - Provide state grant funding for broadband technology and demonstration projects in unserved or underserved areas of the State of Maine
 - Provide access to existing or new low-interest loan programs, including direct state funding of part or all of the required match contributions
 - Give state and local personal property tax exemptions for incremental broadband investment in unserved and underserved areas
 - Direct state grant funding for certified incremental broadband investment
4. Create a “Broadband Development Authority”
 - Create a permanent development authority to implement state broadband policy; monitor broadband deployment in Maine, maintain, and publicize information on broadband availability, demand, and funding mechanisms; obtain and maintain current data and maps on broadband availability in all locations of the state; study and recommend regulatory changes to enhance broadband deployment; identify unserved and underserved areas of the state; solicit proposals for broadband expansion projects, demonstration projects, and other initiatives, and administer

the process for selecting and specific broadband projects and providing incentives, among other duties

- Create a cabinet level position to provide statewide strategic and tactical coordination for telecommunications and information technology purchasing, systems, services, and staffing.
- Unify all state technology resources under one office and establish an aligned information technology vision and mission for the state.

Web Link: <http://www.maine.gov/mpuc/broadband/index.htm>

Appendix C – Recommendations from the Maine Public Utilities Commission for Expanding High-speed Internet and Advanced Communications Services Statewide, December 30, 2004.

1. The Legislature should make explicit and possibly expand the authority of the Commission under state law to order line sharing and to require that Verizon and the other local telephone companies make available for reasonable compensation other elements of their networks to competitive carriers seeking to use those facilities to provide broadband service.
2. If the Legislature wishes to take action to supplement market-based broadband deployment activity, we recommend that a broadband deployment working group be formed, sponsored by the Governor's Office, SPO, DECD, or the Legislature, to define the problem and seek solutions. Members of the group could include representatives of the relevant state agencies (BIS, SPO, DECD, DECD Office of Innovation, MTI, PUC, OPA, etc.), 5 service providers (ISPs, telecommunications companies, cable companies, wireless companies, etc.) and interested or affected businesses and individuals. A permanent advisory council like those used in some other states should also be considered.
3. It appears that a primary impediment to obtaining funding or technology information, either by companies or municipalities, is the lack of a centralized source of information. The Maine Municipal Association, DECD, PUC, or similar organizations, could be a resource for information on developing technologies like WiFi and WiMax networking, or BPL. Having centralized information about funding sources, like federal grants and loans, would provide a valuable service to the smaller towns and businesses that do not have the resources to be on the lookout for opportunities.
4. Broadband service providers could be urged (or given incentives) to give reduced rates in Pine Tree Zones. Similarly, wireless networks could be encouraged to connect to the high bandwidth service points and provide WiFi access to businesses or business parks that locate in the PTZs.
5. The State could adopt policies that standardize and expedite rights-of-way permitting and limit the fees imposed for ROW access. The difficulty in obtaining such rights of way is sometimes identified as a barrier to broadband deployment.
6. The State could encourage more rapid broadband deployment by funding the "laptop" program at levels sufficient to bring high-speed computers to students in all high schools. The logic of this approach is that, as students see the capabilities of high-speed connections, they and their parents will purchase what is available, and encourage expansion of availability.
7. The Legislature should also consider developing a comprehensive telecommunications plan (similar to the plan implemented in Vermont) and update it on a regular basis.

Web Link:

http://www.maine.gov/mpuc/staying_informed/legislative/2005legislation/2005reports.htm.

Appendix D – Recommendations from the Washington County Telecommunications Infrastructure Assessment and Plan, May 2005.

Investments

1. Investments in any telecommunications infrastructure should include and/or support new equipment that increases high speed internet capacity.
2. Investments in cellular telephone infrastructure should be closely coordinated with investments in infrastructure to improve emergency response and public safety. This should include leveraging of funding sources from economic development, homeland security and emergency response.
3. The public sector should recognize that market demand is strong and provide financial assistance with start up ventures and on-going business development efforts to improve high speed internet access.

Infrastructure

1. Examine capacity, engineering feasibility and costs of co-location of facilities on public and private sites identified in Table 2 to improve cellular telephone and radio coverage in Washington County. Prioritize sites for infrastructure improvement with results.
2. Coordinate, where feasible, co-location of cellular telephone, emergency services and broadband wireless infrastructure on new and existing sites.
3. Review and revise county and town policies to allow and encourage private use of public sites.
4. Develop a site for a new tower to replace/enhance wireless facilities on County Court House in Machias. Build for co-location to support emergency services and regional economic development goals.

Private Sector

1. Washington County high speed internet service providers should aggressively make their service areas known to the PUC and link this information to local economic development web sites (Sunrise County Economic Council, Eastern Maine Development Corporation, all local Chambers of Commerce).
2. Develop and expand public and private funding sources to assist with initial capital equipment costs to develop high speed internet capacity in rural areas that will extend service beyond existing infrastructure constraints.
3. Explore subsidies for bulk purchase of wireless reception devices on individual residences and businesses.
4. Facilitate sharing of infrastructure to spread capital costs across public and private sector and across telecommunications service needs (broadband, cellular, radio).

State Level Efforts to Improve Service:

1. Focus state studies and capital investments on the private sector who have demonstrated a technical and entrepreneurial ability to provide high speed internet services.
2. Given the importance of internet access to economic development, the authority to set membership, powers, duties and goals of the proposed Maine Internet Access Authority should rest with the Joint Standing Committee on Utilities and Energy and the Joint Standing Committee on Business, Research and Economic Development.
3. Any state mandated requirement that wireless equipment be allowed at little or no cost on municipal structures should be balanced by a similar mandate that accommodates public sector needs for emergency services infrastructure.
4. Create the State Matching Fund to encourage and implement creative Internet access technologies as soon as possible. Include sufficient public funds for front end capitalization of private firms to implement business models that are already in place.
5. Include evaluation of Department of Conservation “Communication Sites” for improving cellular telephone and wireless broadband service in Washington County as part of evaluation of sites noted in Table 2.

Models for Municipal Licensing, Regulation and Management

1. Several models are provided for Washington County communities to use to develop wireless facility siting ordinances. Cooperation among Washington County communities to establish a common set of standards for all communities and wireless facility providers is recommended. Ordinances should include response times for co-location inquiries, standards of “reasonable” cost and at least five future co-locations per site.
2. Include concealment and “stealth” requirements in any ordinance or facilities siting efforts that occur in areas of particular historic significance (historic districts) or scenic beauty (undeveloped hill tops, vistas) and seek funds that will assist with any additional costs associated with these efforts.
3. Recognize the importance of co-location of facilities to limit their total number but, where it will protect cultural and scenic resources, allow a denser array of non-intrusive structures.

Funding Sources for Infrastructure Investment.

1. Coordinate multiple sources of funding and site feasibility analysis to fill gaps in coverage by construction facilities that serve the multiple objectives of economic development, emergency services, homeland security and cultural/scenic protection.

Web Link: <http://www.emdc.org/community/curprojs.cfm>

Appendix E – Broadband Delivery Modes⁵⁰

	DSL	SDSL	T-1/DS-1	DS3	FTTP	BPL	Satellite	Cable	ISDN	Dial-up	WiMax	Other Fixed Wireless
Formal Name	Digital Subscriber Line [ADSL, VDSL, ADSL2, VDSL2	Symmetric (or Single-Line) Digital Subscriber Line	Digital Signal Level 1	Digital Signal Level 3	Fiber-to-the-Premises	Broadband over Power Lines			Integrated Services Digital Network	Dial-up Service (via modem)	Worldwide Interoperability for Microwave Access	Varies
Means of Conduction	2 copper wires [POTS* wire]	2 copper wires [POTS wire]	4 copper wires	Coax cable	Fiber-optic cable	Power lines	Radio frequencies; sometimes has dial-up as uplink	Coax to customer. Often fiber to neighborhood	4 copper wires	POTS	Radio frequency	Radio frequency
Synchronous?	No	Yes	Yes	Yes	Yes	No	No	No	Yes	No	No	Maybe
Range	Varies with sub-type, Can be from 7,000 to 25,000 feet of town center	18,000 feet	How long is a piece of wire?		6-40 miles		Universal where there is a direct view of the southern sky				30 miles (licensed) 7-10 miles (unlicensed)	1-30 miles
Typical Upload Speed	512kb/sec-1mb/sec	77 kbps-2.3 Mbps	1.5m/sec	45m/sec	10-1gb/sec	2mb-10mb/sec	100-256kb/sec	768kbps	115k/sec	54kbps	Up to 60Mbps	512k/sec to 155m/sec
Typical Download Speed	3m/sec to 40m/sec	77 kbps-2.3 Mbps	1.5m/sec	45m/sec	10-1gb/sec	2mb-10mb/sec	256kb/sec-1m/sec	2-5Mbps	115k/sec	40kbps	Up to 60Mbps	512k/sec to 155m/sec
Chief Advantages	Fairly wide availability in densely populated areas. Market tested. Can and does piggyback on existing POTS lines.	Symmetric**	Symmetric. Low latency. Certain bandwidth. Reliable. Useful for businesses	Symmetric. Low latency. Certain bandwidth. Reliable. Useful for businesses	Suitable for “triple-play” services (voice, data, and video). Speed can be almost infinite	Could be in expensive, moderate speed	Universal	Can piggyback on existing cable TV service; competes with DSL so there is some negative price pressure	Symmetric. Still helpful in videoconferencing and remote audio recording. Can theoretically function in areas far from a central office.	Ubiquitously available and decreasing in price	Still unproven, Won’t be available until 2006	
Chief Disadvantages	Limited range. Most areas without service are outside range. Not symmetric, not useful for many businesses	Relatively low speed	Cost is out of reach of most home/SOHO users. Only for business market. Low speed. High cost per megabit/sec	Cost is high. Business only. Somewhat high cost per megabit/sec	High-cost. Ownership issues	Unproven and controversial. Still in early stages of development	Expensive, high latency. Low speeds in general and particularly low uplink	Cable users share bandwidth, which means that performance can suffer as load increase	Out of favor in US as a means of delivery for broadband access and seldom available for that purpose anymore	Extremely low narrowband speed. On this list strictly as a benchmark. The antithesis of broadband.	Must be line of sight.	

*Plain old telephone service

**Meaning the speed is the same in both directions. This is important for businesses which publish as much data as they consume

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